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VOLUME 2. ECONOMIC OPENNESS IN MODERNIZING CHINA

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LETTER OF TRANSMITTAL

MAY 2, 1986.

To the Members of the Joint Economic Committee:

Transmitted herewith for use by the Joint Economic Committee, Congress, and the interested public is a study consisting of a compilation of papers assessing the economy of the People's Republic of China entitled, "China's Economy Looks Toward the Year 2000, Volume 2—Economic Openness in Modernizing China."

China has been "opened" many times by foreign powers seeking to extend their sovereignty and to serve their own national interest. Now, for the first time in its long history, China seeks to join the world trading community and benefit from the relative advancement of the developed economies. China is pursuing this course of economic development without a dominating priority on military growth, another characteristic that sets its current strategy apart historically.

Policymakers in the United States look with interest and hopefulness at these historical developments.

We are grateful to the Congressional Research Service of the Library of Congress for making available the services of John P. Hardt to help plan the study. Dr. Hardt and Richard F. Kaufman of the Committee staff coordinated and directed the project and edited the present volume. Dr. Hardt was assisted by Donna L. Gold and Jean F. Boone of the Library staff. We are also grateful to the many government and private specialists who contributed papers to the study.

It should be understood that the views contained in the volume are those of the authors and not necessarily those of the Joint Economic Committee or of individual Members.

Sincerely,

DAVID R. OBEY,
Chairman, Joint Economic Committee.

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VOLUME 2. ECONOMIC OPENNESS IN MODERNIZING CHINA

HIGHLIGHTS

By John P. Hardt

China is becoming involved in the international economy at an unprecedented rate, opening its economy in a fashion unparalleled by any other Communist country's economic development. As recently as 1970 the People's Republic of China was isolated from the global economy. In the 1980s, having abandoned its policy of self-reliance, China is opening its economy and society to spur modernization. Seeking to become a major trading country in the Pacific, China has set a goal of tripling its trade with the United States. Moreover, China supplies modest economic aid and influence throughout the Third World, projecting its role as the largest socialist developing country.

By its own success in selective emulation of the developed Western economies, China provides an effective role model to all the developing countries. Over its long history, China has been opened many times from the outside by West Europeans, Americans, Japanese and Soviets interested in extending their sovereignty and expanding their trade. Now, under Deng Xiaoping, China is pursuing interdependence with the developed Western economies on its own initiative and has invited in foreign economic and technical influences to help revolutionize its economic system and broaden accommodation with the global economy. The Special Economic Zones (SEZ) created in the PRC have provided the meeting place for the centrally-planned, developing Chinese economy and the market economies of the developed West. Joint ventures, Western legal systems, Western management, and Western technology have not only been permitted into China but embraced. In this way, one of the world's oldest, most traditional societies has sought and successfully absorbed, in a relatively short time, important aspects of Western political-economic culture. Reflecting this dramatic change in Chinese openness to Western economic influences is the slogan of Shenzhen, the most advanced SEZ—"Time is money, efficiency is life."

China has experienced energy shortages, though these shortfalls have not been for lack of natural resources. Richly endowed in oil, gas, coal, and hydro, China has the resource capability to provide for its own needs and become a major exporter of energy. Development of nuclear electric power potential may help resolve China's regional electric power supply and demand inequities; but energy output and supply have fallen far short of the needs and potential, making energy the pervasive bottleneck for meeting macro- and micro-economic goals.

Early post-Mao optimism on energy sufficiency gave way to a policy of readjustment, reform, consolidation, and improvement [the eight character policy], designed to alleviate energy deficiencies. To meet the leadership's target of quadrupling the gross value of industrial and agricultural output by the year 2000, a doubling of total energy and a four-fold increase in electric power production will be required. Continued central planning and control may be needed to provide the necessary investment for expansion programs in energy and transportation.

- Central planning appears to be imperative in comprehensive development of hydrocarbons, hydro and nuclear power and transmission networks; local investment increases may be largely adequate to develop coal mining supplies.
- Key energy projects may be given special priority and access in order to assure adequate supplies of foreign exchange and imported technology. Foreign funds are especially important for long-term, large scale oil and hydro programs.
- Overall comprehensive plans for coordinated development of hydro, thermal and nuclear capacity are needed but not developed to meet ambitious electric power goals. Investment debates pitting transmission against fuel transport rquirements are likely, especially in decisions on coal and hydro programs (e.g. whether generating capacity should be located at energy source or demand center). Advocates of nuclear power tend to argue for location of nuclear power stations at the demand or load center. Supply of nuclear reactors, especially from the United States, will have to comply with nuclear non-proliferation agreements.
- Petroleum prospects may be constrained by lack of success in attracting foreign investment for expansion of offshore and interior-based oil production; by inadequate advanced technology to improve recovery rates at old wells; and by inadequate modern equipment to improve efficiency throughout reservoir exploitation.
- Energy conservation and restructuring of the energy balance is likely to be necessary, with particular focus on reducing oil consumption. Shift in priority from heavy to light industry is currently helpful in reducing energy needs but is not a long term solution.

Modernization of the military is underway as well, but remains the fourth modernization. The continued low priority of military modernization is in tune with the generally non-military character of the non-Communist, Pacific region. Thus "guns" are characteristically submerged to the claims of "growth" and "butter":

- The short-term objectives of defense modernization are aimed at improvement in combat readiness of forces through adaptation of combined arms operations; improvement in the technical, professional skills of officer corps; and creation of monetary incentives keyed to improved professional performance.
- The long-term objectives may be served by improvement in the scientific and technical base making it capable of developing and producing weapons based on modern technology; and by the development and deployment of strategic systems which provide a more credible nuclear deterrent.

PRC military expenditures are exceeded only by those of the U.S. and U.S.S.R. and the Chinese defense industrial base is among the world's largest; nevertheless, the burden of defense has not offset or seriously retarded civilian modernization. Defense allocations have not increased appreciably since 1972, except for a modest increase to fund the Vietnam invasion of 1979. Still, military modernization will in time represent a major overhaul of the defense establishment. Although some external assistance will be needed, the primary objective is to develop a self-sustaining defense infrastructure. The traditional multi-functional role of the armed forces in the Chinese economy and society has been maintained with continuing attention to its symbolism, even when the substance of resources for priority modernization is lacking. Upgraded military modernization always threatens other modernization efforts:

- Growth needs may create hard choices in military modernization, particularly if the external threat increases and the security requirements are upgraded.
- Perceived threats or opportunities in the external environment that may lead Chinese leaders to upgrade military modernization would tend to further generate threats in an escalating process.

PRC defense modernization presents opportunities and risks for U.S. interests:

- Offsetting the increases in Soviet power in Asia is consistent with U.S. interests.
- However, the Chinese might use political-military power in Asia at the expense of U.S. interests, raising the threat, for example, of a forceful solution to the Taiwan question.

Science and technology is to play a key role in modernization; China must not let the new industrial revolution of the Western industrial economies pass it by. Therefore, it is deemed necessary (though not sufficient) to plan for the transition from extensive to intensive growth. The reform of science and technology may be formally associated with a March 1985 decree in which the need for a "technology policy" was announced in order to:

- Overcome the disconnection between research and production deriving from Soviet-style over-centralization of research;
- Improve the quality and relevance of technical and scientific research; and
- Develop a sufficient scientific and technical manpower pool.

China has developed complex and expanding ties with the international technical community and has introduced new approaches to R & D. The strategy for S & T modernization has been to simultaneously attack the five institutional parts of China's research system: the Academy of Sciences, Institutions of Higher Education, production ministries, national defense research institutions and local science and technology departments. The separation of these institutions currently acts as an impediment to development; improved communication and stimulation are needed to create a dynamic environment. The establishment of super-ministries may help coordinate S & T at the top but local participants possess 80% of the resources needed to stimulate modernization.

Recent changes in research funding are intended to provide incentive systems that will help stimulate R & D, through change from central and institutional funding to the development of contract research mechanisms and project choice based on peer group review. Specific problems in transfer of technology such as patent copyrights and systems must be addressed as well. Production and research managers alike must learn to avoid risk aversion—because of conservatism and lack of stimulation, the Chinese system of S & T has been wasteful, rigid, and not as productive as it could be. The impact of Western imports of science and technology may have serious effects on the Chinese political system; modern, dynamic science and technology has an inherently pluralizing effect on a controlled political system.

The new generation of Chinese youth, unlike their predecessors, who were sent to the work bench and commune during the Cultural Revolution, now find themselves in the throes of an explosion of educational opportunities as well as uncertainties. Pragmatic training as scientists, engineers, and managers has replaced the ideological requirements for success; achievement will be measured in large part by their ability to effectively adopt Western methods and adapt them to Chinese needs.

Scientific and technological modernization will depend on effective reforms in the advanced educational system, which will help determine how wide the opening to the West must be. Already, the modernization of science and technology has reached abroad with the presence of over 12,000 Chinese students in U.S. higher educational institutions. Although the current system is elitist, it does provide upward mobility, even for rural youth. Equality of opportunity has explicitly replaced equality of reward, although differentiation in the social system and change in the political culture may go beyond the bounds of what is acceptable to future leaders.

The People's Republic of China is projected to become a major actor in the Pacific region and in the global economy. However, the process of participating in and adapting to the global market has been uneven. Rapid initiation of foreign commercial relations in the post-Mao period has led to periodic retrenchments, sharp cutbacks and adjustments. Commercial growth projections are subject to a variety of tenuous assumptions and considerations:

Opening to and Absorption in the World Market Is Uneven:

- Long term growth in commercial relations is tied to the Chinese ability to export—especially hard currency-earning sales of offshore oil.
- Ineffective industrial accommodation to joint ventures has restrained the absorption of foreign technology, especially transfer through the Special Zones to domestic economy. Foreign intervention in domestic Chinese decision-making may not prove to be in Chinese interests and may revive latent xenophobia.
- Substantial credit potential and full use of the foreign direct investment inherent in close commercial ties has not been forthcoming.

Energy Constraint Ties Effective Opening to Modernization Programs:

- Major economic constraints, especially in energy and transport, counter stimulants to continued domestic growth.
- Investment requirements to relieve energy and transport bottlenecks may compete with burgeoning requirements of housing and consumer durables needed to meet rising expectations and facilitate incentive systems in the domestic economy.

Chinese modernization and opening to the world economy offer opportunities and challenges to the United States that may promote or impede PRC developments:

- Diversification and expansion of global Chinese commercial relations is a part of an overall normalization process with East and West. A shift in the structure of trade from material exports to machinery, in time, is the objective.
- Japan has advantages of geographic proximity and cultural affinity to reinforce natural economic fit. Aggressive Japanese promotion strengthens this natural advantage.
- Major economic turning point in U.S.-PRC trade is tied to South China Sea oil.
- Textiles will continue to be a key export of China and threaten U.S. industry but may be a manageable problem area with U.S., especially with an amicable settlement of disagreement over the General Agreement on Tariffs and Trade (GATT), the Multifiber Agreement (MFA) and continued extension of Generalized System of Preferences (GSP).

Chinese leaders envision the PRC becoming a major trading country in the Pacific. If they are successful, the Chinese market would cease to be the mirage of the past and live up to its long-term promise. At the same time, development of the economic ingredient of Chinese power would permit China to exercise influence over political, military and economic affairs in Asia and throughout the world that would not necessarily be consonant with U.S. interests.

V. ENERGY

OVERVIEW: ENERGY IN CHINA

By Thomas Fingar*

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INTRODUCTION

Energy has been at or near the top of the policymaking agenda for most of the post-Mao era, but, despite increased investment, innovative policies, and impressive achievements, energy problems remain a, if not the, critical "weak link" in China's economy. Factories still operate below capacity because they cannot obtain adequate supplies of fuel and power, agriculture and rural development in general are retarded by increasingly serious energy bottlenecks, and urban residents must endure brownouts caused by coal shortages at thermal power plants.[1] Recent policies have led to increased energy production, more efficient utilization of available supplies, and alleviation of some bottlenecks, but planners and political leaders will continue to face serious energy problems for the rest of this century and beyond. Solving them will be a major economic and political challenge.

That China confronts severe energy problems is both paradoxical and unnecessary. Richly endowed with hydrocarbons and hydro-

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[1] "Energy Conservation and Its Prospects," *Beijing Review* (hereafter BR), No. 46 (November 12), 1984, pp. 20–23.

electric potential, China's energy resources rank with those of the United States and the Soviet Union.[2] Ironically, abundance, steadily rising production, and the discovery of the huge Daqing oilfield contributed to policies that caused or exacerbated present energy problems. Abundant and seemingly inexpensive fuel and power encouraged extensive growth with only minimal effort to use energy efficiently. Rapidly increasing oil production led to the construction of thermal power plants and the neglect of large-scale hydropower development. Most importantly of all, abundance delayed recognition of future problems.[3]

Although the need to increase production and reduce energy "waste" was a recurring theme in the 1950s and early 1960s, far more effort went into raising output than improving efficiency. As a result, China's factories, power plants, and other facilities are among the least efficient in the world.[4] Unfortunately for China, the dramatic increases in oil production at Daqing, Shengli, and other new fields coincided with the start of the Cultural Revolution. For a decade (1966-76), officials smugly—and confidently—boasted that China was immune to the "energy crisis" afflicting the rest of the world.[5] Boasting was harmless; the policies pursued in this period were not. The energy sector was forced to expand production at the expense of maintenance and modernization. Injuries to workers increased; so did the cost and complexity of deferred but essential technical improvements. Moreover, pursuit of local "self-reliance" led to investment in small, often highly inefficient facilities rather than in large mines or hydropower installations. Similarly, the construction of myriad small fertilizer, cement, and other factories intended to meet local requirements was pursued to the neglect of larger, more energy-efficient facilities. The legacy of this policy greatly complicates the task of energy and economic planners who must either take the difficult step of closing the plants or diverting scarce financial and energy resources to keep them in operation.

Unwarranted optimism about the country's energy situation persisted into the first year of the post-Mao era and is reflected in the overly ambitious developmental program announced in February 1978.[6] Even before that program was adopted by the National People's Congress, however, energy, especially electricity, bottlenecks had begun to appear.[7] Energy shortages became more serious in 1978 and figured prominently in the discussions at the Central

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[2] See Vaclav Smil, "China's Energetics: A Systems Analysis," Joint Economic Committee, *Chinese Economy Post-Mao*, Vol. 1 (Washington, D.C.: U.S. Government Printing Office, 1978), pp. 323-369.

[3] See the discussion in Thomas Fingar, "Energy in China: Paradoxes, Policies, and Prospects," in Richard C. Bush, Ed., *China Briefing, 1982* (Boulder: Westview, 1983), pp. 49-67.

[4] See the paper by Albert Keidel in this volume; and, for example, Chen Xi, Huang Zhijie, and Xu Junzhang, "The Effective Use of Energy is an Important Issue in Developing the National Economy," *Renmin Ribao* (hereafter RMRB), May 13, 1979, in Foreign Broadcast Information Service, *Daily Report: People's Republic of China* (hereafter FBIS), May 29, 1979, pp. L7-10.

[5] See, for example, Chong Qian, "Behind the So-Called Energy Crisis," *Hong Qi* (hereafter HQ), No. 2, 1974, pp. 83-86.

[6] Hua Guofeng, "Unite and Strive to Build a Modern, Powerful Socialist Country," in BR, No. 10 (March 10), 1978, pp. 7-40.

[7] See, for example, "After the Masses were Informed of Difficulties," RMRB, March 11, 1977; and Qian Zhengying, "Electric Power Should Play a Pioneering Role," HQ, No. 11, 1977, pp. 18-23.

Work Conference preceeding the Third Plenum.[8] The so-called "eight character policy" of readjustment, reform, consolidation, and improvement announced six months later at the Second Session of the Fifth National People's Congress was justified, in part, as necessary to alleviate existing energy problems and their economic and political consequences.[9] In the months and years that followed, more specific policies were adopted to achieve this objective. These policies have many shortcomings (e.g., they are often vague or inconsistent) and implementation has proven difficult,[10] but, as the other papers in this section demonstrate, significant results have been achieved. Production of fuel and power has increased by approximately five percent per year since 1981 (following three years of decline), and, according to Chinese calculations, 70 million tons of standard coal equivalent have been saved "between 1981 and 1983."[11]

Detailed information on growth rates and other developments in the energy sector can be found in the papers by analysts of the Central Intelligence Agency. Since they have described and analyzed the results of policies adopted in recent years, the remainder of this paper will focus on the policies themselves and the reasons they were adopted.

Defining the Problem

By late 1978, senior Chinese officials recognized the existence and urgency of their country's energy problems and the need for immediate steps to alleviate the situation. Measures subsumed under the rubric of "readjustment," especially the reduction of investment and output targets for heavy industry, were an attractive and effective first step. Readjustment was attractive to political leaders because it could be accomplished relatively easily through the planning process, was inexpensive, and was consistent with other policies and policy objectives. Despite its other advantages, however, readjustment was never more than a stopgap solution to China's energy problems.

The search for policies that would "solve" rather than merely alleviate energy problems is similar to that found in other issue areas. Reacting against the impetuous and ill-infomed policies of the "gang of four," Deng Xiaoping and his allies demand that decisions be based on careful analysis of both specific cases and the overall situation. The proliferation of research organizations and advisory bodies that has occurred since 1979 reflects this effort to raise the quality of analysis and the efficacy of policy decisions. As part of the "truth from facts" approach to policymaking, officials and a growing array of "experts" have conducted innumerable studies designed to identify underlying problems and their interrelationships.

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[8] Huang Gudan, "A Look at the CCP Central Committee's Working Conference, "*Zheng Ming*, No. 20 (June 1), 1979, in FBIS, June 8, 1979, pp. U1-6.

[9] See Thomas Fingar, "Implementing Energy Policy: The Rise and Demise of the State Energy Commission," in David M. Lampton, Ed., *Policy Implementation in Post-Mao China* (Berkeley: University of California Press, forthcoming); and Hua Guofeng, "Report on the Work of the Government," BR, No. 27 (July 6), 1979, pp. 5–31.

[10] Fingar, *supra* note 9.

[11] See the paper by an analyst of the Central Intelligence Agency in this section, and "Energy Conservation . . .," *supra* note 1.

Over the past six years, Chinese officials and energy specialists have identified literally hundreds of problems in the energy sector. The number, range, and character of these "key problems" reflect both the effort to find them and the way the search has been conducted. Armed with a mandate to "find the problem," analysts are certain to find something to report. In addition, the formation of numerous research bodies with different responsibilities and capabilities has led inevitably to very different diagnoses and prescriptions. Thus, for example, senior economic officials define the problem as one of excessive and scattered investment in energy facilities while technical specialists point to design flaws in industrial boilers or electric motors.[12]

As a result of this extensive search for information and informed analysis, policymakers must now cope with a new problem: information overload. Which problems are most important? Is there a logical or necessary sequence in which they should be addressed? What criteria should be applied to determine relative importance or priority? How should technical, economic, social, and political considerations be weighed when selecting from among competing alternatives? The list of such questions is long and still growing. China's leaders have attempted to deal with both procedural questions and the myriad problems identified by energy specialists through simplification, delegation, and deferral.

Simplification has been accomplished by grouping problems under relatively few broad headings. This has the advantage of enabling senior decisionmakers to focus on general questions and reducing the number and variety of matters to be considered simultaneously. Such simplification also makes it easier to explain problems and policies to subordinates and the public, and, more importantly, to assign responsibilities to specific agencies and individuals.[13] The remainder of this section will survey the types of problems identified by Chinese commentators and the range of measures adopted to deal with them.

Administrative Problems.—This category subsumes organizational and jurisdictional questions (e.g., which agency and/or individual should decide energy-related questions), problems associated with the absence or inadequacy of rules and regulations, and problems resulting from the shortage of competent managers and administrative staff. Analyses defining the problem in administrative terms emerged in the context of a broader effort to revitalize the bureaucracy and clarify institutional and individual responsibilities.[14] Many solutions were proposed—and adopted—to resolve jurisdictional problems. In 1979, the State Economic Commission (SEC) was assigned primary responsibility for most energy-related matters, but this solution proved inadequate and, in August 1980, a new agency, the State Energy Commission, was established. Among

[12] Examples include Gui Shiyong, "Strive to Consolidate the Favorable Economic Situation," RMRB, July 6, 1983, in FBIS, July 14, 1983, pp. K10-15; and Qiu Changqing, "Suggestions on the Use of Large-Capacity, High Parameter Thermoelectric Power Generators," *Dianli Jishu*, No. 10, 1982, in Joint Publications Research Service, *China Report: Economic Affairs* (hereafter JPRS), No. 83434 (May 9, 1983), pp. 62-68.

[13] See, for example, Zhao Ziyang, "Report on the Restructuring of the State Council's Organization," in FBIS, March 9, 1982, pp. K1-7.

[14] 4 *Ibid.*; and Deng Xiaoping, "The Reform of the Party and State Leadership System" (August 18, 1980), in RMRB, July 2, 1983.

its many responsibilities, the Energy Commission was supposed to draft laws and regulations governing the distribution and use of fuel and power. For a variety of reasons, creation of a new, supra-ministerial body failed to solve many administrative problems and it was abolished in May 1982.[15]

Primary responsibility reverted to the Economic Commission, but other changes, such as the merger of the Ministries of Electric Power and Water Conservancy in February 1982, and the establishment of energy conservation bureaus at all levels of the system, reduced the authority as well as the responsibility of the SEC. Efforts to alter and clarify lines of responsibility for specific energy questions have been and continue to be intertwined with broader issues of organizational reform and the redistribution of power and resources.

Despite bureaucratic battles over turf and continuous jockeying for position at the budgetary trough, there has been movement as well as motion; a steadily increasing number of laws, regulations, and guidelines have been issued and responsibility for administering them has been clarified.[16] Party rectification and promotions of "younger, better educated, more competent, and more revolutionary" cadres have helped alleviate personnel problems in the energy sector.[17] Recently adopted reforms that make greater use of market mechanisms and devolve some authority and responsibility to lower levels of the system have also facilitated the implementation of energy policies. Local officials and enterprise managers now have more incentives and authority to save energy and to invest in energy producing facilities.[18] Among other consequences, these changes have reduced the magnitude of the task confronting officials in Beijing. True in general, this is especially the case with respect to energy; many other matters have been delegated to others so that central planners and economic officials can devote more attention and resources to key sectors such as energy and transportation.

Technical Problems.—During the first two years of the post-Mao era, commentaries on the technical needs of the energy sector, like those dealing with all other sectors, assumed or asserted that existing problems could easily be overcome with a "technology fix." Between 1976 and 1979, science and technology were often described in almost miraculous terms; freed from the fetters of the Cultural Revolution, science and technology could quickly and easily alleviate bottlenecks, reduce costs, and increase efficiency.[19] By 1979, it had become painfully clear that the number, complexity, and severity of China's technical problems, and the difficulty and expense of acquiring, applying, and absorbing new technologies, were much

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[15] For a more extensive discussion, see Fingar *supra* note 9, and the sources cited therein.

[16] "State Economic Commission Issues Main Points for this Year's Work in Industry and Communications," *Gongren Ribao*, February 2, 1982, in JPRS, No. 80241 (March 4, 1982), pp. 1-6.

[17] See, for example, "New Leading Group Appointed to Coal Ministry," in FBIS, March 16, 1982, pp. K8-9.

[18] See, for example, Kang Shien's speech at the Beijing rally for "Energy Conservation Month," reported by Beijing Radio, October 31, 1979, in FBIS, November 1, 1979, pp. L12-18; and "Interview with Qian Zhengying on Development of Power Industry at a Faster Pace," *Jingji Ribao*, May 4, 1984, in FBIS, May 10, 1984, pp. K9-10.

[19] See the examples and analyses in Richard Baum, Ed., *China's Four Modernizations: The New Technological Revolution* (Boulder: Westview, 1980).

greater than had been realized. The more people looked, the more problems they found.

Reports by individuals and groups of technical specialists have appeared with growing frequency since 1979.[20] Like similar reports from other countries, they tend to focus on specific problems such as the efficiency of generating units or the special problems associated with mining high sulfur coal.[21] Precise definitions of technical problems are essential for engineers and design specialists, but not for senior policymakers. As part of the simplification process noted above, technical problems appear to be grouped into four subcategories: production, consumption, distribution, and monitoring.

The technical needs and difficulties of the oil industry are obviously very different from those of coal, natural gas, or electric power, and there is no need to look at those problems in detail here. It is important to note, however, that senior officials seem to have adopted the same general approach to solving technical problems related to production in all four industries. That approach has the following elements: (1) if technical obstacles to rapid production increases can be easily and quickly removed by using indigenous technology and equipment, use what is available domestically; if not, purchase whatever is needed from abroad; (2) enlist the help of foreign firms and technical specialists while making better use of Chinese engineers; (3) give highest priority to the solution of those technical problems that have the greatest impact on production; (4) ensure that technical decisions are made by qualified people, (5) recognize that technical needs will differ from one situation to another and that different solutions and priorities are appropriate; and (6) recognize that it is impossible to do everything at once and that it will be necessary to retrofit existing facilities while constructing relatively few new ones.

Primary responsibility for making and implementing technical decisions has been largely delegated to the relevant production ministries (Coal, Petroleum, Electric Power and Water Resources, and the Nuclear Industry) and their subordinate units.[22] In addition, mines and generating facilities under the jurisdiction of local units seem to have been given a relatively free hand to make technical decisions so long as they do not compete with or jeopardize projects and facilities controlled by the Center.[23]

A similar approach has been adopted to solve technical problems on the consumption front. Technical transformation—or retrofitting—of existing facilities to make them more energy efficient has been endorsed by senior leaders and facilitated by the establishment of special funds that are to be used explicitly and only for

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[20] Many such articles have appeared in the journal *Neng Yuan* published by the Energy Research Institute as a *neibu* document in 1979-80, and as an open journal since 1981.

[21] Examples include Qiu Changqing, *supra* note 12; and Han Guangxu, "Environmental Problems Caused by Coal Industry: Current Situation, Countermeasures, and Prospects," *Huanjing Baohu*, No. 9, 1983, in JPRS-CST-84-004 (February 14, 1984), pp. 64-70.

[22] See, for example, Gao Yangwen, "Rely on Scientific and Technical Progress to Initiate a New Phase of the Coal Industry and to Realize the Doubling of Coal Output," *Zhongguo Meitan Bao*, July 30, 1983, in JPRS, No. 84737 (November 14, 1983), pp. 50-56.

[23] Hu Zhonggui, "A Tentative Look at the Technological Transformation of Shanxi Coal Mines," *Jishu Guanli Yu Guanli Yanjiu*, No. 2, 1983, in JPRS, No. 84737 (November 14, 1983), pp. 57-61.

that purpose.[24] Teams of energy auditors and various meetings and visits to "exchange experiences" are used to identify and help solve technical and managerial problems that waste energy.[25]

Chinese officials frequently discuss energy and transportation problems in the same breath and, until recently, reports summarizing expenditures for capital construction and technical transformation usually lumped energy and transportation into a single category.[26] The reason for doing so is that transportation bottlenecks are most severe in the energy sector. More specifically, limited rail capacity (i.e., inadequate rolling stock and locomotives, poor scheduling, inefficient and antiquated yards and single-track lines) makes it impossible to move available and badly needed coal from mines to industrial and urban consumers.[27] Overcoming this bottleneck will require both substantial investment and solving difficult technical problems.

The magnitude of transport problems will increase in the future as more coal, electric power, and, possibly, oil and natural gas, are produced in regions far from centers of consumption. Increased coal production in Shanxi, hydropower from distant projects under construction or being considered, and electricity generated in mine-mouth power plants will require new rail lines, coal slurry pipelines, and high voltage transmission lines. The way in which China's political leaders appear to be addressing these immediate and longer-term technical problems is to encourage development of energy resources located close to urban centers (thereby reducing transportation problems).[28] One manifestation of this approach is the growth of local coal mines, another is the decision to construct nuclear power plants (see the accompanying paper by Suttmeier).

The final subset of technical problems to be discussed here centers on the need to develop technical specifications for everything from boiler efficiency to the insulation requirements of new refrigerators. What design standards should be applied when developing new products or retrofitting existing facilities? Should foreign standards be adopted or new ones developed to reflect conditions in China? How should compromises between what is technically possible or desirable and what is economically viable be made? Progress is being made, albeit very slowly. This is an area where decentralization and incentives to innovate both complicate the task of developing and enforcing technical standards and make it more important to do so.[29]

Enforcement of standards and planned allocation are difficult because until very recently China did not monitor energy use. Factories and households were not equipped with meters to record elec-

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[24] Editorial, "Carry Out Technical Transformation and Equipment Renewal," RMRB, October 11, 1981; and Editorial, "Proceed with Technical Transformation Selectively and Methodically," RMRB, September 20, 1982.

[25] See, for example, Yu Dehong, "Zhejiang Industry Energy Conservation," *Zhejiang Ribao*, November 2, 1982, in JPRS, No. 83162 (March 30, 1983), pp. 143-144.

[26] See, for example, Zhao Ziyang, "Report on the Work of the Government" (at First Session of the Sixth NPC), in FBIS, June 23, 1983, pp. K1-26.

[27] Commentator, "Railway and Coal Mining Departments Should Cooperate in Producing More Coal and Transporting it Faster," RMRB, July 23, 1982.

[28] See, for example, "Wang Lin Speaks at Third Theoretical Symposium of Shanghai Economic Zone, Calling for Meeting Challenge of New Technological Revolution," *Shijie Jingji Daobao*, April 9, 1984, in FBIS, April 30, 1984, pp. K12-17.

[29] "Energy Standardization Forum Issues Report," FBIS, March 22, 1983, p. K12.

tricity or gas consumption, and little effort was made, even in major consuming industries such as steel or cement, to monitor how much energy was being used. Now that it has become important to obtain accurate records (needed to enforce policies that have been on the books for up to six years), it is essential to install meters and other monitoring and control devices.[30]

Financial Problems.—The technical problems outlined above are formidable, but most can be overcome with proven technologies and available equipment. Similarly, developing new oil fields, coal mines, and power plants is difficult, but generally within China's technical capacity. Shortages of skilled engineers, managers, construction foremen and other key personnel intensify those problems, but limited financial resources are an even more serious complication. China simply cannot afford to do all that it would like to do.

Financial constraints affect every facet of China's modernization effort, and, in certain respects, energy faces the same funding problems as do education, agriculture, the military, and other sectors. There is an important difference, however; energy projects, especially those to increase production, tend to be more expensive and, at the present time, less easily postponed than those in other areas. Since energy shortages are a critical impediment to industrial and agricultural growth, projects to increase the supply of fuel and power must be assigned high priority. But because these projects are very expensive, they draw off funds that are badly needed to raise salaries, build housing, modernize the military, and attain other important objectives.

In the past few years, China had devoted a substantial and increasing portion of total government spending to the energy sector. In 1984, approximately one quarter the capital construction budget was earmarked for energy. As responsbility for many other activities has been shifted to local governments and individual enterprises and households, the Center has taken more responsibility for large-scale energy development. It is able to do so because, through the substitution of taxes for profits and other revenue policies described elsewhere in this volume, the resources available to the Center will increase even though the scope of responsibility, and hence the number of activities that it must pay for, has decreased.

Many other measures have been adopted to ensure that more funds can be used to overcome energy problems. One is the imposition of a special tax to be used for key energy projects. This tax, equal to 15% of the amount of locally raised funds for capital construction, is described as "an appropriate measure to collect part of the funds dispersed among different departments and units, so as to step up the construction of key projects and ensure coordinated development in economic construction as a whole." [31]

In addition to measures that inceased the amount of money available to the central government for investment in energy projects and for the technical transformation of existing facilities, senior leaders have authorized local governments to sell bonds to

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[30] See the discussion in Fingar, *supra* note 9.

[31] Wang Bingqian, "Report on the Final State Accounts for 1983 and the Draft State Budget for 1984," in FBIS, June 4, 1984, pp. K1-10, at K3.

raise money for energy projects. A similar measure makes it possible for local units to sell shares of stock to raise capital for small power plants or coal mines.[32] Although it is unclear what effect these policies have had, they indicate how far officials are willing to go to overcome financial difficulties.

The general policy of tapping all available sources of funding, as well as the need to acquire technology and assistance from abroad, have led Chinese officials to solicit foreign loans and direct investment in the energy sector. Foreign oil companies have thus far borne most of the expenses incurred in the search for oil in China's coastal waters, and Japanese and American firms have invested in the development of coal mines. The Guangdong nuclear power plant will be funded primarily by foreign investors, and substantial infusion of capital from abroad seems likely in the electric power sector. Once wary of either loans or direct foreign investment, China now actively solicits both to help solve its energy problems.

The preceding discussion has synthesized and simplified a wide range of energy-related problems and the general approaches employed by senior leaders to deal with those problems. The following two sections will look in more detail at specific measures adopted to increase production and promote conservation of energy.

Attacking Energy Problems

Since China has many different energy problems, officials have found it both possible and necessary to attack them with a wide array of policy weapons. Some can be engaged simultaneously with a single policy (e.g., raising the price of coal to promote production and conservation), others require highly specific solutions (e.g., the purchase of a particular technology from abroad). Financial, administrative, and technical constraints make it necessary to defer some problems while attacking others. The previous section summarizes the general approach or guidelines used to determine which problems should be tackled first, but, as the Chinese have learned, general guidelines are a poor substitute for detailed policies. Over the past six years, a large and still growing array of policies has been adopted to address general and specific problems on the energy front. Many of these policies are described in the accompanying papers by Suttmeier and analysts from the Central Intelligence Agency. Their analyses focus on developments in particular segments of the energy sector (i.e., oil, coal, and electric power) and look primarily at the production side of the energy equation. Since they have used a vertical approach, this paper will examine developments using a horizontal or integrative approach. Also, since they have concentrated on production, I will devote relatively more attention to policies that address the need to conserve energy.

Policies to Promote Production

China's leaders have exhorted the nation's miners, oilfield workers, and power industry officials to produce more energy since the earliest days of the People's Republic; in recent years they have done more than ever before to make that happen. To achieve the

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[32] See Qian Zhengying, *supra* note 18.

goal of quadrupling the value of industrial and agricultural output announced at the Twelfth Party Congress in September 1982 will, according to Chinese calculations, require a doubling of total energy and a four-fold increase in electricity production. As William Brown argues in his paper, attaining these goals will be difficult. Nevertheless, important gains have already been achieved through the implementation of measures to increase production. Two broad policies appear to have been most important in bringing about the increases that have occurred thus far.

Increased Investment.—Despite rhetorical pronouncements on the importance of raising energy production, State investment in the energy sector actually declined from 1978 through 1981.[33] Total energy production also declined during this period. Since local investment of all kinds increased dramatically during this period and some of the increases went into energy facilities, Brown's data may be a bit misleading, but, more important than the size of the decline is the fact that since 1982 the Center has channeled more money into the energy sector. Moreover, despite efforts by the Center to regain control of funds accruing to local governments and individual enterprises, there is considerable evidence that local investment in energy has continued to rise. Indeed, most of the increase in coal production comes from local mines, not those under the central government.[34]

Increased funding for exploration and development of energy resources has been obtained in many ways. Loans from international lending agencies have made an important addition to the total amount of foreign exchange available for energy projects and, in the case of the World Bank loans, required the Chinese to award contracts on the basis of competitive bidding, a practice that seems to be spreading even when not required by foreign lenders.[35] Loans from foreign governments have also provided important funding for energy projects, and joint ventures, especially for oil exploration and coal mine development but, increasingly, for electric power as well, have also added significantly to the funds available for energy development. Money from foreign sources has not yet been translated into large production gains because of the long construction periods required to open new mines or develop hydroelectric facilities, but future increases are certain even if offshore oil discoveries fail to materialize.

Direct State investment in energy production has been increased in two ways. One, noted above, has been to increase both the absolute amount and relative share of funds earmarked for energy construction in the national budget.[36] A second, and surprisingly effective, way has been to impose a special tax on local construction projects. Intended to increase State control over unplanned capital construction as well as to generate revenue for energy and transportation projects, the tax proved so lucrative that the rate was

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[33] See the papers by CIA analysts in this volume.

[34] See the paper by Alfred Keidel in this volume; and "Local Coal Mine Production Rises in 1984," in FBIS, November 27, 1984, p. K22.

[35] See "International Bidding on PRC Oil Projects Begins," in FBIS, January 16, 1984, p. A1; and "Bids Open for Shanxi Coal Mining Projects," in FBIS, December 21, 1984, pp. K15–16.

[36] Yao Yilin, "Report on the 1983 Plan for National Economic and Social Development," in FBIS, June 24, 1983, pp. K1–11, at K6; and Wang Bingqian, *supra* note 31.

raised from 10% to 15% in mid-1983. A total of 9.3 billion yuan was raised through this tax in 1983. To put this in perspective, State revenue in 1983 totaled 124.9 billion yuan and the total capital construction appropriation for the year was 38.3 billion yuan.[37]

Investment funds from the center are supplemented by revenues raised by local governments, enterprises, and, experimentally, individuals. For example, local governments are authorized to invest a portion of their "surplus" capital in power projects in exchange for a share of the electricity generated and the profits realized by the venture. They are also permitted to make loans to energy producing projects; the loans are to be repaid with interest and/or a portion of the energy produced. The sale of shares or bonds for energy development is being tested in selected areas.[38] Some, probably most, of the money raised in this way is invested in nearby coal mines and power projects, but some is being used to develop larger projects located far from the source of the funds.[39]

Increased Attention to Key Projects.—Beginning in 1982, Chinese officials began to complain about excess capital construction and the need to concentrate available resources to ensure timely completion of key projects.[40] Increasingly specific guidelines were adopted to ensure that funds, equipment, building materials, etc. needed to construct major facilities would not be used for "ordinary" projects. In addition to general admonitions to "shorten the capital construction front," commentators began to emphasize the importance of bringing key projects, especially major energy producing projects, on line as quickly as possible.[41]

The importance of major energy projects was underscored by commentaries on the Sixth Five-year Plan. Of the 120 key construction projects identified by the plan, 70 were under construction as of December 1983, including eight coal mines and 13 power projects.[42] In addition to decreeing that key projects will have priority access to funds and material, officials have adopted several other measures to shorten construction times, reduce waste, and improve the quality of construction. One of the first such measures was to "strengthen leadership over the construction of key projects" by requiring that a single person be assigned to take charge of each project. That individual is to be responsible for all aspects of the project.[43] The best workers, construction supervisors, and managerial personnel are supposed to be assigned to key projects, and when numerous different construction units are involved, one is to have overall responsibility.[44]

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[37] Ibid., p. K2.

[38] See Qian Zhengying, *supra* note 18.

[39] "Ministries, Provinces to Boost Coal Production," in FBIS, May 19, 1982, p. K13; and "Accord Reached for Shanxi's Coal Development," in FBIS, April 25, 1983, p. K19.

[40] See, for example, Editorial, "Concentrate Funds to Ensure Completion of Key Capital Construction Projects," RMRB, October 5, 1982; and Zhao Ziyang, "Report on the Sixth Five-year Plan," in FBIS, December 14, 1982, pp. K1-34, especially pp. K18-20.

[41] See, for example, Editorial, "Control the Scale of Capital Construction, Guarantee Key Construction Projects," RMRB, April 2, 1982; and Gui Shiyong, "Strive to Consolidate and Develop the Favorable Economic Situation," RMRB, July 6, 1983, in FBIS, July 14, 1983, pp. K10-15.

[42] Lin Fatang, "Key Projects During Sixth Five-Year Plan," BR, No. 2 (January 9), 1984, pp. 22-27. Also see, "List of Key projects of Sixth Five-Year Plan," in FBIS, July 13, 1983, pp. K7-9; and "Planning Commission Picks More Key Projects," in FBIS July 20, 1983, p. K20.

[43] "Construction of Key Projects to be Accelerated," in FBIS, April 11, 1983, p. K13.

[44] Ding Shi, "The Best Construction Units Should be Thrown into the State's Key Construction Projects," *Jingji Ribao*, August 10, 1983, in FBIS, August 19, 1983, pp. K8-10; and "Plans to Transfer Scientists Announced," FBIS, March 28, 1984, pp. K12-13.

Another way in which officials have moved to speed completion of key energy projects is to give them priority access to foreign exchange and imported technology. Both China's own foreign exchange reserves and loans from abroad have been earmarked, in substantial measure, for energy projects. Similarly, planned acquisition of foreign technology, by purchase or through joint ventures, has emphasized technologies needed for development of coal mines, oil fields, and power generating facilities.

Concentration of resources to realize gains promptly is reflected in other ways as well. For example, although plans and policies call for development of both hydroelectric and thermal generating facilities to alleviate power shortages, current policies emphasize thermal power plants because they can be built more quickly and more cheaply than can hydroelectric plants.[45] Similarly, when choosing among alternative energy projects, planners and officials are supposed to give special weight to the anticipated construction time and, other things being equal, pick those that can be built most quickly.[46]

The measures summarized above have alleviated some of the problems impeding completion of key construction projects, but they have created or aggravated others. For example, reducing the number of projects and giving priority access to funds, equipment, and other limited resources have inevitably intensified competition for high priority projects, especially energy projects. There is a bureaucratic dimension to this competition (e.g., between the Ministry of Coal and the Ministry of Water Resources and Power), but the most intense clash of interests is that between areal jurisdictions. Coastal regions compete with the interior provinces for energy investment.[47] So, too, do provinces, counties, and cities.[48] Since the stakes are higher than in the past, the process has become more political even though decisions are supposed to be based on technical and economic criteria.

Another consequence of giving higher priority to key projects is that local governments, enterprises, and even individuals have sought to derive special benefits from favored projects. Commentators have denounced efforts to inflate the cost of key projects so that more funds will be spent locally, to increase the cost of land and materials purchased for these projects, or in other ways to realize private gain at the expense of the public good.[49]

Measures to Increase Coal Production.—The general policies outlined above have been made more specific and applied with grow-

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[45] See, "Li Peng Assesses Energy in PRC Quarterly," in FBIS, August 29, 1984, pp. K7-8.

[46] See, for example, Li Peng, "China's Policies for Hydropower Development and Strategic Measures for Speeding Up Hydropower Construction," *Shuili Fadian*, No. 7, 1983, in JPRS, No. 84737 (November 14, 1983), pp. 17-27; and Gao Yangwen, "We Must Make Great Efforts to Create a New Situation in Modernizing the Coal Mining Industry," *Neng Yuan*, No. 2, 1983, in JPRS, No. 84452 (September 29, 1983), pp. 22-33.

[47] Examples include Wang Lin, *supra* note 28; and Li Wenyan and Chen Hang, "Efforts Must Also Be Made to Actively Develop Coal Mining in the Five Provinces of Shandong, Anhui, Henan, Guizhou, and Yunnan—On Two Articles Dealing with the Development of North China Coal," RMRB, August 2, 1979.

[48] See, for example, "First Secretary of Yangquan Municipality has Published an Article in *Shanxi Ribao*: 'If Established as the Energy Base for Shanxi, Yangquan Will Make Many Contributions,'" RMRB, June 9, 1980.

[49] Commentator, "Stop Extorting Key Construction Projects," *Xinhua*. June 28, 1983, in FBIS, June 29, 1983, pp. K3-5; and Commentator, "It is Necessary to have a Firm, Clear-Cut Attitude," RMRB, July 7, 1983.

ing effectiveness in all segments of the energy sector. In the case of coal, production is supposed to reach 1.2 billion metric tons by 2000; of this total, 600 million metric tons (MMT) is to come from new mines.[50] Other papers in this section describe some of the steps that have been taken to achieve these goals and Keidel shows that despite substantial efforts to open and expand large mines, most of the increase in coal production thus far has come from small local mines. One reason is the long lead time required to bring new mines on line; investments made since 1978 will not begin to produce significant results for a few more years.

In the case of coal, policies to concentrate resources and bring mines into production more quickly have the more specific goal of reducing construction time from the current average of 8–10 years to 6 years.[51] In accordance with the "tried-and-true" experience of other countries, open pit mines are to have highest priority.[52] Mines in the eastern part of the country, i.e., those closest to industrial and urban centers with the best transportation infrastructure, are to have higher priority for technical transformation investments than are those in the west, but large-scale mines in Shanxi will have higher priority for new construction funded by the Center.[53]

The productivity of existing mines is to be raised through better management, elimination of jurisdictional and other administrative obstacles, higher prices, wages and other incentives for mining enterprises and individual workers, and by use of temporary workers.[54] Foreign capital and expertise are to be tapped to overcome problems more quickly than would otherwise be possible. The largest example of foreign participation to date is the joint venture with Occidential Petroleum to develop the Pingsuo open pit mine, but smaller ventures have also been undertaken with Japanese, German, and other American firms.[55]

Electric Power.—Shortages of electricity already force industrial enterprises to operate below capacity and limit household consumption even in Beijing. To overcome existing bottlenecks and to quadruple GVIAO by 2000 will, according to China's energy planners, require a four-fold increase in electricity production. CIA and Chinese analysts view this as a challenging but not impossible goal.[56] To achieve this objective, the Chinese have called for but apparently not yet formulated an overall plan for the development of hydroelectric, thermal, and nuclear power plants.[57] There has been continuing debate between advocates of thermal and hydroelectric power with much of the disagreement centering on the calculation

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[50] Yu Hongen, "Striving to Fulfill and Overfulfill Coal Industry Targets in 1983," *Shijie Meitan Jishu*, No. 1, 1983, in JPRS, No. 83434 (May 9, 1983), pp. 69–81.

[51] *Ibid.*

[52] *Ibid.*, p. 71; and Gao Yangwen, *supra* note 46.

[53] *Ibid.*; and Yu Hongen, *supra* note 50.

[54] See the article by Gao Yangwen in *Meitan Kexue Jishu*, No. 10, 1985, in JPRS, No. 83434 (May 9, 1983), pp. 82–87.

[55] See, for example, "Occidential Petroleum Signs Coal Project Agreements," FBIS, May 1, 1984, pp. B16–18; and "PRC-U.S. Joint Venture to Build Coal Mine," FBIS, December 26, 1984, p. B3.

[56] See Xiao Genxing, "The Enormous Task of the Electric Power Industry," *Xiandaihua*, No. 1, 1983, in JPRS, No. 83434 (May 9, 1983), pp. 1–5.

[57] See Wang Junchen, "Understanding the Problem of Small Hydropower Development," *Neng Yuan*, No. 6, 1982, in JPRS, No. 83757 (June 24, 1983), pp. 40–49.

of long and short term costs and the time needed for construction.[58] This debate has acquired a new dimension in the past two years as advocates of nuclear power have joined the fray (see Suttmeier's article in this section).[59] In 1983, hydropower had highest priority, but by late 1984 thermal power had been given precedence, primarily because projects could be brought on line more quickly.[60]

A separate but at times overlapping debate has centered on the question of whether to transport power or fuel. Advocates of minemouth power plants argue that it is easier and ultimately cheaper to expand power grids and high voltage transmission capabilities than to ship coal from distant mines to power plants located near the cities.[61] Supporters of large hydropower development employ a similar argument,[62] while the champions of nuclear power point out that plants can be built close to centers of demand thereby minimizing the task of transporting both fuel and power.[63] These debates have both a bureaucratic and an areal dimension; since large amounts of money, many jobs, and other benefits will accrue to those places selected for development of generating facilities as well as to the bureaucratic agencies in charge, participants work for decisions favorable to themselves, and decisionmakers find it necessary to apply political as well as economic and technical criteria. In China, as elsewhere, development of electric power provides opportunities for pork barrel politics.

In addition to pursuing simultaneous development of large scale thermal, hydro and, now, nuclear power, Chinese officials continue to emphasize the importance of small, locally financed hydroprojects. In 1983, 1150 new small hydropower facilities were brought on line, bringing the total to 86,000. It is important to recognize that most of these facilities are very small indeed. The 1150 powerplants completed in 1983 added only 400 megawatts to total capacity. This brought the total generating capacity of the small plants to only 8,500 megawatts.[64] Since virtually all increases in electricity for the rural areas (now accounting for 1/7 of total consumption) [65] will have to come from such small plants, electrification of the countryside will proceed very slowly. The "ideal electrified county" will have 30-40 MW of generating capacity and an average per capita consumption of only 200 KWH/year.[66] It is important to note, however, that small hydropower has critics as well as supporters in China. Critics argue that the State subsidizes 1/4 to 1/3 the cost of

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[58] See, for example, Shi Xican, Cai Ansi, and Lin Xiangyue, "The Problems of Making Dynamic and Economic Comparisons of Hydroelectric and Thermal Power Stations," *Shuili Fadian*, No. 3, 1981, in JPRS, No. 78818 (August 25, 1981), pp. 13-22.

[59] Jiang Shijie, "Developing Nuclear Energy is a Major Strategic Measure in Economic Construction in China," *He Kexue Yu Gongcheng*, No. 1, 1984, in JPRS-CST-84-016 (June 6, 1984), pp. 14-19.

[60] Compare Xiao Genxing, *supra* note 56; and Li Peng, *supra* note 45.

[61] Xiao Genxing, *supra* note 56.

[62] Xiao Genxing, "Electric Power Construction in the Northwest—An Overall View," *Liaowang*, No. 8, 1984, in FBIS, March 20, 1984, pp. K5-8; and Zhang Siping, "Several Questions Concerning the Exploitation and Development of the Chang Jiang Valley," *Guangming Ribao*, March 29, 1984, in FBIS, April 11, 1984, pp. K19-23.

[63] See Jiang Shijie, *supra* note 59; and Qu Geping, "Nuclear Power—Safe and Economical Energy," RMRB, March 16, 1984.A554A EXT .009 EDITED BY "EDSTD" ON 16-AUG-85 24034 Dominguez August 16, 1985 Folio[s] .... 35......... 37

[64] "More Small Power Stations Built," BR, No. 18 (Apirl 30), 1984, p. 9.

[65] "Rural Electricity Consumption Figures Released," FBIS, April 11, 1984, p. K24.

[66] "More Small Power Stations . . . ," *supra* note 64.

small projects, that they are much more expensive per kilowatt of capacity and per kilowatt hour of operation, and that it would be more cost effective to channel local investment into large generating facilities.[67]

Adding to installed capacity is the most important way to increase the supply of electricity, but, especially in the short term, much is to be gained from increasing the efficiency of existing facilities. Both managerial and technical remedies have been adopted to achieve this goal. The potential benefits of better management and improved technologies are substantial since the power industry itself consumes 16 percent of total energy and thermal plants use 18-20 percent of the oil and coal produced in China.[68] According to Chinese estimates, greater efficiency is essential if the country is to reach the projected total of 1.2 trillion KWH of power by the year 2000; simple expansion or extensive growth of the power industry cannot meet this goal.[69]

Oil.—Efforts to increase oil production may be divided into three general categories: measures to attract and accelerate foreign participation in the search for oil in China's coastal waters and, with less success, interior provinces; investment in new equipment and adoption of new technologies to increase extraction rates at Daqing and other producing fields; and efforts to develop and improve all segments of the domestic petroleum industry (e.g., rigs, pumps, and data processing centers). Foreign participation, through sales and a wide range of joint venture arrangements, is seen as crucial to the success of all three efforts. Although Chinese officials trumpet the success of their efforts to attract foreign investment and other forms of participation in the petroleum industry, the results to date have been disappointing.[70] One indicator of both the difficulty China has had and its willingness to make further concessions is the promise that companies that bid for the second round of drilling rights can expect more flexible and advantageous terms than were offered in the first round.[71]

Despite difficulties and disappointments, China has succeeded in reversing the decline in oil production and total output now ranks seventh in the world.[72] Total production in 1984 reached 115 MMT of which 28 MMT was exported.[73] New discoveries have been announced, but it is too early to assess their potential or the ease with which they might be exploited. China's plan and impatience to develop its oil resources appear to have been hurt to some extent

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[67] Wang Junchen, *supra* note 57.

[68] See the article by the Electric Power Production Office of the Ministry of Water Resources and Electric Power in *Dianli Jishu*, No. 8, 1983, in JPRS, No. 85027 (December 29, 1983), pp. 66-70.

[69] Liu Jian, "Unit Fuel Consumption of Thermal Power Plants by End of Century Estimated," *Dianli Jishu*, No. 8, 1983, in JPRS, No. 85027 (December 29, 1983), p. 22-28; and Xiao Genxing, *supra* note 56.

[70] See, for example, Zhong Zhengxiang, "New Developmens in Oil Exploitation in the Western South China Sea," *Zhongguo Xinwen She*, July 24, 1984, in FBIS, July 27, 1984, pp. K9-10; and "China Daily Views Joint Offshore Oil Ventures," in FBIS, November 8, 1984, pp. K29-30.

[71] See Zhou Jisheng, "Three Characteristics of China's Second Invitation of Bids for Offshore Oil Drilling," *Zhongguo Xinwen She*, November 21, 1984, in FBIS, November 28, 1984, pp. K21-22.

[72] See, "PRC Ranks 7th in World Petroleum Production," FBIS, August 7, 1984, p. K20; and "China Ranks Among Major Oil Producing Countries," RMRB, August 18, 1984.

[73] Lu Dong, "Reforms Invigorate 1984 Economy," BR, No. 10 (March 11), 1985, pp. 15-17, 24; and "Petroleum Products Exports Hit Record in 1984," FBIS, January 18, 1985, pp. K25-26.

by the softening of the world oil market. Chinese deposits are expensive to exploit; the drop in world prices has made it less attractive for foreigners to assume the relatively high risks of investment in China. For this and other reasons, foreign firms have not developed new fields in Bohai or the South China Sea as promptly as the Chinese would like.

Policies to Reduce Consumption and Promote Conservation

Recognizing that even an all out effort to increase energy production could not satisfy the rapidly growing demand for fuel and power, China's leaders have adopted a wide array of policies to limit demand and promote more efficient use of available supplies.[74] Although all such policies are subsumed under the general heading of "energy saving measures" (*jieneng banfa*), it is useful to distinguish among three subcategories: measures to restrict construction of energy consuming facilities; measures to decrease current demand for total energy and/or specific fuels; and measures to increase efficiency. Officials have underscored the importance of these policies by enjoining cadres at all levels of the system to give equal or greater attention to conservation than to increasing energy production.[75] Efforts to reduce consumption are described as the key to easing energy shortages and guaranteeing continuous development of the economy. To emphasize this point, November has been celebrated as "energy conservation month" since 1979.[76] While it is questionable whether the now ritualized observance of energy conservation month has much of an impact, other measures have been effective.

Measures to Restrict Construction of Energy Consuming Facilities.—One of the first steps taken to slow the growth of demand for energy was to abandon the overly ambitious targets that had been announced in 1977 and early 1978. Energy problems were cited by Hua Guofeng as an important reason for the shift in policies and priorities announced at the Third Plenum of the 11th Central Committee in December 1978 and elaborated six months later at the Second Session of the Fifth National People's Congress.[77] That shift included adoption of the sweeping rural reforms described elsewhere in this volume, a development that dramatically reduced the role of the central government in bringing about the modernization of agriculture. While ballyhooing the production responsibility system and related changes, officials quietly dropped plans to mechanize agriculture by 1985. Even had there been no other obstacles (which of course there were), the energy requirements would have been prohibitive. By 1981, spokesmen were more explicit; the central government could not increase supplies of commercial energy to the countryside during the remainder of this century; any growth in demand would have to be met with locally mined coal, small hydro facilities, or biomass.[78] For all practical purposes, the countryside was simply written out of the national energy plan.

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[74] See Fingar, *supra* note 9.

[75] *Ibid.*; and Gao Yangwen, "On the Issue of China's Energy Policy," *Meitan Kexue Jishu*, No. 4, 1981, in JPRS No. 78872 (August 31, 1981), pp. 13–22.

[76] Kang Shien, *supra* note 18; and "Li Peng Urges Better Energy Conservation," FBIS, November 1, 1984, pp. K5–6.

[77] Hua Guofeng, *supra* note 9.

[78] See Fingar, *supra* note 3.

Other, more publicized measures to limit the growth of demand included increasingly explicit prohibitions against construction or expansion of any factory, housing development, etc. unless adequate supplies of energy could be obtained. This amounted to a requirement that all plans for capital construction be accompained by an energy impact statement; unless the fuel and power needed to operate the installation were certain to be available when needed, construction was prohibited.[79] The need for such a policy became apparent as facilities competed for limited supplies. One consequence and continuing manifestation of this problem is the illegal manipulation of energy supplies by unscrupulous cadres.[80]

General restrictions to limit construction or expansion of energy consuming installations were accompanied by specific prohibitions against certain types of facilities such as industrial boilers or power plants designed to burn oil. Oil consumed as boiler fuel could not be exported to earn foreign exchange or refined to produce high profit and badly needed fuels, lubricants, and feedstocks. Commentators had begun to condemn direct burning of oil as early as 1979.[81] They had good reason for concern; approximately one-third of total oil production and one-half of domestic consumption was burned directly as boiler fuel.[82]

Measures to Reduce Current Demand for Energy and/or Specific Fuels.—As noted above, the "eight character policy" of readjustment, reform, consolidation and improvement was adopted, in part, to alleviate shortages of fuel and power. "Readjustment," especially the shift from heavy to light industry, significantly reduced total demand for energy while increasing the output of high profit items. The logic and explanation is simple and straightforward; light industries require less fuel and power per unit of output (and per yuan of profit).[83]

Since the goal of quadrupling GVIAO announced by Hu Yaobang is his Report to the Twelfth Party Congress is to be achieved with only a two-fold increase in energy, the economic and political significance of this shift is obvious. Even more significant are the energy savings that have been achieved through readjustment and "consolidation" (i.e., closing, reorganizing, or converting inefficient factories). Although it has proven difficult to close inefficient and unprofitable plants and heavy industry is once again growing at a high rate, the structural changes achieved through readjustment and consolidation account for at least half and possibly two-thirds of the energy savings achieved in recent years.[84] Improved man-

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[79] *Ibid.*

[80] See, for example, "Text of CPC Circular No. 7 on Rectification," FBIS, March 5, 1984, pp. K1-5, at p. K5; and "Hunan Investigates Wrongful Use of Electricity," FBIS, January 5, 1985, pp. P3-4.

[81] See Commentator, "Resolutely Curtail the Consumption of Fuel Oil and Practice Economy in Oil," RMRB, September 12, 1979; and Thomas Fingar, "Energy and Development: China's Strategy for the 1980s," in Peter Auer, Ed., *Energy and the Developing Nations* (New York: Pergamon, 1981), pp. 418-445.

[82] Lang Fengjun and Zhang Kehua, "Organizing the Petrochemical Industry," *Shijie Jingji Daobao*, January 24, 1983, in JPRS, No. 83162 (March 30, 1983), pp. 96-97; and Tong Yihao, "An Investigation into the Effective Use of 100 Million Tons of Petroleum," *Neng Yuan*, No. 3, 1983, in JPRS, No. 84332 (September 29, 1983), pp. 109-116.

[83] See, for example, Zhou Shulian and Wu Jinglian, "Accord Priority Status to the Development of Light Industry," RMRB, August 31, 1979.

[84] Structural change is credited for one-half of the energy saved thus far in "Energy Conservation . . . ," *supra* note 1; CIA analysts ascribe two-thirds of total energy savings to readjustment.

agement and technical improvements have had much less impact. Among other implications, this suggests that it will be difficult to sustain the conservation rates achieved in the past.

Like measures to slow the growth of energy demand, general policies to reduce consumption of energy have also been accompained by rules and regulations designed to reduce the amount of oil consumed as boiler fuel. Since 1979, officials have demanded that oil-fired boilers be converted to burn coal.[85] Specific targets and schedules have been adopted to ensure that this policy is implemented. Following the general approach of beginning with those steps that can be taken most easily, the Chinese started by reconverting boilers that were designed to burn coal but later retrofitted to burn oil. The next step was to tackle boilers that had been designed for oil and required construction of special coal handling facilities.

The principal instrument for achieving these goals has been the system of planned allocation. To achieve the shift from heavy to light industry or to force inefficient factories to close, the Center simply adjusted the amount of energy allocated to different enterprises, industries, regions, or sectors.[86] Allocations of fuel and power were also used to achieve many other goals besides reducing demand for energy, however. For example, policies have required that available supplies of energy be allocated, on a priority basis, to factories producing goods for export, and that the light and textile industries receive guaranteed supplies of fuel and power so that they can operate at full capacity to meet rising consumer demand and help alleviate unemployment problems.[87]

Measures to Increase Efficiency.—Chinese analysts have prepared numerous studies that compare energy efficiency in China to the levels achieved in other nations to illustrate the potential for saving energy through better management and technologies.[88] Their results show that there is much room for improvement.

The most effective way to achieve long-term efficiency gains, the Chinese acknowledge, is to build more efficient factories and to retrofit existing facilities, but technical solutions are expensive. Since entirely new facilities are very expensive and take a long time to build, retrofitting, or, as the Chinese say, the technical transformation of existing plant and equipment, must be emphasized in the near-term. Special funds for technical transformation to save energy have been established as part of the national and local budgets, and banks have been instructed to give priority to projects that promise to save energy when evaluating applications for loans.[89] One result has been a scramble for these funds and their misuse by managers and local officials who have viewed them as a way to avoid restrictions on the availability of money for capital construction.[90]

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[85] See Fingar, *supra* note 81 and the sources cited therein.

[86] See Fingar, *supra* note 9.

[87] *Ibid.*, and the sources cited therein.

[88] See, for example, "Energy Conservation . . .," *supra* note 1.

[89] Editorial, "Carry Out Technical Transformation and Equipment Renewal," RMRB, October 11, 1981; and Editorial, "Proceed with Technical Transformation Selectively and Methodically," RMRB, September 20, 1982.

[90] Zhao Tianzuo and Huang Jiasheng, "A Second Front Not to be Ignored," *Jiefang Ribao*, February 3, 1981, in FBIS, February 5, 1981, p. 05; and Editorial, "Technical Transformation is a Major Policy," RMRB, January 29, 1982.

Following the general approach outlined above, funding, imported equipment, and other elements needed to increase energy efficiency have been channeled, to the extent possible, into those industries and enterprises that consume—and waste—the most energy. This has meant that the electric power, metallurgical, petrochemical, chemical, and a few additional industries have received the lion's share of investment to save energy, and that within each industry, resources have gone primarily into the largest facilities. This produces substantial energy savings, but each additional increment is more difficult to achieve.

Since technological improvements are expensive and decreasingly cost effective, and since much energy waste results from poor management practices, the Chinese have also adopted several policies to improve energy management. Some of these policies are general (e.g., Party rectification, promotion of younger, better educated, and more technically competent cadres, and assignment of individual responsibility); others are specifically tailored to reduce energy waste. Examples of the latter include the creation of special energy conservation bodies at all levels of the system to assist and monitor the performance of individual enterprises, workshops, and management personnel, and the use of rewards and penalties to induce more efficient use of energy.[91] Factories that consume more energy than they have been allocated may have their supply reduced and/or be forced to buy additional supplies at higher rates. Since this will reduce profits and bonuses, workers and managers alike are expected to respond by reducing waste.

Installation of meters and other monitoring equipment, better records of energy consumption, more, and more specific, standards and regulations, increased reliance on prices to regulate consumption, and several other measures contribute to the effort to improve energy management. Thus far the Chinese have tried many partial solutions but have refrained from making full use of price incentives. Chinese energy analysts understand that prices have proven to be the most effective stimulus to conserve energy elsewhere, but the potential ripple effects of freeing energy prices are too great to allow this to happen in the near future.[92] As a result, they must use other, less effective mechanisms. Nevertheless, as other papers in this section demonstrate, much has been achieved.

Summary and Prospects

Although China's energy problems remain serious and will continue to challenge political leaders for decades, real progress has been achieved in the past five years and policies now in effect promise further gains in the future. Measures to increase production—greater reliance on foreign equipment, expertise, and financial assistance; increased investment in large-scale projects and encouragement of locally-funded development of smaller facilities; better utilization of technical and managerial personnel; and increasing use of pricing and financial reforms—have begun to demonstrate their efficacy and, given the long lead times required to

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[91] Yu Dehong, *supra* note 25; and "Energy Conservation . . . ," *supra* note 1.

[92] See the discussion in Thomas Fingar, *Energy Policy in the United States and China* (Stanford: Northeast Asia-United States Forum on International Policy, 1983).

bring new producing facilities on line, will lead to higher output of coal, oil and gas, and electric power in the years ahead. Similarly, policies designed to reduce wasteful consumption of fuel and power—closing or retrofitting of energy-wasting enterprises; technical transformation of existing facilities and construction of more energy efficient factories; energy audits and a wide array of penalties and rewards to induce greater efficiency; and more and tighter laws and regulations governing energy use and efficiency standards of new products—will continue to "free up" energy for more productive uses. Despite considerable achievements and the likelihood of continued progress, however, the situation might well get worse before it becomes substantially better.

Predicting the future on the basis of past performance is difficult, as noted in the CIA contributions to this section. On the production side, one can confidently predict that new coal mines will be brought into production and old mines will increase their output in the years ahead. Given the richness and accessibility of China's coal deposits and the emphasis on and investments in transportation infrastructure to move coal from mine to consumers, steady progress seems likely. The picture is much less certain with respect to production of oil and gas. Projections by Chinese energy analysts assume that substantial and economically exploitable deposits of oil will be found in their country's coastal waters and that both offshore and new on-shore fields will be brought into production quickly. These projections may be correct, but there is less certainty than implied in Chinese commentaries. The CIA paper identifies some of the factors that might make it difficult for the Chinese to attain predicted increases in oil production; its projection that oil output will reach only 115 MMT in 1990 is considerably below the Seventh Five-Year Plan target of 150 MMT.[93]

Electricity remains the most serious bottleneck to economic growth and steady improvement of living standards, especially in the countryside. The papers by CIA analysts address the magnitude of the problems that must be overcome to increase electricity supplies as rapidly as projected, but they also argue that steady increases can and probably will be attained. According to statements by senior Chinese officials, electricity generating capacity is to increase at an annual rate of 5–6 thousand megawatts (compared to an average of 3000 megawatts in 1980–85) to reach a total of 100,000 megawatts in 1990.[94]

The situation with respect to energy conservation is somewhat different. Policies to reduce demand and increase efficiency have, properly, emphasized measures that will save the most energy in the shortest possible time at the lowest possible cost. Easily realized energy savings have been or soon will be achieved; each incremental improvement in the future will be more costly and more difficult to attain. Moreover, the temporarily effective step of "readjusting" the balance between light and heavy industry by closing or curtailing production at heavy industrial facilities cannot be sustained. To attain desired growth rates, China will have to expand production of iron and steel, transportation equipment, building

[93] 93 See "International Business Symposium Continues," in FBIS, October 18, 1984, p. A1.
[94] *Ibid.*

materials, chemicals and petro-chemicals, and other industries that consume large quantities of energy. One should anticipate, therefore, that the gains from energy conservation will diminish.

Energy is and will remain one of the critical weak links in China's economy, but empty rhetoric and unrealistic plans have given way to more pragmatic policies and challenging but possibly attainable goals. Even if the policies fall considerably short of their intended objectives, however, the energy situation will continue to improve if those policies remain in effect. But the stability of energy and other policies pursued by Deng and his allies is still uncertain. Ironically and importantly, the efficacy of the entire reform program depends, in large measure, on the success of efforts to alleviate energy bottlenecks. Without real and continuous progress, it will be impossible to attain the developmental goals and fulfill the promises that are the basis for regime legitimacy.

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CHINA: ENERGY AND ECONOMIC GROWTH

By William B. Brown*

CONTENTS

OVERVIEW

China, in the past six years, has made exceptional progress in improving the efficiency with which its economy uses energy. This has allowed fairly rapid economic growth and a large increase in energy exports despite erratic growth in the production of energy. Unlike most countries, China has done this without sharp increases in energy prices.

Energy conservation has not come without costs, however. Use of capital equipment is down sharply because of fuel and electricity shortages. Some indexes of economic progress, such as the share of farmland plowed mechanically, have actually declined. Moreover, in terms of energy consumption, China's vast rural population remains one of the most impoverished in the world.

Pressures upon China's energy supplies caused by economic growth are likely to increase through the rest of the 1980s:

Offshore oil production may not be available soon enough to offset an expected decline in production from the country's large but mature onshore oilfields—especially Daqing.

Coal, because it is being counted on to substitute for oil wherever possible, will be hard pressed to provide the energy needed to fuel economic growth.

Electricity shortages, caused by insufficient investment in recent years and surging demand, may be the most critical short-term bottleneck to economic growth.

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Beijing is currently facing a host of difficult decisions related to energy policy that have long-term implications for the country's economic growth pattern. Two important issues now being debated are whether to reduce oil exports—20 percent of the country's foreign exchange earnings—and how to build the political consensus that is needed to raise domestic energy prices sharply.

The government's strong control mechanisms and the high priority placed on energy conservation should allow the economy to increase at a modest 4- or 5-percent rate through the rest of the 1980s—slower than in the past but faster than that initially planned by Beijing. The much faster growth expected by Beijing for the 1990s is unlikely to be achieved, however, without putting undue strain on both energy producers and consumers.

A key decision made in 1978 to forgo self-reliance in the energy sector and bring in foreign investment is firmly on track. Commercial opportunities for US energy companies in China will continue to expand and help to strengthen political links between the two countries.

The depth of such cooperation—and China's long-term ability to meet its energy requirements—is critically dependent on large oil discoveries being made in China's offshore regions. If large oil deposits are not found—and so far the results are disappointing—China may have to decide between importing oil in the 1990s—at great expense to the country's international financial position—or returning to the more self-reliant and isolationist economic policies of the past.

Introduction

Six years ago China sharply reduced its long-term expectations for energy production—particularly petroleum—and began to address a problem of energy shortages that has increasingly been seen as an obstacle to economic growth. Looming energy shortages were an important factor behind Deng Xiaoping's major economic "readjustment" of 1979, when it became apparent that Soviet-style growth led by heavy industry—without the Soviet Union's huge energy resources—could prove disastrous.

Beijing's economic "readjustment" policies have countered the energy problem on three fronts. First they have attacked the country's wasteful energy consumption habits by restructuring industry, closing inefficient plants, and placing quotas on energy use. Political considerations and a lack of flexibility in the price system have prevented China from raising energy prices sharply, the single most effective measure taken by other countries to curb energy consumption. Nevertheless the program has been successful. Energy consumption increased by only 2 percent per year between 1978 and 1983 while industrial growth averaged more than 7 percent. In the first three decades of the PRC's existence, energy consumption rose at a faster rate than industry as a whole.

Secondly, China has tried to correct policies that pressed energy industries to meet short-term production goals at the expense of developing the resource base. Higher priority, at least in theory, has been given to exploration and infrastructure development. Beijing has probably not been completely satisfied with results thus far.

Proven oil reserves, for instance, declined through 1982 although an increase appears to have been registered in 1983. Also a recent surge in demand for coal, caused by a sharp rebound in heavy industrial output, is putting pressure on coal mines to produce as much as possible, neglecting investment in long-term coal production capacity. Capital-intensive hydroelectric and nuclear projects, moreover, have been slow to move out of the planning phase.

Thirdly, and of the most interest to the United States and other foreign countries, Beijing has opened important segments of its once protected energy industries to Western and Japanese investment. In a remarkable turnaround, the Petroleum, Coal and Electric Power Ministries, once bastions of Mao Zedong's ideology of self-reliance, have become leading proponents of Western investment in China. Projects already under way will help to foster long-term commercial links between China and the non-Communist world.

This three-pronged strategy is aimed at doubling both energy output and the efficiency of energy use between 1980 and the year 2000, thus allowing a quadrupling of GNP by that date without the need for importing energy. These goals imply growth rates of 3.5 percent per year for energy output and 7 percent per year for the economy as a whole. The following analysis is an attempt to determine how realistic these goals are and, perhaps more importantly, to give an appreciation of the energy related problems that face the Chinese leadership as it formulates the Seventh Five Year Plan (1986–1990).

ANALYTICAL APPROACHES

Data recently released by the Chinese makes possible a relatively good understanding of how energy is produced and consumed in China. Also a resurgence in Chinese scholarly publications, in which authors often discuss energy production forecasts, makes possible a reasonable estimate of medium-term energy production prospects.

Forecasting future energy demand is more difficult. Data limitations and the lack of market mechanisms make standard econometric forecasts of dubious value for China. Static input-output matrixes, on the other hand, also require large amounts of data and tend to underestimate the potential for efficiency gains. These shortcomings are compounded by the need to differentiate between oil, coal, gas, and hydroelectricity in order to avoid assuming too large a degree of substitutability between fuels.

A rather rough idea of potential energy demand can be obtained by breaking the economy into the key energy-consuming industries. I have used a cross section of industries for which the Chinese have published relatively complete plans that include either physical or value growth targets and estimates of the coal, oil, gas and electricity required for such growth. The aggregation of these individual industry studies, weighted by the value of output in each, then provides data to make energy/national income elasticity judgments—the percent change in energy required for a given percentage increase in the value of output—that may be applicable to the entire economy. Many rather subjective judgments are still involved, particularly relating to light industrial demand and household consumption. Even so it enables me to avoid the common but often unwarranted assumption that energy demand increases in a one-to-one relationship to GNP, i.e. an elasticity of 1. At the same time I can examine the implicit assumption by China's planners that energy demand will increase at only one-half the rate of increase of GNP, that is an elasticity of 0.5.

My results suggest that the Chinese economy will have an overall energy elasticity of between 0.65 and 0.70 for the remainder of the 1980s and the 1990s—that is to say that energy consumption will increase at between 65 and 70 percent as fast as national income. This is an encouraging coefficient—smaller than what is expected for most major countries and much smaller than China's historical record. It is slightly higher than China's performance since 1978 because considerable industrial restructuring has occurred since that date.

This study suggests that the use of oil will increase only 45 percent as fast as national income in the 1980s, rising to 80 percent in the 1990s as opportunities for switching to coal are reduced. This will allow substantial growth in the petrochemical industries. Coal consumption will increase about 75 percent as fast as national income in the 1980s, falling to 60 percent in the 1990s with a large part of the increase going to the electric power industry. For electric power itself, I have used the official Chinese targets that assume electricity consumption will increase at the same speed as national income although this may be somewhat optimistic—in most countries, both developed and less developed, electricity consumption has increased much faster than national income.

These results suggest that oil, coal, and electricity each become a drag on the economy at a long term annual economic growth rate of about 4–5 percent. Unlike some previous forecasts they do not imply that China would have to import oil to maintain that growth rate. In the near term, a shortage of electric power appears to be the most likely constraint on economic growth.

China's Energy Supply

China ranks third in world energy output, following the Soviet Union and the United States. In per capita energy production, however, China ranks in the bottom one-third of all countries in the world. Commercial energy production totaled about 700 million tons of coal equivalent (MTCE) in 1983, up 5 percent from 1982. A similar increase appears likely in 1984. Energy output in the past six years, however, has increased at an average annual rate of only 2 percent, in marked contrast to the 6-percent annual growth registered in the preceding two decades. The steady erosion of coal's share of energy supply that occurred from 1950–1978 has been reversed; coal's share of energy output rose from 70 percent in 1978 to 71 percent in 1983 and will be still higher in 1984. Petroleum, with output flat since 1978, has lost about 4 percentage points and is now providing 18.8 percent of national energy supply. Hydropower has gained steadily to provide about 4.4 percent of the country's energy, while natural gas has declined to only about 2.5 percent. In addition, Chinese economists estimate that agriculture and forestry provide about 300 MTCE in the form of crop stalks and firewood, which is consumed in rural China on a noncommercial basis.

China's Sixth Five Year Plan (1981–85) and less definite but widely quoted long-range plans indicated that energy output will continue to grow slowly through the end of the century. Table 1 includes what appears to be the most realistic energy-sector targets. The 1985 targets are revised official Sixth Five Year Plan goals and appear reasonable. For 1990 I have used my own estimates, which are based on Chinese projections except for oil for which Beijing has recently increased its medium term output projections. For 2000 I have used projections made in 1982 by the *Shanghai World Economic Herald,* a Chinese Academy of Social Sciences publication.[1] The *Herald* also made projections for 1985 and 1990, but these appear overly pessimistic in the light of a strong performance in 1982 and 1983. These projections fall slightly short of Beijing's general guidelines for doubling the availability of energy by the year 2000. They imply growth rates of about 3 percent a year through the rest of the 1980s and the 1990s.

Achievement of these energy production targets will require a sharp boost in investment. Energy investment now accounts for about 45 percent of industrial investment, and Beijing's efforts to control its overall investment outlays have strongly affected the energy sector. Despite considerable emphasis on the energy problem, Beijing reduced state investment in energy development from 11.4 billion yuan in 1978 to only 9.1 billion yuan in 1981 and 10.1 billion in 1982 (see table 2). Only since 1983 has Beijing allowed energy investment to rebound.

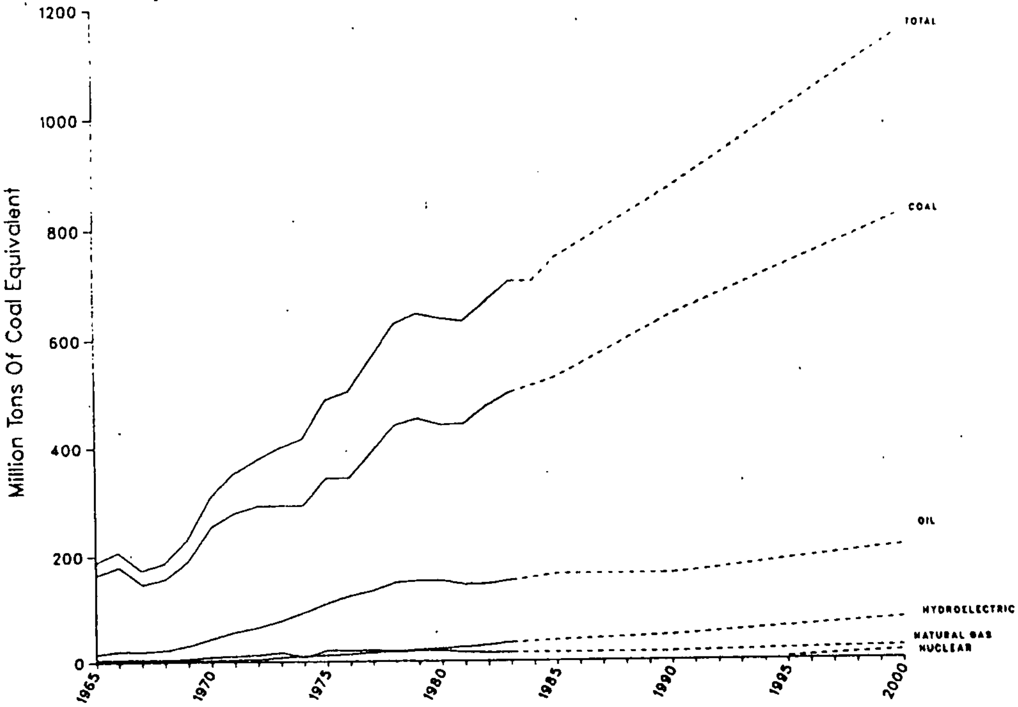
TABLE 1.—CHINA'S ENERGY PRODUCTION [1]

	1980	1981	1982	1983	1985 [2]	1990	2000 [3]
Total MTCE	637	632	668	702	745	870	1,150
Coal:							
Million Tons	620	620	666	700	740	900	1,150
Million TCE	442	444	475	500	527	641	821
Oil:							
Million Tons	106	101	102	105	115	115	150
Million TCE	152	145	146	151	164	164	214
Gas:							
Billion m^3	14.3	12.7	11.9	12.1	12	12	18
Million TCE	19	17	16	16	16	16	24
Hydropower:							
Billion kWh	58.2	65.5	74.4	87.8	95	115	187
Million TCE	24	27	30	35	39	47	77
Nuclear Power:							
Billion kWh	0	0	0	0	0	0	36
Million TCE	0	0	0	0	0	0	15

[1] I use the Chinese definition of coal equivalent energy to aggregate various energy types. One ton of coal equivalent energy [TCE] is defined as the amount of fuel that is required to provide 7 million kilocalories of heat energy. It is equivalent to 1.4 tons of raw coal, 0.7 ton of crude oil, 752 cubic meters of natural gas, and 413 kilowatt hours of electricity.
[2] Chinese targets.
[3] Shanghai World Economic Herald forecast, 1982.

[1] JPRS 83757, 24 June 1983, p. 16.

FIGURE 1
China: Energy Production, 1965–2000



COAL—CHINA'S ENERGY FOUNDATION

The 71-percent share of China's energy provided by coal is the highest for any major country. As suggested in table 1, that share will probably rise even higher in the next two decades as China strives to double coal output. China certainly has the coal reserves to meet that goal—official Chinese estimates of 600 billion tons are 900 times current annual output. Beijing, moreover, has recently begun an investment program that should allow substantial growth in coal output.

TABLE 2.—CHINA: ENERGY INVESTMENT [1]

[Billion yuan]

	1978	1979	1980	1981	1982	1983 [2]
Total investment of which	50.1	52.3	55.9	44.3	55.5	64
Industry	27.3	25.7	27.6	21.6	26.1	30
Energy	11.4	10.7	11.3	9.0	10.2	13.6
Coal	([4])	3.2	3.3	2.3	3.0	([4])
Crude Oil	([4])	2.7	3.2	2.7	2.6	([4])
Exploration	([4])	1.3	1.5	1.3	2.2	([4])
Development	([4])	.9	1.1	.9		
Refining	([4])	.5	.6	.5	.4	([4])
Electricity	([4])	4.8	4.8	4.0	4.6	[3] 5.4
Hydropower	([4])	([4])	1.8	1.3	1.5	([4])
Thermal	([4])	([4])	1.9	1.5	1.8	([4])
Transmission	([4])	([4])	1.1	1.2	1.3	([4])

[1] Basic capital construction investment from State State Statistical Bureau and other official sources.
[2] Projected from 6-month data. Industry breakdown is not available.
[3] Plan for 1983.
[4] Not available.

Coal output has surged since 1982, rising at an annual rate of 7 percent and reached the 1985 target of 700 million tons two years early. The improved performance comes after a difficult period between 1980 and 1981 during which coal investment was slashed and output dropped. The decline was in part caused by government policies that encouraged investment in profitmaking industries at the expense of industries, such as coal, that often operate at a loss because of low prices arbitrarily set by the state. Low prices are a continuing problem for large state owned coal mines but prices have been increased for locally controlled coal mines and Beijing has substantially increased central government investment.

Three years ago Beijing set targets of 700 million tons of coal output by 1985, 850 million tons by 1990, and approximately 1,200 million tons by 2000. The 1985 target was reached in 1983 and a new 1985 target of 740 million tons—which will probably be met in 1984—has been set. State owned coal mines have generally stuck to their planned output levels but locally controlled mines have increased output much faster than Beijing had anticipated.

Beijing's strategy for reaching these goals includes:

Encouraging the development of small mines to meet local and short-term coal requirements. These mines have accounted for about two-thirds of the increase in national coal output during the last three years. They are slated to increase output from 350 million tons in 1982 to 500 million tons in the year 2000.

Significantly expanding and developing new state-controlled underground mines—especially in Shanxi, Shandong, Anhui, and Guizhou Provinces—using domestic, Japanese, and European financing. These mines will increase production capacity from about 350 million tons in 1982 to 600 million tons in 2000.

Opening five very large open-pit mining areas using large amounts of US and European investment. These new mines will produce 200 million tons by 2000.

Of the 600-million-ton increase in capacity, at least 130 million tons will be developed in cooperation with Western and Japanese firms. Problems in marketing the foreign company's share of coal from these projects have arisen as a result of a sharp drop in international coal prices. These, and the transportation problems that constantly plague the industry, will make it difficult to meet the 1.2 billion target for 2000, but given the high priority currently afforded the coal industry and the pressure that will be placed upon it by the demand side, the target is not an impossible one. I have used a range between the 1982 *World Economic Herald* and the official target for my energy balance projections in Table 11.

PETROLEUM—DEPENDING ON OFFSHORE DISCOVERIES

China's oil production peaked in 1979 at 106 million tons (2.12 million b/d), declined slightly through 1982, and has since increased to what will amount to about 110 million tons in 1984. This makes China the seventh-largest producer in the world, about the same as Venezuela and the United Kingdom. Beijing earlier this year revised its medium-term oil production targets upwards, setting a goal of 5-percent annual growth through the 1980s. This would bring output to an annual rate of about 150 million tons by 1990. Beijing previously anticipated no growth until the late 1980s when offshore oil was expected to come on line and boost output to 150–200 million tons by the year 2000. Given China's current oil reserves situation this still appears to be a more prudent forecast. It is basically the one I have used in constructing the 1990 energy balances, although I have allowed a slight increase to 120 million tons by 1990.

A QUESTION OF RESERVES

Beijing has had a very poor record of forecasting oil production as is illustrated in figure 2. Much of the problem probably results from inadequate data on reserves. Beijing does not release official oil reserve statistics, and unofficial press reports—both Chinese and Western—are often very misleading. A common mistake by the press is to equate estimates of oil-in-place or "geologic" resources with proven, recoverable reserves. Usually only about a third to half of the oil-in-place in a given reservoir can be recovered. In 1981 an authoritative Chinese journal, *Liaowang,* published what appears to be the best reserve figures available.[2] These are included in table 3 for 1980, the presumed year of record. Proven remaining reserves totaled 1.6 billion tons or between 11 and 12 billion barrels.

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[2] *Liaowang* No. 10, October 1981 or *JPRS* No. 228, p. 12.

NCNA, in mid 1984, released figures for new proven oil discoveries of 1.06 billion tons for the 1981-83 period and 570 million tons for 1983 alone.[3] When depreciated by the same recovery factor used by *Liaowang* to determine recoverable oil reserves and netting out production, these figures show a slight decline in reserves in 1981-82 and a somewhat larger increase in 1983 to about 1.7 billion tons (12 billion barrels). Oil production totaled 774 million barrels last year so the reserves to production (R/P) ratio was about 15.6/1.

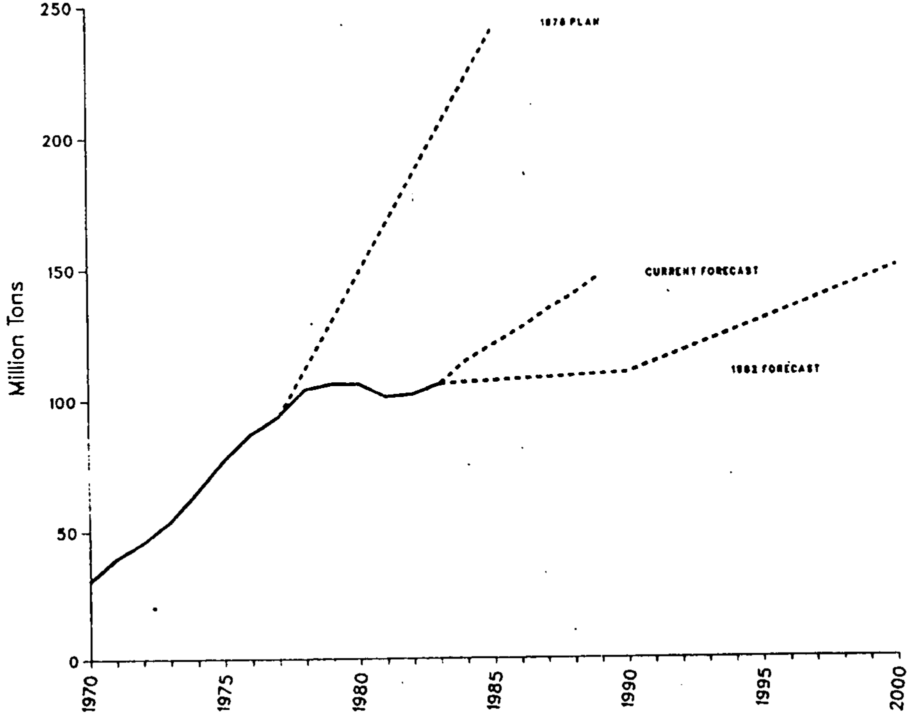
TABLE 3.—CHINA: ESTIMATED OIL RESERVES

[Billion tons (billion barrels)]

	1980	1981	1982	1983
Oil-in-Place	6.8	7.04	7.29	7.86
	(49.64)	(51.39)	(53.22)	(57.38)
Recoverable	2.3	2.38	2.47	2.66
	(16.79)	(17.37)	(18.03)	(19.42)
Produced	.7	.80	.90	1.01
	(5.11)	(5.84)	(6.57)	(7.37)
Reserves remaining	1.6	1.58	1.57	1.65
	(11.68)	(11.53)	(11.46)	(12.05)
Production	.105	.101	.102	.106
	(.77)	(.74)	(.74)	(.77)
Reserves to production [R/P]	15.2	15.6	15.4	15.6

[3] *Xinhua* 8 May 84, Beijing. *FBIS* 5/8/84.

FIGURE 2
China: Petroleum Output Plans



This level of reserves relative to production is not necessarily a problem for a country such as China with large, relatively unexplored regions offshore and in its far west. The R/P ratio for the US in comparison is only 9/1. Two problems with China's reserves, however, make a significant increase in production difficult and a decline possible. First, probably about 20 percent of these reserves are in West China where lack of infrastructure constrains output. At least a decade of high-cost, intensive effort is required before any significant output can be obtained from the Qaidam and Tarim basins.

Second, most of the reserves lie in fields already in mature stages of production, making maintenance of current production rates difficult. Nationwide, well productivity is declining at an annual rate of about 10 percent or about 10 million tons. This is being offset by drilling more than 2,000 new wells a year, thus increasing the density of wells in the oilfields.[4] More ominously, 93 percent of oil production is obtained by injecting water into the oil reservoirs to push the oil out—usually a secondary recovery measure in the US. For the nation as a whole, probably more water is now recovered from the oil wells than is oil. In most fields, when this water-cut ratio reaches between 60 and 70 percent, oil output begins to drop rather sharply.

NEW HOPE FOR OLD FIELDS

The current Chinese optimism appears to stem from new discoveries in the Shengli producing area—first discovered in 1962 and currently accounting for about 20 percent of the nation's output. Hu Yaobang, for instance, in May stated there is a fair chance that Shengli's output will rise to 40 million tons by 1990, up from its current rate of 20 million tons per year. Some skepticism, however, appears in order. Erroneous forecasts for this area in the mid-1970s were probably the main reason why Beijing had to reduce oil projections sharply in 1978. The geology of the North China Basin, where Shengli is located, is very complex with many faults that can limit the size of reservoirs. Also, most of the oil is heavy and waxy, which complicates and reduces recovery.

Beijing has also expressed more optimism that Daqing—by far the country's most important field with 52 million tons or 50 percent of the nation's output—will be able to hold output steady until late in the 1980s. Daqing Oilfield, aided by a 1982 policy change that allows the field to sell above-quota oil at world market prices and by a $160 million World Bank loan, is pumping large amounts of money into production facilities. Current strategy is to maintain the field's overall output rate by drilling more in-fill wells—1,000 a year are scheduled through 1987—by importing hundreds of submersible pumps to increase fluid flow, and by completing development of a deeper reservoir that will bring on line about 4 million tons of output by 1987. The Ministry of Petroleum also will probably receive over $300 million in low-interest Japanese loans for development of two marginal fields in the Daqing area.

[4] JPRS 83438 May 9, 1983, p. 122, from *Jingji Ribao* Feb. 5, 1983.

Analysis performed by Daqing Oilfield's Research and Planning Institute, published in a Chinese technical journal in July 1983, however, is not very optimistic. The analysis showed that the field's overall water-cut ratio had reached 64 percent by 1981 and would reach 75 percent by 1985 if the current 3-percentage point annual rate of increase in this ratio is maintained.[5] Another article in February 1984 stated that the water-cut was close to 70 percent and that 25 percent of the field's original 3.5 billion tons of oil-in-place had already been recovered.[6] The authors held out the possibility of pushing the water-cut up to 85 percent before allowing oil output to decline—about five years at the current rate. This would require a doubling of already pressed water injection and handling facilities. Clearly at some point the costs associated with handling this geometrically increasing volume of water will cause the oilfield to abandon the goal of level production. Moreover, the longer the field is pressed to maintain maximum production, the faster will be the decline.

THE OFFSHORE STRATEGY

The Ministry of Petroleum's general strategy—at least until the recent change in production targets—has been to put intensive efforts into keeping oil output steady in the country's northern and northeastern oilfields until offshore oil has a chance to come on line. Offshore oil is then expected to more than offset the decline of the onshore fields.

The offshore oil exploration program, however, has been slow in developing. The failure of a decade-long effort (1968–78) by the Ministries of Petroleum and Geology to find and develop offshore reserves led China to sign risk contracts with 30 Western and Japanese oil companies—a process completed only last year. The companies are to explore and develop five of the six major offshore basin complexes—only the East China Sea was excluded. The companies pay all exploration expenses—already well over $1 billion—and will split development costs evenly with the Chinese. In return they hope to recover their costs with up to 50 percent of oil produced and earn a small profit share. Western geologists—after completing high-quality seismic analysis of the basins—have been very optimistic, estimating that they might find as much as 30 billion barrels of recoverable oil.

Early offshore results, however, have not been promising. The Japanese have achieved some success in the Bohai, but elsewhere—and especially in the most promising Pearl River Basin—only dry or noncommercial oil wells have been drilled. Many prospects remain to be drilled and a second round of competitive bidding for new leases is expected next year. Several of the best locations, however, have already been drilled raising concern among the Chinese that the new bidding round will not be well received.

Continuing poor drilling results will have no impact on short-term production prospects unless Beijing feels obligated to conserve

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[5] "Studies on the Mathematical Model for Planning the Development of Daqing Oilfield, *Shiyou Xuebao* No. 3, 1983 p. 56.

[6] Lin Heng "Maintaining Peak Production at Daqing in its high Water-Cut Production Period" *Shiyou Kantan yu Kaifa* No. 2 1984, p. 44.

its resources. It will, however force a major reassessment of China's ability to increase oil in the 1990s in the face of an almost certain decline of Daqing. In that case, Beijing would probably push forward exploration in frontier areas and in the East China Sea and in the meantime rethink its current oil export policies.

NATURAL GAS—UNKNOWN POTENTIAL

Natural gas production has dropped by 20 percent since 1979 and, like oil, the industry faces cloudy prospects because of limited proven reserves. Official data are not available but unofficial Chinese sources placed reserves at about 180 billion cubic meters in 1981. The World Bank on the other hand estimates that in 1981 China had proven gas reserves of only 131.5 billion cubic meters including 58 billion cubic meters of associated gas found in oilfields and 73.5 billion cubic meters of nonassociated gas. This is enough gas for only 11 years at current production rates.

About 45 percent of China's gas is produced from gas fields in Sichuan Province. Many of these are having severe difficulties maintaining current production rates. US firms have been invited into Sichuan to give technical advice and sell some improved production equipment. Prospects for these fields do not appear good, but more intensive exploration of southeastern Sichuan and Guizhou Provinces could turn up large new deposits. The remainder of China's gas output is produced as associated gas in the major northeastern oilfields, with Daqing, Liaohe, and Shengli the major contributors (see table 4).

Natural gas output relative to oil output is unusually low in China, particularly because of the country's largely continental hydrocarbon source rocks, which many geologists believe should be conducive to gas formation. Some geologists believe that much of the gas that was created escaped to the surface in China's typically highly faulted basins. Others believe there is a great deal of gas potential, particularly at extreme depths, but that Chinese drilling technology is not sophisticated enough to find it.

TABLE 4.—NATURAL GAS PRODUCTION

[Billion cubic meters]

	1978	1979	1980	1981	1982	1983
Total	13.73	14.51	14.27	12.74	11.93	12.1
Sichuan	6.15	6.52	6.33	5.78	5.24	(1)
Daqing	3.20	3.31	3.39	2.90	2.78	(1)
Liaohe	1.80	1.86	1.88	1.53	1.26	(1)
Shengli	1.40	1.50	1.42	1.04	0.97	(1)
Other	1.18	1.32	1.25	1.49	1.68	(1)

1 Not available.

These differing views make it difficult to predict gas production even in the short term. A gradual increase appears likely because of new imported technology and some new discoveries. The most important onshore find is in the Zhongyuan area that the World Bank is helping to develop. Gas resources in Zhongyuan's eight identified oil and gas fields might total as much as 36 billion cubic meters. Output in 1983 was probably about 300 million cubic meters, and allowed a slight rebound in national gas output. By 1985 the area is to produce 500 million cubic meters a year.

Gas discoveries have also recently been made offshore in the Bohai, the East China Sea, and in the Yinggehai Basin south of Hainan Island. The Yinggehai discovery, made by Atlantic Richfield in its concession area, is particularly promising. Chinese authorities have tentatively approved a proposal by ARCO to establish a giant fertilizer complex on Hainan to use this gas. The plant would be large enough to make China a potential fertilizer exporter instead of a perennial importer.

ELECTRIC POWER—STRONG GROWTH BUT MORE SHORTAGES

China's economic planners admit that electricity consumption in the long term must increase at close to if not faster than the overall economic growth rate. Over the past three decades, electricity consumption in China has risen twice as fast as industrial growth. China's broad goals for "modernizing" the country thus include a guadrupling of electric power availability by the year 2000—an annual growth rate of about 7 percent. This represents a massive challenge for the industry but not necessarily an impossible one. Other countries, including the US and the USSR have achieved this rate of growth for long periods of time.

China has two major disadvantages that will make it difficult to raise capacity by anything more than 5 percent per year. First is the limited availability of domestic capital and high worldwide interest rates if China should decide to borrow capital. Secondly, limited supplies of oil and gas and much higher costs for nuclear power plants are forcing China's power development to be rather narrowly focused on long lead time coal-fired thermal and hydroelectric power plants.

SLOWDOWN IN CAPACITY EXPANSION

In the 1970s, power output in China increased at a 10-percent annual rate, reaching 300 billion kilowatt-hours (kWh) by 1980. Generating capacity rose by 11 percent per year to reach 66,000 megawatts (MW) in 1980, sixth largest in the world. Beijing's modest Sixth Five Year Plan (1981-85) called for an increase of 12,900 MW of generating capacity by 1985. Total capacity to rise to about 81,000 MW by 1985, an annual increase of only about 4 percent.

China will probably slightly exceed that target by 1985 but capacity growth is still much slower than in the past and power shortages are becoming more widespread. Actual expansion has been between 3,000 and 4,000 MW a year since 1981 to a total capacity of about 76,000 MW by the end of 1983. Plants under construction that are scheduled to come on line in 1984 and 1985 total 6,500 MW, indicating capacity increases will continue to be only about 4 percent per year.

These increases are much smaller than the peak additions of 5,048 MW and 4,651 MW in 1978 and 1979 respectively. The slowdown can be directly attributed to cutbacks in electric power investment. As Table 2 indicates, investment in the industry was slashed by 20 percent in 1981 with only partial recovery in 1982. Investment in electric power increased sharply in 1983, far above the Sixth Five Year Plan budget allocations.

Despite the slowdown in the growth of generating capacity, electric power output growth so far has slackened only slightly. Output increased by only 2.9 percent in 1981, when industry was depressed, but has risen steadily at a 7 percent annual rate since then. Capacity utilization, particularly for hydroelectric facilities, has also grown very fast, removing a cushion that had been developed in the 1970s and may now be at an unsustainable level. If so, and if capacity increases in 1984 and 1985 continue at only a 4 percent rate of growth, annual increases of power output may slump to 3 percent per year, a severe limitation on an industrial sector already starving for electricity.

Longer term prospects are somewhat better, provided Beijing is willing to steadily increase its budget allocations. China now has approximately 22,000 MW of capacity—net of expected retirements—under construction that is slated to come on line between 1986 and 1990. This will allow an annual growth rate of about 5 percent.

THERMAL POWER

TABLE 5.—ELECTRIC POWER CAPACITY

[Thousand megawatts]

	1978	1979	1980	1981	1982	1983	1985	1990	1995	2000
Total:										
Capacity	57.1	63.0	63.4	69.3	72.4	75.9	81.0	103.0	130.0	165.0
Percent change	([1])	10.3	4.3	3.0	6.8	5.0	3.4	4.9	5.0	5.0
Thermal:										
Capacity	39.8	43.9	45.6	46.8	49.4	52.5	56.2	73.0	90.0	110.0
Percent change	([1])	10.3	3.9	2.4	5.8	6.3	3.5	5.4	4.3	4.1
Hyroelectric:										
Capacity	17.3	19.1	20.3	21.7	23.0	23.5	25.0	30.0	37.0	45.0
Percent change	([1])	10.4	6.3	3.9	9.0	2.2	3.1	3.7	4.3	4.0
Nuclear:										
Capacity	0	0	0	0	0	0	0	2.5	10.0	....
Percent change	0	0	0	0	0	0	0	([1])	([1])	....

[1] Not available.

Thermal power plants account for approximately 50,000 MW or 70 percent of China's power capacity and contribute 77 percent of power output. They include an estimated 43,000 MW of coal-fired and 7,000 MW of oil-fired plants. The industry is characterized by hundreds of small plants that use inefficient 50-, 100- and 200-MW turbine/generator units.

The lack of larger scale generators reflects the inability of China's machine-building industry to produce large numbers of more efficient 300-MW turbine/generator units. After more than a decade of development, only five indigenously developed 300-MW units are in operation.

This situation is changing rapidly as China imports needed technology from the West. In 1978, Westinghouse and Combustion Engineering signed contracts making available to China 300- and, eventually, 600-MW turbine/generator technologies that are already beginning to have an impact. These units will form the basis for capacity expansion in the industry in the late 1980s and in the 1990s.

China is also rapidly expanding its 500-kilovolt transmission capabilities with some imported equipment. This is particularly important if China is to develop large power plants at mine locations that probably offer China the best chance of keeping up with its power needs. These plants not only alleviate the need for transporting coal, they can be located in rural areas and will not contribute to already major pollution problems in China's cities.

HYDROELECTRIC POWER

China has developed only a tiny share of what is generally accepted as the world's greatest hydroelectric power potential. Hydroelectric generating capacity now totals about 24,000 MW, of which 8,000 MW are small-scale rural plants not tied into any grid systems. Hydroelectric output totaled 74.4 billion kWh in 1982, 23 percent of total power output. Hydro's 13-percent increase over 1981 was the only reason the Ministry of Electric Power met its annual goals; thermal plants missed their target as a result of a fuel shortage. Hydroelectric output did even better in 1983 with production up over 14 percent.

Beijing, in keeping with its goal to quadruple electricity supply by the year 2000, has ambitious goals for the hydro sector. According to figures published in a Ministry of Water Resources and Electic Power (MWREP) journal, hydroelectricity will increase by 4,000 MW between 1981 and 1985 (most of this has already been achieved); by 9,000–10,000 MW in the Seventh Five Year Plan (1986–90); by 12,000–16,000 MW between 1991 and 1995; and an astonishing 11,000–20,000 MW between 1996 and 2000.[7] Included in these plans for the 20 years (1981/2000) are 12,000 MW of additional hydropower from small plants and 28,000–38,000 MW from medium and large plants. This is an annual growth rate of about 5 percent in the 1980s, accelerating to over 6 percent in the 1990s.

Achievement of these goals is highly unlikely. Currently, 27 large- and medium-sized power plants with designed capacity totalling over 12,000 MW are under construction; most have only recently been started and will not produce electricity until the late 1980s and early 1990s. With a minimum of 12 years required to construct a large hydroelectric plant, the 1990 and 1995 targets already seem out of reach. Plants now under construction plus 400 MW per year of small scale hydro, should bring capacity up to about 30,000 MW by 1990 and close to 37,000 MW by 1995—an annual growth rate of 4 percent.

NUCLEAR POWER

China has been actively considering the development of nuclear power since at least 1970 but thus far has made little progress. One small (300 MW) domestically designed plant is in an initial stage of construction at Qinshan near Shanghai with a completion target of 1988. MWREP has also negotiated with Western firms for two

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[7] *Shuili Fadien*, Feb. 12, 1982 and *JPRS* No. 243.

1800-MW turnkey plants, one for Guangdong Province that would share power with a Hong Kong utility, and a second plant near Shanghai. The Guangdong plant has received State Council approval and if MWREP can settle with the French firm, Framatome, construction could begin within a year. Framatome has signed a preliminary agreement that includes both the Guangdong and Shanghai plants but China continues to state it prefers a U.S. supplier if U.S. nonproliferation concerns are worked out.

These plants will give China practical experience with a technology that some Chinese planners believe is the only solution to China's long-term energy requirements. Beijing last year, however, cut in half its plans to have 20,000 MW of nuclear capacity on line by 2000, reflecting the high cost of building nuclear capacity. Some estimates for the Guangdong plant, for instance, range as high as $5 billion, more than five times the cost of an equivalent coal-fired plant. This new 10,000 MW target appears feasible and is one that will still offer a substantial market for sales of Western technology and equipment. However, it will contribute only about 6 percent of the nation's power output and about 1 percent of total energy supply at the end of the century; the investment required will probably total more than $20 billion in 1982 dollars.

China's Demand for Energy

China has slowed the rate of increase in energy consumption in the last five years. Unlike in many Western economics, this conservation has taken place in a period of fairly rapid economic growth. Energy consumption in China increased at an annual rate of 2 percent from 1978 through 1982 while national income increased at a 6.3-percent rate. This energy elasticity of national income of 0.30 is in sharp contrast to an elasticity of 1.47 for the Chinese economy from 1965 to 1978 (see figure 5).

Most observers, inside China and in the West, doubt this low elasticity can be maintained.[8] Much of the improved energy use between 1978 and 1982 was the result of economic restructuring caused by rapid growth in energy-efficient light industry and agriculture and slow growth in energy-intensive heavy industry. Beijing officially attributes two-thirds of the energy savings to structural change and only one-third to conservation. This suggests that had the structural change not occurred, energy consumption would have been 12 percent higher in 1982—76 million tons of coal equivalent energy—twice the level of energy exports in that year. In 1983, when light and heavy industry grew at close to the same rate, preliminary data shows that the energy elasticity was close to .75.

The separation of structural change—the production of a different mix of products that require less energy—from a more narrowly defined efficiency gain—reduced energy consumption for production of a given product—is important in forecasting China's future demand for energy because Beijing's plans call for more or less balanced growth between heavy industry and light industry and some-

[8] See Zhang Siping "The Relationship Between Energy Consumption and the Structure of the National Economy", *Shehui Kexue Yanjiu* No. 4, 1980, pp. 52–56.

what slower growth for agriculture. If efficiency gains continue along recent trends, this balanced growth would suggest an elasticity close to 0.75, which is not consistent with Beijing's planned 0.50. It would imply that if energy supplies double by the year 2000 as planned, the overall economy could increase at a rate of only 4.8 percent per year, not the planned annual rate of 7.2 percent.

Although these broad elasticity statistics are useful in providing a general idea of China's energy problem, they can be misleading on two accounts. First, there can be considerable structural change within a broad sector like heavy industy that can have a strong but, without careful study, ambiguous impact on energy demand. Secondly, they do not differentiate between types of energy. Oil, coal, and electric power output are not likely to increase at the same rate nor can we assume that demand for these energy sources will increase at the same rate. To the extent that these fuels cannot be readily substituted for each other, bottlenecks can occur as a result of a shortage of one fuel, even though in more aggregate terms the country might have plenty of energy.

A first step in analyzing China's energy demand is, therefore, the disaggregation of energy consumption by energy type and energy-consuming industry as is shown in tables 6 and 7 for 1978 and 1982. The 1978 data is taken largely from a Chinese publication, *Energy Technology and Economics.*[9] No similar source is available for 1982 so I have had to include a mixture of official data, where they are available, and my own estimates. Where there is no basis for making an estimate I have included only an "NA". Electric power consumption is treated as an intermediate product and is included in the table only as a consumer of primary energy. The distribution of electric power consumption can be found in table 12.

[9] *Nengyuan Jishu Jingjixue*, Hunan Renmin Chubanshe, 1981, p. 462.

TABLE 6.—CHINA: PRIMARY ENERGY CONSUMPTION, 1978

	Energy		Coal		Oil		Gas		Hydropower	
	Total (MTCE)	Share (percent)	Total (MTCE)	Share (percent)	Total (MTCE)	Share (percent)	Total (MTCE)	Share (percent)	Total (MTCE)	Share (percent)
National total	571.3	100	404	100	129.7	100	18.1	100	19.4	100
Industry	311.6	54	225	56	71.0	55	15.6	85		
Heavy industry of which	267.6	47	196	49	56.0	43	15.6	85		
Metallurgy	65.9	12	56	14	8.2	6	1.7	9		
Ferrous	63.2	11	54	13	7.5	6	1.7	9		
Nonferrous	2.7	1	2	Negl	0.7	1	Negl	Negl		
Chemicals of which	55.7	10	35	9	11.0	8	9.7	53		
Ammonia	30.2	5	20	5	0.5	Negl	9.7	53		
Petrochemicals	3.5	1	Negl	Negl	3.5	3	Negl	Negl		
Building materials of which	18.2	3	17	4	1.2	1	Negl	Negl		
Cement	10.0	2	9	2	1.0	Negl	Negl	Negl		
Energy	31.9	6	16	4	12.1	9	3.8	20		
Coal	16.0	3	16	4	Negl	Negl	Negl	Negl		
Oil	15.9	3	Negl	Negl	12.1	9	3.8	20		
Machine building	16.3	3	15	4	1.3	1	Negl	Negl		
Light industry	43.7	8	29	7	14.7	11	Negl	Negl		
Transportation of which	38.0	7	20	5	18	14	Negl	Negl		
Rail	21.0	3	18	4	1	1	Negl	Negl		
Motor vehicle	16.0	3	Negl	Negl	16	12	Negl	Negl		
Agriculture	16.5	1	2	Negl	14.5	11	Negl	Negl		
Household/commercial	78.5	14	76	19	Negl	Negl	2.5	14		
Electric power	126.6	22	81	20	26.2	20	Negl	Negl	19.4	100

TABLE 7.—CHINA: PRIMARY ENERGY CONSUMPTION, 1982

	Energy		Coal		Oil		Gas		Hydropower	
	Total (MTCE)	Share (percent)	Total (MTCE)	Share (percent)	Total (MTCE)	Share (percent)	Total (MTCE)	Share (percent)	Total (MTCE)	Share (percent)
National total	615.7	100	454.0	100	115.9	100	15.8	100	30.0	100
Industry	326.8	53	246.0	54	66.0	57	14.8	94		
Heavy industry of which	265.8	43	201.0	44	50.0	43	14.8	94		
Metallurgy	57.8	9	51.0	11	6.3	6	0.5	3		
Ferrous	54.8	9	49.0	11	5.3	5	0.5	3		
Nonferrous	3.0	Negl	2.0	Negl	1.0	1	Negl	Negl		
Chemicals of which	NA	NA	41.0	9	NA	NA	10.8	68		
Ammonia	36.8	6	24.0	5	2.0	2	10.8	68		
Petrochemicals	5.0	1	Negl	Negl	5.0	4	Negl	Negl		
Building materials of which	NA	NA	NA	NA	NA	NA	Negl	Negl		
Cement	17.0	3	16.0	4	1	1	Negl	Negl		
Energy	41.5	7	18.0	4	20.0	18	3.5	22		
Coal	18.0	3	18.0	4	Negl	Negl	Negl	Negl		
Oil	23.5	4	Negl	Negl	20.0	18	3.5	22		
Machine building	NA	NA	NA	NA	1.0	1	1.0	6		
Light Industry	51.0	8	35.0	8	16.0	14	Negl	Negl		
Transportation of which	38.0	6	21.0	5	17.0	15	Negl	Negl		
Rail	22.0	4	21.0	5	1.0	1	Negl	Negl		
Motor vehicle	15.0	2	Negl	Negl	15.0	13	Negl	Negl		
Agriculture	16.0	3	2.0	Negl	14.0	12	Negl	Negl		
Household/commercial	88.0	14	87.0	19	Negl	Negl	1.0	6		
Electric power	146.9	24	98.0	22	18.9	16	Negl	Negl	30.0	100

NA = Not available.

DEMAND FOR COAL

China's consumption of raw coal reached 637 million tons in 1982, up from 565 million tons in 1978—an annual rate of increase of about 2.5 percent. In terms of standard coal equivalent, these figures are 455 million tons and 404 million tons respectively. Preliminary data indicate that coal consumption increased even faster in 1983, probably by more than 6 percent and is rising rapidly again in 1984. The resurgence in coal demand results largely from two factors; resumption of rapid growth in heavy industry and a sharp rise in retail sales of coal to households and local industries.

Five industries—electric power, iron and steel, synthetic ammonia, building materials, and railroads—accounted for 45 percent of China's coal consumption in both 1978 and in 1982. This group thus forms a convenient cross section by which to look at future industrial demand for coal. Household consumption accounts for most non-industrial use of coal. Estimates of future consumption by these sectors is included in table 8. They suggest that demand for coal will increase by about 3.9 percent per year through 1990 and about 3.4 percent per year in the 1990s—presuming an economic growth of 5 percent per year. Total demand, including losses, would thus reach about 900 million tons in 1990 and 1,200 millon tons in 2000. These demand projections are very close to the official coal production targets and leave no room for coal exports. Exports in fact, however, have a very high priority and thus some coal will most likely still be exported in the 1990s putting a further squeeze on domestic uses.[10] Beijing may, therefore, have to increase even futher coal production targets or slow the conversion of industrial boilers from oil to coal.

The electric power industry is China's largest industrial consumer of coal, accounting for about 140 million tons or 22 percent of the nation's total demand in 1982. Power plants have increased coal consumption by approximately 5 percent a year over the past five years, slightly faster than the output of thermal electricity because of the gradual conversion of oil-fired plants to coal. Despite the high priority in fuel allocations given to the electric power sector, lack of coal has constrained electricity supply, particularly in 1981.

TABLE 8.—CHINA'S COAL DEMAND

[Million tons]

	1978	1982	1990	2000
Total demand	565	638	864	1,170
Industry demand	465	517	686	881
Steel	76	69	80	96
Ammonia	28	34	38	43
Cement	15	22	41	67
Electricity	113	137	198	260
Rail	25	29	32	30
Other	208	224	297	385
Household demand	100	122	178	289

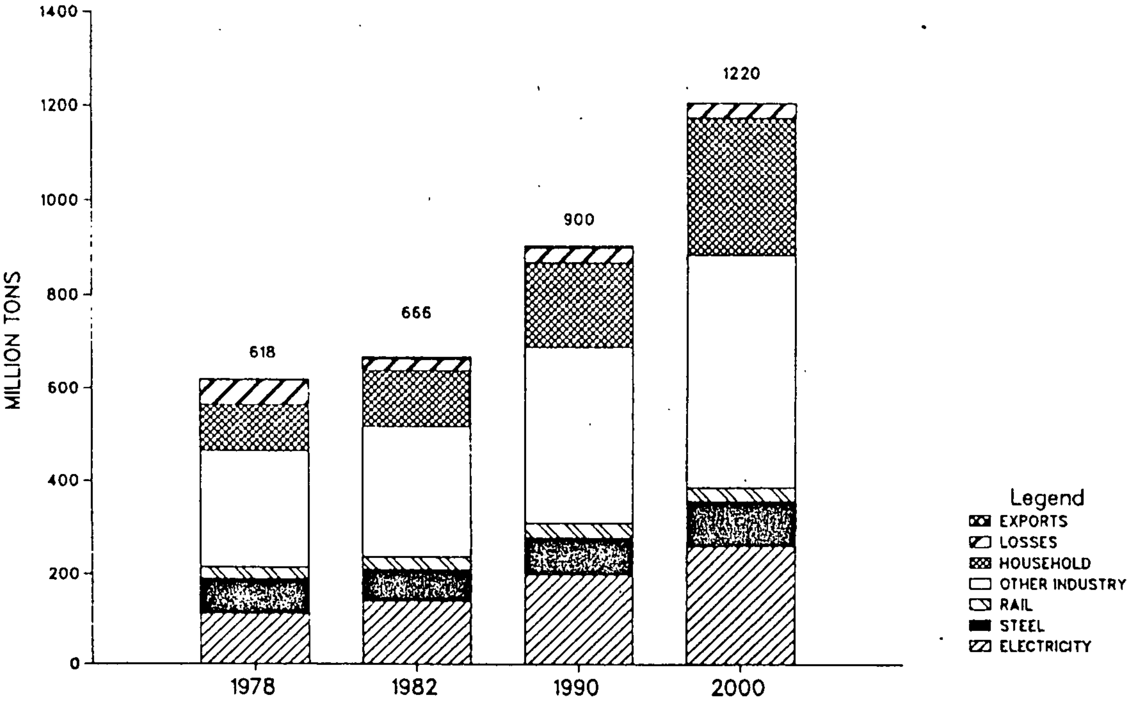
[10] See "Why Export Coal When There's still an Energy Shortage", *Shijie Jingji Daobao* #10 or JPRS 83162, 30 March 1983, p. 11.

TABLE 8.—CHINA'S COAL DEMAND—Continued

[Million tons]

	1978	1982	1990	2000
Production	618	666	900	1,150–1,200
Losses and stocks	53	24	30	30
Total supply	565	642	870	1,120–1,170
Net exports	1	5	5	50–0

FIGURE 3
China: Coal Consumption, 1978–2000



Over the past three decades the power industry has steadily improved the efficiency with which it burns coal. Coal consumption per kilowatt-hour has dropped from 700 grams in 1949 to 399 grams in 1983, an average gain in efficiency of about 1.6 percent per year. This gain has leveled off to about 1 percent per year recently, a rate of improvement that, according to articles in Chinese electric power journals, Beijing hopes to maintain through the 1990's. Large-scale production and installation of more efficient 300-MW and 600-MW turbines and generators in new plants should make this efficiency gain possible.

Thermal power capacity and output—according to my estimates in table 5 will increase at a rate of between 4 and 5 percent per year. With efficiency of coal burning rising by 1 percentage point a year, and with a gradual slowing down in the conversation of oil fired plants, the power sector's consumption of coal should rise at a manageable 3 to 4 percent annually.[11] On the other hand, were China to succeed in quadrupling power output by the year 2000—its official target—coal consumption would have to rise at an annual rate of 6.7 percent and reach 450 million tons by 2000. This would require a doubling of the power sector's share of coal consumption—to about 40 percent—and that appears highly unlikely.

The iron and steel industry is China's second largest industrial consumer of coal. In 1978 it consumed about 76 million tons of raw coal, 13 percent of the nation's total. Consumption declined to less than 68 million tons in 1981 despite a 12-percent increase in steel output. This represents an efficiency gain of 20 percent in the three-year period—from 2.00 tons of coal per ton of steel in 1978 to 1.59 tons of coal in 1981. Much of this improvement was the result of closing hundreds of small steel plants. Also less wastage of pig iron in making steel saved considerable energy. In 1982 and 1983 the efficiency gains have been much less—probably about 1.5 percent per year, because of fewer plant closings.

The steel industry will continue to offer one of China's best opportunities for saving coal. With only modest goals for steel production and large efficiency gains still available—particularly through the use of modern integrated mills such as the Baoshan steel mill now under construction—the industry's coal consumption need increase only by about 1 percent per year through the end of the century.[12]

China's chemical sector also offers substantial coal savings. In 1978, chemicals consumed 48 million tons of coal—8.4 percent of the nation's total—28 million tons of which were used as feedstock for synthetic ammonia. By 1982, coal consumption in the chemical sector had risen to about 57 million tons, including about 34 million tons in making synthetic ammonia. Growth targets for the chemical industry show that fairly rapid expansion is planned through the rest of the century, but much of the increased energy demand will be met by petroleum rather than coal. Chemical use of coal will probably increase at a rate of only 1 or 2 percent annual-

[11] "Coal Consumption Forecast By Thermal Powerplants by Year 2000", Dianli Jishu #8, 5 Aug 83 also JPRS 85027 29 Dec 83, p. 22.

[12] See Zhao Zhengguo "We Must Use Energy Conservation As the Key to Developing the Iron and Steel Industry" *Neng Yuan* No. 3, 25 June 1983, pp. 5-7 or JPRS 84432 29 Sept. 83 p. 102.

ly, again making substantial amounts of coal available for use in other sectors.

Building materials, particularly cement, are likely to take up some of these savings. The cement industry consumed about 22 million tons of coal in 1982. I estimate that rapid expansion of the industry—much of it in relatively inefficient small plants—will increase its consumption rate to close to 8 percent through the 1980s, falling to perhaps a 5-percent annual rate of increase in the 1990s.

China and India are the only major countries that continue to use steam locomotives as the primary power source for their railroads. About 75 percent of China's freight is pulled by steam locomotives. These consumed 25 million tons of coal in 1978 and an estimated 28 million tons in 1982. Efficiency gains by steam locomotives have lagged in recent years. Coal consumption per ton-kilometer of freight actually increased slightly in 1982.

China's railroad sector over the past decade has been unable to keep up with economic growth. Freight movements, as measured in ton-kilometers, have increased by only a little more than 4 percent per year. The resulting bottlenecks have been particularly troublesome for coal transport and are causing Beijing to reconsider its dependence on steam locomotion. Ultimately, China may be forced to move toward diesel and electric locomotion. The reasons, as expressed by Chinese authors in energy and transportation journals, are the efficiencies of energy and capital that diesel and electric offer.[13] The changeover will be gradual—70 percent of locomotive production is still steam engines. Rumors at China's single remaining steam locomotive plant in Datong—the largest in the world—suggest, however, that it will change over to diesel electric production sometime in the not too distant future.

Retail sales of coal reached approximately 150 million tons in 1982, up sharply from only 100 million tons in 1978. This 10-percent-a-year increase has been a major stimulus to coal production by locally owned coal mines, which in 1982 alone increased output by 20 million tons—an increase of 15 percent. In 1978, almost all retail sales of coal went for household consumption. Liberalization of controls on the private mining and selling of coal and the proliferation of private and collectively owned industry since 1978, however, indicate that only a portion of the increased sales went toward household consumption. I estimate that households increased consumption of coal by 5 percent per year over the period, the same rate that was officially reported for 1979. This would bring household consumption to 122 million tons in 1982.

Coal still provides only about a third of the energy used in China for heating and cooking—plant materials including firewood and crop stalks provide almost all of the rest. The effort required for peasants to gather these materials and the extensive ecological damage caused are now often cited among rural China's most pressing problems.

Under these circumstances—and with the relatively cheap price of coal—household demand for coal is practically inexhaustible. The central government will continue to try to control this demand

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[13] See for instance Jin Chenhu, *Jiche Dianchuandong* #4, 1982, pp. 8–12.

by refusing to sell coal produced in state-owned mines for rural household use. However, as long as locally controlled coal mines are given free rein to produce and sell coal on retail markets, households should be able to rapidly increase their coal consumption. Continued annual growth of around 5 percent thus appears likely, barring more restrictive government policies toward local coal mines.

DEMAND FOR PETROLEUM

China's annual oil consumption declined by 12 percent—10 million tons—between 1978 and 1982, a remarkable achievement given the country's substantial increase in industrial and agricultural output. Despite a 2-million-ton decline in oil output, Beijing was able to boost annual exports by 8 million tons to take full advantage of the 1979 jump in oil prices. The value of oil exports thus rose from little over $1 billion in 1978 to about $5 billion in 1982, an important element in China's greatly improved international financial situation.

The decline in consumption was made possible by shifting from oil to coal in many boiler and furnace operations and by Beijing's extraordinary control over the disposition of petroleum products. Consumption of gasoline and diesel fuel actually declined despite a 40-percent increase in the stock of motor vehicles and tractors. Although forcing some improvement in the efficiency of fuel use, Beijing's policies have greatly reduced the utilization rate of motorized vehicles and machinery.

Savings still can be made in China's oil consumption habits, but the easiest gains have probably been made and Beijing will be forced to allow a gradual increase in consumption. An upward trend has in fact already begun. Preliminary production and export statistics suggest that consumption in 1983 increased by about 5 percent. By my calculations—as follow in a sector by sector analysis—if the economy is to grow at a 5-percent annual rate, a minimum 2-percent annual gain in consumption will be required to meet the needs of the consuming sectors. This corresponds to an elasticity of oil consumption of about 0.5. Oil consumption under this scenario will then reach about 100 million tons per year by 1990. These results are shown in table 9. When compared to my estimate of oil output in 1990, it shows only a slight reduction in oil exports. By the year 2000, however, increasing demand may overtake production, requiring China to buy back some of the oil that foreign firms hope to export.

INDUSTRIAL FUEL OIL CONSUMPTION

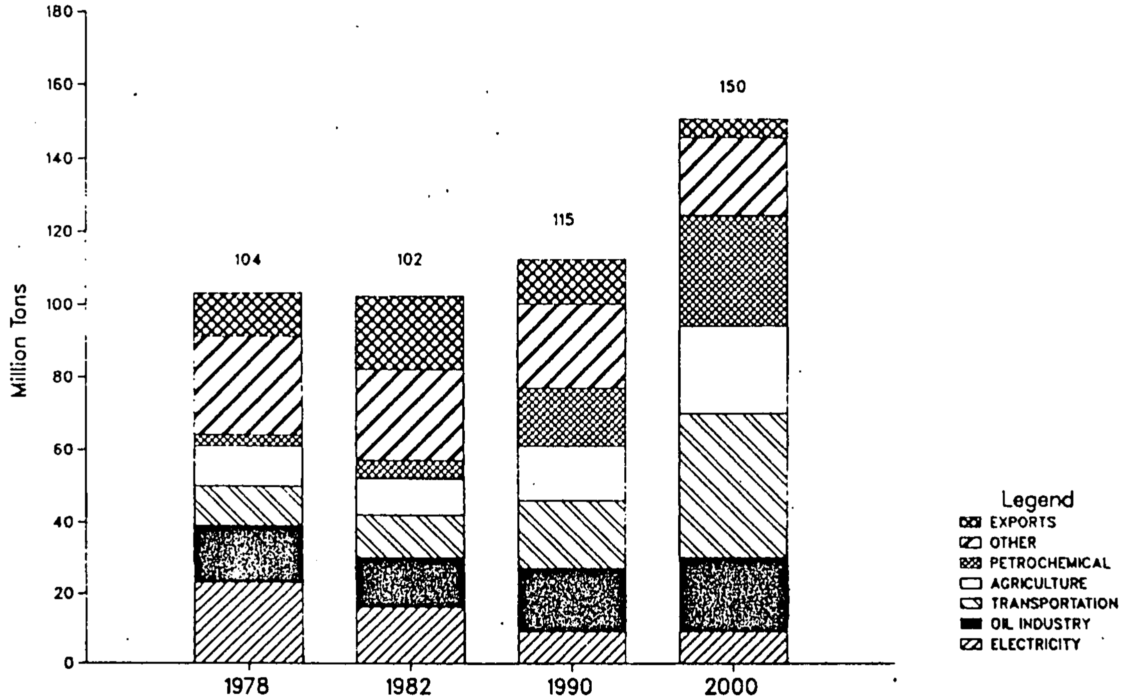
Beijing's primary focus in its effort to reduce oil consumption has been to cut back sharply the direct burning of crude and fuel oil in power plants and industrial boilers and furnaces. In 1980 the country burned 40 million tons in these operations, including about 12 million tons of crude oil and 28 million tons of fuel oil. This was particularly wasteful of the crude oil which could have been distilled and cracked into a higher value range of products.

TABLE 9.—CHINA: DEMAND FOR OIL

[Million tons]

	1978	1982	1990	2000
Oil production	104	102	115	150
Domestic consumption	91	81	100	145
Industry	63	54	60	71
Oil industry	16	14	18	21
Oilfield use	2	2	4	5
Transportation loss	7	6	5	5
Refinery use	8	6	9	12
Boiler and furnace	44	35	26	20
Electric power	23	16	9	9
Other	21	19	17	11
Petrochemical	3	5	16	30
Transportation	11	12	19	40
Agriculture	11	10	15	24
Other	6	5	6	9
Available for export	12	20	15	5
Foreign company share	0	0	3	10
Net exports	12	20	12	−5

FIGURE 4
China: Oil Consumption, 1978–2000



In 1981 and 1982 the State Council imposed strict regulations on such use—including a tax of 40 to 50 yuan per ton on fuel oil—and by 1982 oil burning had declined to 35 million tons.[14] Beijing has called for an annual reduction of 2 million tons per year in the direct burning of petroleum through 1990 in order to reduce such use to 20 million tons. The high cost of converting units to coal—1.6 billion yuan were spent in 1981 and 1982—and slower-than-planned conversion of power plants thus far suggests that China will do well to reduce crude and fuel oil consumption to 25 million tons by 1990.

Coal-fired electric power plants have always dominated China's power industry, but in the late 1960s through the mid-1970s China constructed large numbers of oil-fired stations and converted dozens of coal-fired units to oil to take advantage of the country's booming oil production. This was particularly true in the Shanghai area and in the industrial northeast where transportation and environmental conditions discouraged the use of coal. By 1978 the country had a total of 12,000 MW of oil-fired capacity—17 percent of total power capacity—that consumed 18.3 million tons of crude and fuel oil and about 500,000 tons of diesel fuel.

After 1978, Beijing began to emphasize the conversion and reconversion of these plants to coal. Just over 4,100 MW of capacity were planned for conversion by 1985 for an annual savings of over 8 million tons of oil; most of this capacity had probably been coal fired originally and thus much easier to convert. By the end of 1981, 2000 MW had been converted and annual oil consumption had dropped by 4 million tons. However, the rate of conversion has slowed as easier units were completed first, and in 1981 only 340 MW were converted. I estimate that oil consumption in the power sector will decline about 800,000 tons each year through 1988 and then will flatten out at about 9 million tons of fuel oil and about 750,000 tons of diesel oil.

Metallurgy, chemicals, and light industry—particularly the papermaking industry—account for most of the remaining fuel oil consumption. Beijing plans to reduce oil burning by these industries by about 1 million tons a year through 1990—a 5-percent decline in 1983 rising to a 10-percent rate of decline by 1990. This is slower than in 1981 and 1982 when oil consumption was reduced by 3 million tons and appears to be a reasonable target.

PETROCHEMICAL FEEDSTOCKS

Chinese discussions concerning the optimal use of oil focuses on the need to rapidly increase the share that is processed into high-value fertilizers and petrochemical products. These are currently large import items that are particularly important in US-China trade. Only about 5 million tons of oil, largely diesel fuel and naphtha, were used for these purposes in 1982, up from about 3 million tons in 1978. I estimate that this demand will rise to about 16 million tons by 1990 and perhaps as much as 30 million tons by 2000.

Three large ethylene plants are currently under construction that when operational—probably by the end of 1986—will consume

[14] JPRS 81453, 4 Aug. 1982, pp. 4–6.

4 million tons of crude oil annually to provide materials for synthetic fiber and plastics production. A rapid increase in the production of synthetic ammonia using residual fuel as the primary feedstock is also likely—a shift away from coal-derived feedstock technology that currently consumes large amounts of electricity.

DEMAND FOR LIGHT PETROLEUM PRODUCTS

China's output of light products—excluding naphtha, which is used either as petrochemical feedstock or exported—has remained steady at about 35 million tons annually since 1978. Exports of these products more than doubled to 5.3 million tons between 1978 and 1982, however, so that products available for domestic consumption declined by 7 percent (2.5 million tons). The largest decline came in the supply of diesel fuel—from 17.3 million tons to 16.3 million tons. Gasoline output increased from 9.9 million tons to 11.1 million tons in the same period but all of the increases went to exports—most of it going to the United States. Domestic consumption of gasoline has held steady at about 9.7 million tons a year.

AGRICULTURAL DEMAND

Consumption of light petroleum products by the agricultural sector totaled 10.4 million tons in 1978, including 8 million tons of diesel fuel and 2 million tons of gasoline; 46 percent and 20 percent of total demand for these products. Agricultural use of these products declined through 1982 according to Chinese press statements but no specific statistics are available.

This decline in petroleum consumption has little to do with improved efficiency of farm machinery nor does it reflect a reduction in demand for these products. The stock of agricultural machinery—particularly tractors and irrigation pumps—increased by approximately 40 percent (measured by total horsepower in use) between 1978 and 1982 and peasant demand is nowhere near satisfied. Chinese journals and newspapers increasingly carry complaints that the peasants are not getting maximum use out of new machinery because of fuel shortages. One author in *Guangming Ribao,* for instance, complains that agricultural "modernization" is impossible given the shortage of fuels.[15] The result, as shown in official statistics, is a slowdown even to the point of a reversal, in farm mechanization and powered irrigation. Given continued growth in rural incomes and in the stock of machinery it appears doubtful that agricultural demand for petroleum fuels can continue to be held down. I estimate that it will increase by about 5 percent annually.

TRANSPORTATION DEMAND

China's transportation sector consumed approximately 12 million tons of petroleum products in 1982, including 7.5 million tons of gasoline and about 3.5 million tons of diesel fuel. Fuel consumption has increased by about 3 percent per year since 1978; annual effi-

[15] JPRS 70574, 8 Oct. 1980.

ciency gains of 3.6 percent in the use of gasoline and 2.6 percent in the use of diesel fuel have allowed a 6-percent annual rate of increase in total freight carried.

These efficiency gains notwithstanding, China's transportation sector continues to face severe fuel shortages that are largely the result of the government's determination to increase exports of these products. Nationwide, the annual allocation of gasoline and diesel fuel declined from 7.1 tons per truck (about 2,200 gallons) in 1979 to only 4.5 tons in 1983.

A Chinese economist, writing in a recent edition of *Neng Yuan* (Energy), calculates that transportation services in China must increase about 1.37 times the rate of increase of industrial and agricultural production.[16] In recent years, transportation's relatively slower growth has caused major bottlenecks. This suggests that transportation services will increase at about 7 percent per year if a 5 percent annual economic growth rate is maintained.

Efficiency gains can probably continue at a 2- to 3-percent annual rate, but this will be offset in part by the railroads' increased consumption of diesel fuel as they gradually shift away from coal. On balance, the use of gasoline and diesel fuel should increase at about a 5-percent rate, rising to about 16 million tons in 1990 and perhaps to as high as 38 million tons by 2000.

DEMAND FOR ELECTRIC POWER

China consumed 350 billion kWh in 1983, up from 257 billion in 1978. Power consumption rose by more than 7 percent in both 1982 and 1983, far above the annual planned increase, but still short of demand. Despite the high priority being given to the power sector, in the short and medium term, electricity shortages will probably be the most important energy related impediment to economic growth.

Electric power is one of, if not the leading, growth industry in China, having grown at a 12-percent annual rate over the past 25 years. Perhaps more so than in any other major country, this growth has served industrial consumers; industry received about 75 percent of power in 1982. The chemical and metallurgical sectors are by far the most important consumers, each accounting for about 16 percent of national power consumption. Households, in contrast, account for only about 5 percent of consumption. Approximately 40 percent of China's population has no access to electricity and the vast majority of those that do are allocated only enough power for very limited lighting. The average Chinese household thus probably consumes even less electricity than households in India.

Even with the high priority afforded industry, industrial demand for electricity exceeds power supply by about 50 billion kWh, a gap that causes industry to operate 20 percent below capacity. This gap is likely to widen in coming years if electric power supply increases only at the 4–5 percent rate that seems probable. National income, even according to official Chinese plans, is not likely to increase more rapidly than electric power supply over an extended length of

[16] *Neng Yuan* #5, 1983,

time. Over the past 25 years, power consumption has increased at more than twice the rate of increase of national income—an elasticity of 2.25—and 1.25 times as fast as industrial output.

TABLE 10.—CHINA: ELECTRIC POWER CONSUMPTION, 1978-82

[Billion kWh]

	1978 [1]	1979	1980	1981	1982
Total of which	257	282	301	309	328
Power industry consumption	46	48	43	46	48
Industry demand	166	185	196	197	209
Heavy industry of which	138	150	164	162	171
Coal	15				
Petroleum	7				
Metals	47		46	45	45
Metal Processing	18				
Chemicals	43				
Building Materials	8		11	11	11
Light industry of which	28	35	32	35	38
Paper	15				
Textiles	9				
Foodstuffs	4				
Transportation	2	1	2	2	2
Rural demand	29	33	37	42	49
Municipal demand	14	11	17	18	20
Other	4	4	3	2	

[1] 1978 data are derived from Neng Yuan Jingji Jixu.

A key problem will be supplying power to meet nonindustrial needs—particularly household consumption. Beijing is giving high priority to the production of goods that will improve the people's standard of living. The production of many of these goods—television sets, electric fans, washing machines, even small refrigerators—is giving a tremendous boost to the industrial production statistics and, because of the low electricity consumption per unit of output, is helping to lower the electric power elasticity of industrial output. These items are, however, causing a rapid increase in the demand for electricity in the commercial and household sectors. Between 1978 and 1982 nonindustrial consumption has increased by about 13 percent annually.

So far the problem has not been a major one because of the low base from which nonindustrial demand is rising. As incomes rise in the 1980s, however, this will be an increasing problem perhaps becoming a critical issue by the 1990s. Beijing can limit the expansion of nonindustrial electricity consumption by fiat; but only at considerable cost to one of the fundamental goals of the modernization program—the improvement in living standards.

TABLE 11.—ENERGY BALANCES FORECAST [1]

	1978	1982	1990	2000
Coal (million tons):				
Production	618	666	900	1150-1200
Consumption	618	662	894	1200
Net Exports	1	5	5	−60-0
Oil:				
Production	104	102	115	150

TABLE 11.—ENERGY BALANCES FORECAST [1]—Continued

	1978	1982	1990	2000
Consumption	92	81	100	145
Exports	12	21	15	5
Foreign company share	0	0	3	10
Net exports	12	21	12	−5
Electric power (billion KWh)				
Production [2]	257	328	482	786
Consumption [3]	257	328	482	786

[1] Assumes a 5-percent annual increase in national income.
[2] Assumes capacity increase of 5 percent per year; fuel is taken into account in coal and oil consumption.
[3] Power demand assumed to increase at least as fast as national income—that is, 5 percent.

IMPLICATIONS

Table 11 summarizes the results of the balances between supply and demand for oil, coal and electricity that I project if China has an annual 5-percent economic growth rate. No major gaps are evident but there is a definite tightness in the energy balances that will force Beijing to make difficult decisions in allocating energy supplies. Coal supplies, even assuming the year 2000 target is reached, will be particularly tight, possibly causing China to slow down somewhat conversions from oil to coal. These calculations also allow only a little room for energy exports in the 1990s—currently over 20 percent of China's foreign exchange earnings.

Economic growth faster than 5 percent would probably cause serious energy shortages unless China was prepared to import substantial volumes of energy. If my energy elasticities of coal, oil, and electric power demand—0.75, 0.5, and 1.0 respectively—are anywhere close to being accurate, a 7-percent annual rate of growth would require major adjustments by 1990:

A sharp reduction of oil exports by 1990 and a need for oil imports by 2000.

Resolving a 100-million-ton shortfall in annual coal supplies by 1990.

Coping with a further 15- to 20-percent shortfall in electricity supplies.

By the same token, long-term annual economic growth of only 3 or 4 percent would probably not run into an energy constraint. Energy exports could be kept at current levels and perhaps even increased.

BEIJING—TOUGH CHOICES AHEAD

Weakness in China's supply of energy has already forced Beijing to make major changes in the country's long-term political and economic policies. The measures taken so far have helped to push China's economy away from its Stalinist and Maoist heritage and to bring it somewhat closer to Western-style economies. The Deng-Zhao economic readjustment and reforms program, for instance, was given a strong impetus by the 1978 revision in oil supply projections. The new leadership was quick to realize that China did not have the resources and the capital to continue to support a massive Soviet-style industrial buildup and hence opted for a more consumer- and export-oriented economy led by light industry.

Equally important was the realization that China could not solve its energy problems by itself. At least for the energy sector, self-reliance as a guiding principle was discarded to allow the introduction of Western capital and technology in ways that the leadership's Maoist predecessors would have considered "exploitationist". Offshore oil is the most dramatic example, but Western and Japanese firms are increasingly becoming involved in everything from onshore seismic surveys to nuclear power development.

Continued tightness in China's energy balances will strengthen China's need to cooperate with the West. At the same time, however, it will force Beijing to make difficult and politically divisive decisions about the allocation of increasingly scarce energy resources. These decisions may threaten the leadership consensus that has allowed Beijing to make bold decisions on the importation of Western capital and technology and the unavoidable "capitalistic" and "bourgeois" influences that come with it. This danger will be particularly evident if major programs—such as the offshore exploration effort—are unsuccessful. Some of the key areas that will require controversial energy-related decisions over the next decade are as follows.

INVESTMENT STRATEGY

Within the energy sector, Beijing is now grappling with tough investment decisions that will have a large impact on future energy supply:

In the electric power sector, whether to emphasize long-term, capital-intensive but fuel-saving hydroelectric and nuclear power development or faster and cheaper coal-fired capacity.

In oil exploration, whether to emphasize areas where discoveries can be exploited quickly or areas, such as the Tarim Basin, with better prospects that will take decades to exploit.

In coal mine development, whether to continue to allow the rapid development of small, non-state-owned coal mines or whether to step up investment in large, state-owned, mining operations.

A key difficulty in making investment decisions is the lack of a rational interest rate structure. The very low domestic rates tend to encourage capital-intensive projects, particularly nuclear and hydroelectric plants, whereas the large differential between domestic and international market interest rates tends to discourage borrowing from the West.

ENERGY PRICES

This brings into focus one of the key problems in China's economy—the lack of a pricing mechanism that allocates scarce resources efficiently. China's energy prices are by almost all accounts far out of adjustment. To preserve price stability, Beijing has held energy prices relatively constant since the 1950s despite clear changes in domestic and international supply and demand conditions.

Crude oil and coal are currently priced at only 25 percent and 20 percent of the international price respectively. Gasoline is priced close to the international level, but diesel fuel is inexplicably priced at only 40 percent of the price of gasoline. Heavy fuel oil is also very cheap. Although the international prices may not be a perfect indicator of supply and demand within China, Chinese economists are increasingly turning to them to illustrate the inadequacy of Chinese prices.

Also the price system does not take into account the differences in quality among types of crude oil and coal. Washed coal, for example, is sold at the same price as unwashed coal, which creates a disincentive for mines to clean up their production. This also forces the railroads to haul tons of rubble along with the coal.

In the Maoist system—at least in theory—the relative price of energy made little difference since energy was simply allocated according to plan and enterprise profits were returned to the state. In the emerging "mixed" economy that some of the economic reformers are trying to bring about, prices are much more important. Numerous articles in Chinese economic journals now attack what their authors see as imperfect decisionmaking based upon an irrational price system. Typical complaints are:

The abnormally high profits garnered by petroleum refineries—the result of cheap crude prices and high product prices—have caused the buildup of redundant refining capacity.

Industry is encouraged to burn the relatively cheap crude and fuel oil.

Oilfields and coal mines are encouraged to export crude oil and coal at much higher world market prices rather than sell it to domestic customers.

Prominent Chinese leaders have recognized for years the need to increase energy prices and some steps have been taken. In 1981, for example, after coal output dropped because of the inability of most of the country's coal mines to make a profit, the government increased prices for small-scale coal mines, which helped boost output. More recently, taxes have been imposed on crude and fuel oil to discourage burning these fuels. Much larger and more comprehensive energy price adjustments, however, are clearly a major political problem that so far has not been tested.

OIL EXPORTS

China's ability to increase exports of crude oil, petroleum products, and coal over the past four years is remarkable and is a major factor behind the country's strong international financial position. Table 12 includes the volume and value of China's energy exports since 1978 and their share of total export earnings.

My analysis suggests, however—and this is increasingly reflected in Chinese energy journals—that China may have to reduce and eventually even phase out oil exports.

Premier Zhao Ziyang stated in his report on the Sixth Five Year Plan that China will under no circumstances import oil. My analysis also suggests imports will not be necessary unless the offshore exploration program finds much less oil than the companies expect.

It is significant, however, that Zhao did not rule out a reduction of oil exports.

TABLE 12.—CHINA: ENERGY EXPORTS

	1978	1979	1980	1981	1982	1983
Exports (million tons):						
Petroleum	13.5	16.4	17.5	18.4	20.5	([1])
Crude oil	11.3	13.4	13.3	13.8	15.2	15
Products	2.2	3.0	4.2	4.6	5.3	([1])
Coal	3.1	4.6	6.3	6.6	6.4	6.4
Exports (billion U.S. dollars):						
Total exports	10.16	13.49	18.94	21.54	23.5	([1])
Energy exports	1.34	2.63	4.62	5.01	5.14	([1])
Petroleum	1.24	2.45	4.36	4.67	4.79	([1])
Crude oil	.96	1.75	3.01	3.29	3.40	([1])
Products	.28	.70	1.35	1.38	1.39	([1])
Coal	.10	.18	.26	.34	.35	([1])
Energy share (percent)	13	19	24	23	22	([1])

[1] Not available.

High-level concern over a possible reduction or even an elimination of a commodity that currently provides 20 percent of the nation's foreign exchange earnings may also be a reason for China's reluctance to boost its general level of imports, despite the large current account surpluses of recent years. Some conservatism is probably prudent, particularly until a better idea can be obtained of what oil resources will be discovered offshore.

HOUSEHOLD DEMAND

An issue that probably will come to the forefront later this decade and in the 1990s is the limited degree to which China's commercial and modern energy supplies are allocated for direct household and personal use. Table 13, from a paper presented to a science policy conference in 1982 by 3 scientists from the Guangzhou Institute of Energy Conversion, Chinese Academy of Sciences, includes a breakdown of energy sources used for household and production activities by the rural population—80 percent of China's total population.

The government, through its unified energy distribution system, provides only 7 percent of rural energy supplies and almost all of that is used for production processes—only kerosene, for lighting, is used by households. Nearly half of the production from small coal mines, moreover, is consumed by local industry. Therefore, of the total energy consumed by households for heating, cooking, and lighting, only 17 percent is provided by what are considered "modern" energy sources—coal and electricity.

TABLE 13.—CHINA'S RURAL ENERGY CONSUMPTION, 1981

	Million TCE	Share of rural consumption (percent)	Share of fuel consumed (percent)
Total	420	100	
Noncommercial:			
Crop stalks	215.0	51.2	100
Firewood	57.8	13.8	100
Cattle waste	54.7	13.0	100
Small coal	59.3	14.1	80
Mini-Hydro	5.2	1.2	100
State supplied:			
Kerosene	1.6	0.4	46
Diesel/gasoline	14.0	3.3	12
Electricity	12.7	2.9	2

The scientists state that total rural energy consumption for household purposes falls 7 percent below what the Academy of Sciences calculates as necessary to sustain minimal living standards. As a result many peasants must use roots and tree bark for their winter heating. They conclude that the rural energy situation is "an exceedingly unfavorable development in China's rural economy and is of extreme inconvenience to the peasants livelihood" and go on to say that it is a matter of "urgency" to find ways to resolve the grave shortage of rural energy supplies.

Deng Xiaoping's modernization program and the increasingly available supply of modern consumer items—many of which require electricity—must be raising expectations among Chinese peasants that Beijing will have considerable difficulty meeting.

IMPLICATIONS FOR THE UNITED STATES

China's need for new technology, both to explore and develop new energy resources and to improve the efficiency with which the country consumes energy, is an important reason for Beijing to open up strong commerical links with the Western world. China sees the United States as the best source for much of this technology and thus makes access to it a pivotal consideration in its official dealings with the United States. This technology can thus form a relatively stable underpinning for China's opening to the United States. Beijing did not, for instance, allow the mid-1983 political and economic controversies with the United States to hamper the offshore oil contract negotiations that were occurring during the same period.

There are a number of areas in which energy technology is already forging important commercial links between the two countries:

Offshore oil where a dozen US firms are taking the lead in exploring China's promising South China Sea continental shelf. If successful, this exploration will lead to long-term—up to 35 years—commitments by the firms to work in China in an industry of vital importance to Beijing.

Onshore oil where China is actively negotiating for, and purchasing, US technology needed to maintain output at increasingly mature fields.

Technology for the generation and transmission of electric power, where US firms are becoming involved in upgrading China's obsolete technology. China's power industry will probably expand at a faster rate than in any major country over the next two decades, offering a continuing source of business.

The coal industry, for which China also has probably the most ambitious development program in the world, is also creating a demand for US production equipment and the technology to burn coal cleanly and efficiently.

Two areas of potential cooperation—contingent upon solving difficult investment and political problems—include hydroelectric and nuclear power development, which some Chinese view as the dominant energy sources in the next century.

In most of these areas China believes the United States holds the most desirable technology. US firms, however, usually meet fierce competition from European and Japanese firms. China, moreover, has proven adept at playing competitors against each other. This competition will probably become more intense, particularly when it comes to the financing of energy projects; an area in which the United States is often at considerable disadvantage.

Despite the development of what must be considered an overall advantageous commercial relationship for the United States, China's energy issue also has the potential for creating problems. China's current leadership has placed a great deal of its prestige on achieving economic progress. A willingness to experiment with more capitalistic, decentralized economic policies and a general openness to foreign trade and investment are key features of the government's modernization strategy. If lack of energy were to significantly retard economic growth or cause instability in the form of price increases or trade imbalances, a marked change in economic policy could result.

This analysis suggests, however, that with carefully chosen policies that limit the increase in energy consumption, and with only average luck in discovering new oil resources, China can maintain a reasonable economic growth rate that will limit the need for major policy reversals.

CHINA'S COAL INDUSTRY

By Albert Keidel III*

CONTENTS

I. China's Coal—General Conditions

China's coal industry and the economy's coal consumption provide perhaps the single most instructive example of problems which have plagued Chinese industry for over thirty years. Both production and consumption are technically inefficient. The industry's prices are seriously out of line with coal's scarcity value, and coal's poor financial condition has required very large subsidies for decades. The current reforms are showing both the ingenuity of Chinese reformers in attacking these problems and their inability to foresee complications arising from profit incentives. Furthermore, because of coal's preeminent position in China's energy supply, the success of the current reforms will have both direct and indirect influence on virtually all of China's industry.

A. China's inefficient overdependence on coal

China has made very poor use of her extremely rich coal resources. The result has been an exaggerated and inefficient dependence on coal in comparision to most other world economies. This state of affairs has been a serious limitation on industrial growth. At the same time, such heavy dependence on coal and such serious inefficiency in its use may, counterintuitively, be one of the most important indicators of a strong potential for energy conservation growth in the current period of incentive and management reforms.

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Although most introductions to China's coal industry concentrate on her large high quality reserves and the implied strong potential for output growth, the immediate focus of a study on China's coal should begin with an examination of China's overall energy consumption pattern, dominated as it is by heavy and inefficient use of coal.

This energy use pattern is illustrated below in Table 1, "International Comparisons."

Of the nine countries listed, China and India are by far the poorest, both in GNP per capita and in energy consumption per capita. In terms of coal, however, China's per capita consumption level is significantly higher than either Brazil's or India's. Furthermore, comparing coal consumption with total energy consumption, it is clear that China's dependence on coal (71 percent) is far greater than that of the other countries, with the exception of Poland (67 percent). This means that even for a poor country, China's dependence on coal is unusual. The dependency is even more remarkable when we remember the size of China (991 million persons in 1981). Poland's 36 million persons would not even rank as a small province in China.

The economic significance of China's heavy coal dependency is greatly reduced, however, by the degree of inefficiency in its use. Data on thermal electricity illustrate the point (most, but not all thermal electricity is coal-fired). Column 5 in Table 1, gives per capita thermal electricity consumption. Comparison of columns 4 and 5 implies that a much larger part of China's coal is used directly as fuel, rather than being converted to electric power. The ratio of thermal power use to total coal use is far lower for China than for any of the other countries presented. It is one tenth that of the United States or Japan, for example. It is less than one third of the ratio for India, and one fifth that of Brazil. This underdeveloped thermal power industry can be interpreted as a sign of the immaturity of China coal use technology on one hand but, on the other, it shows the considerable potential for relatively straightforward gains to be achieved from even modest technical inputs to modernize industrial energy use.

TABLE 1.—INTERNATIONAL ENERGY CONSUMPTION COMPARISONS, 1981

	1981 population (millions)	Per capita GNP (U.S. dollars)	Per capita energy (Kg coal)	Per capita coal (kg)	Per capita thermal electricity (kWh)	Energy per GNP dollars (gram)	Coal per GNP dollars (gram)
United States	230	13,160	11,626	2,515	7.94	883	191
Brazil	121	2,240	1,101	66	.10	492	30
China	991	310	618	436	.12	1,994	1,406
India	690	260	210	128	.11	808	490
Japan	118	10,080	4,649	791	3.43	461	78
Korea, South	39	1,910	1,563	669	.98	818	350
Germany, West	62	12,460	6,053	2,011	4.81	486	161
Poland	36	5,635	5,799	3,872	3.12	1,029	687
U.S.S.R.	268	6,619	6,422	1,870	2.12	970	282

Note: Per capita Energy and Energy per GNP dollars are measured in terms of standard coal units (7000 kcal/ton).

Sources: Population and per capita energy, World Bank, "World Tables," 3d edition, 1983 (Baltimore: The Johns Hopkins University Press). Per Capita GNP for 1982: World Bank, "World Development Report 1984," 1984 (New York: Oxford University Press), and PLANECON, Washington, DC Coal and thermal energy consumption: United Nations, "1981 Yearbook of World Energy Statistics," 1983 (New York: U.N. Publishing Services). Energy per GNP dollars: column 3 divided by column 2. Coal per GNP dollars: column 4 divided by column 2.

More direct measures of energy inefficiency confirm China's very poor relative position. Columns 6 and 7 in Table 1 compare energy and coal consumption with GNP for the various countries. China is overwhelmingly the most energy inefficient of them all. China uses roughly twice as much energy per dollar of GNP as the next most inefficient country, Poland. In the case of West Germany and Japan, China uses more than four times as much energy for the same level of output. The calculations for coal use per GNP dollar are even more extreme. When it is remembered that, unlike in the United States, China uses very little energy for household consumption, the energy waste has even more significance for China's long-run industrial output potential.

B. THE POOR ACCESSIBILITY OF CHINA'S COAL

Shifting focus from China's inefficent coal dependence to her high-quality reserves, a second important characteristic of China's coal emerges: the reserves' inaccessibility and relatively poor geographical distribution. It is true that China's coal reserves are very large and of high average calorific content. But this description, as it stands, is misleading. Inaccessible coal reserves cannot be, in an economic sense, rich. In contrast to Marxist economic theory, Western concepts of value place significance on a commodity's time and locational attributes. China's best coal is isolated, and transportation systems will be slow to develop. Until transport and transmission systems are greatly improved, China's coal resources are effectively much poorer than is usually thought. As a result, attention to energy conservation and the transfer of modern conservation technology take on added urgency.

The proven reserves, as such, had grown to over 700 billion metric tons by the end of 1982 and to 780 billion tons by late 1984. This is over 550 billion metric tons of standard coal equivalent (7,000 kilocalories per ton).[1] Roughly two-thirds of these reserves are in the North and Northeastern provinces, but recent discoveries of rich deposits in the outer Northwest have prompted official speculation that proven reserves may soon be over a trillion tons of raw coal.[2] This represents very rapid growth of proven reserves in recent years, as geological exploration has been given renewed importance in China's overall energy strategy. As recently as 1980 proven reserves were reported to be only 642 billion tons.[3]

Although distribution of these reserves heavily favors the North and Northeast, lesser deposits of varying quality are found throughout the country, in over 60 percent of China's counties.[4] The major high-quality reserves are in the North Central provinces, especially Shanxi and Inner Mongolia (with roughly 200 and 190 billion tons of proven reserves, respectively). Many of the scattered county deposits, especially in the Southern provinces, are small and of lower quality. The South and East Coastal Regions

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[1] Xinhua, 3 January 1983 (in JPRS 3/30/83, p. 93), and *Guangming Daily*, reported in Xinhua, 22 January 1985 (in JPRS 3/6/85).

[2] "An Interview with Gao Yang," by Huang Fengchu and Chen Hongyi, in *Liaowang* No. 20, 14 May, 1984, pp. 11-12.

[3] World Bank, *China's Socialist Economy*, Washington, D.C. 1981, Volume II, Annex E, p. 191.

[4] "Present Status and Outlook of China's Energy Structure," by Hao Bin in *Wen Wei Po*, 6 January 1983.

(from Guangxi province up the coast to Jiangsu province) are markedly coal deficient. And yet these regions are precisely those with some of the highest industrial growth prospects. Transporting coal from the North Central regions to the industrial centers on the coast will require large investments and long lead times. In the meantime, rapid industrial growth will require strong conservation efforts, using known technology and rapid implementation.

C. POTENTIAL FOR IMPROVED EFFICIENCY AND COAL QUALITY

Where are the potentials for saving on coal consumption? The largest savings will probably come from better washing and screening of the coal, more efficient electric power generation, and the spread of profit incentives for reducing coal and power consumption in industry.

TABLE 2.—COAL WASHING, INTERNATIONAL COMPARISONS, 1982

	Japan	France	Britain	Germany	Soviet Union	China
Washing of raw coal (percent)	94.7	92.5	88.3	87.4	63.4	18.0

Source: Li, Shaoxun and Ji, Zhongshi, "On Ways to Improve Economic Benefits of Coal Industry Enterprises," in Jishu Jingji yu Guanli Yanjiu, No. 4, December 1982, translated in FBIS, 5/9/83, p. 117.

Very little of China's coal is screened or washed for impurities as is clear from the international comparison in Table 2 above. This has two major effects on coal efficiency. First, output targets based on raw coal rather than washed coal discourage maintenance of a high average caloric content for the output. Second, extremely scarce transport facilities are squandered carrying high percentages of ash, stones and other impurities to industrial destinations, where they are of no use.[5] Although one solution is to express output targets in terms of washed coal,[6] the better long-run solution is a system of wholesale coal prices which reflects the different qualities of coal delivered to the end-user. Such a more indirect mechanism would influence a host of corrective measures, including more suitable output targets.

China's generation of electric power is inefficient by world standards, about half that of some advanced countries. Thermal efficiency is expected to improve 40–50 percent by the end of the century.[7] An important element in the problem is the relatively small scale of China's power-generating plants. By the end of 1980 there were 134 large generators with greater than 100,000 kw capacity, averaging 134,000 kw and accounting for 41.2 percent of China's total installed capacity.[8] For China's few large plants with capacities of 200,000 and 300,000 kw, thermal efficiency is about the same as for the 100,000 kw plants (357–360 grams per kw-hr). This is because of frequent shutdowns and reliability problems with the large-scale equipment. This scale of power-generating plants compares with an

[5] The average calorific content of coal delivered to the thermal power industry is reported to have been only 4,480 Kilo-calories per kilogram.

[6] *China's Socialist Economy*, World Bank, Volume II, Appendix E, p. 215. *Chinese Coal Industry Yearbook*, 1982, p. 137.

[7] *Chinese Coal Industry Yearbook*, 1983, p. 179.

[8] "Suggestions on the Use of Large Capacity, High-parameter Thermoelectric Power Generators," by Qiu Changqing, *Dianli Jishu* [Electric Power], No. 10, October 5, 1982, p. 74.

average of 500,000-600,000 kw for plants recently built in the United States, Japan, and West Germany. Plants as large as 1 million kw have been built in the West, but are no longer popular because of the long lead times and the only small gains in unit costs, given current world technology.[9]

The corollary to increased power plant size is a highly developed power transmission system. China's system of power grids must be extensive enough to deliver electricity from very large pithead power plants in the interior to distant major markets on the coast. Its current regional grids are not sufficiently integrated to perform this function.

How to carry out conservation should be a central policy concern. Whether the coal is consumed directly by industry in factory boilers, or indirectly in the form of thermal power, the greatest force for coal conservation will probably come from reforms of China's overall industrial incentive system, substituting profit targets for physical output targets. The combination of management incentive reforms and high prices which reflect the scarcity of accessible coal could inspire rapid improvement of the current low level of consumption efficiency.

Given the central importance of coal for other industrial sectors, management reforms will be perhaps more important than price reforms. Without profit incentives, price reforms would only change the size of subsidies to coal-using sectors. In considering the dynamics of such reforms, it is even likely that management incentive reforms would speed up the price reforms, as more efficient users outbid others for scarce supplies. If, conversely, price reforms preceded new incentive schemes, the effect would be reversed, and powerful ministries would have even stronger reasons to resist being held accountable for their losses.

D. THE COAL INDUSTRY'S WEAK FINANCIAL POSITION

Coal, more than any other sector in China's economy, illustrates the inconsistencies of China's traditional industrial price system and the pervasive significance of state subsidies to ensure enterprise accounting viability. The coal industry's financial condition is worse than that of any other industrial sector, regardless of the measure of profitability or financial viability used, as is made clear in Table 3 below.

Under the first measure, profits (and taxes) as a percent of costs, the very low 4.4 percent figure for the coal industry is matched only by that for the meat industry, whose products are also notoriously underpriced. It is interesting that most sectors and industries have rather high profit-to-cost ratios by comparison, and those with very inelastic demand, such as salt and tobacco, are clearly heavily taxed. Coal's 4.4 percent is in fact extremely low, even in comparison with the national average of 32 percent.

The other two measures of financial viability give an even worse assessment of the coal industry's position. Costs for coal are shown to be 113 percent of gross output, more than any other sector or industry, and considerably higher than the 73 percent average for

[9] Ibid.

all sectors. This measure of profitability seems to imply that coal and several other entire industries operated at a loss in 1982.

These first two measures reflect profits in relation to working capital. The third measure is a proxy for profits as a share of fixed capital stock expressed as profits (and taxes) as a share of the total value of fixed assets. By this measure, the coal industry's financial position is even worse, with profits equal to only 1.6 percent of fixed assets, compared to 15 percent for heavy industry and 22 percent for industry as a whole.

It should be mentioned that although the three measures of profitability presented are all from official data, they are difficult to reconcile. For example, although 1982 profits in coal are reported to be a positive percentage of costs, costs are greater than gross output (revenues). As mentioned above, this latter circumstance would normally imply that profits were negative in the industry. It is possible that there is some definitional difference not clarified in the original sources. For example, profits in the former measure might be calculated before accounting for depreciation charges.

In spite of these inconsistencies between different measurements of financial viability, it is safe to assume that each definition has been applied consistently across all sectors and industries. Hence, the conclusion is unavoidable that coal has the weakest financial position of all of China's industries. Such a finding is important for understanding the whole industrial pricing problem in China. Given China's exaggerated and inefficient dependence on coal, any attempts to improve the sector's finances by dramatically increasing the price of coal would cause severe repercussions in the financing of virtually every other industrial sector, repercussions which might nevertheless be beneficial for the economy as a whole.

It should also be noted that the financial condition of coal enterprises does not seem to be uniform from one province to the next. Not surprisingly, 1978 data for Shanxi province with its rich high-quality coal deposits show a profit of 257 million yuan on output of 54 million tons from several major mining areas. In Sichuan, however, 1980 data reveal a province-wide loss of 104 million yuan on output of 39 million tons. For certain mines in Sichuan, losses were as high as 6.4 yuan per ton.[10]

TABLE 3.—FINANCIAL INDICATORS OF CHINA'S COAL INDUSTRY, 1982

	Ratio of profits and taxes to cost (percent)	Costs as share gross output (percent)	Profits and taxes/fixed assets [1]
All branches	32.0	73.3	22.2
Light industry	33.1	69.4	56.5
Heavy industry	31.1	76.5	14.9
Metallurgical industry	29.2	75.1	15.9
Ferrous metals	30.7	79.2	16.6
Power industry	72.4	60.5	15.5
Hydropower	107.9	41.0	11.0
Coal and coke industry	5.5	111.1	2.0
Coal	4.4	112.8	1.6

[10] Li Shaoxun and Ji Zhongshi, "On Ways to Improve the Economic Benefits of Coal Industry Enterprises," *Jishu Jingji yu Guanli Yanjiu* [Research on the Economics and Management of Technology] No. 4, 31 December 1982 [in JPRS 5/9/83, pp. 54-56].

TABLE 3.—FINANCIAL INDICATORS OF CHINA'S COAL INDUSTRY, 1982—Continued

	Ratio of profits and taxes to cost (percent)	Costs as share gross output (percent)	Profits and taxes/fixed assets [1]
Petroleum industry	75.1	54.9	38.7
Extraction	79.4	51.2	24.1
Chemical industry	31.5	73.9	26.6
Basic chemical materials	34.2	70.8	21.6
Chemical fertilizer	16.0	90.9	8.0
Chemical pesticides	12.6	82.8	19.2
Organic chemicals	45.9	68.3	42.2
Chemicals for daily use	36.3	62.0	68.0
Machine building industry	23.4	75.7	13.5
Agricultural machinery	7.3	86.7	4.2
Industrial machinery	21.9	80.0	11.1
Transport equipment	18.7	79.9	10.0
Other machinery for production	28.0	73.5	16.4
Electronic apparatus	20.1	66.2	12.4
Metal products for daily use	32.4	70.2	52.6
Building materials industry	27.9	87.1	14.7
Cement and cement products	26.1	95.4	13.6
Bricks, lime, and other building materials	23.4	81.6	13.4
Glass	49.9	75.1	31:7
Ceramics	33.0	74.8	18.8
Nonmetallic minerals	25.9	77.2	11.7
Forest industry	23.3	103.4	16.2
Logging and transport of wood	23.8	111.8	12.3
Food industry	41.2	64.6	83.2
Food and oil	10.9	51.0	31.7
Salt making	233.0	32.1	73.1
Slaughtering and meat processing	4.4	103.9	19.1
Canned food	14.8	80.9	31.9
Sugar refining	37.7	74.8	28.2
Tobacco manufacturers	239.4	34.4	835.9
Liquors	58.2	67.7	65.8
Textile industry	27.0	74.3	55.1
Chemical fibers	36.6	87.7	28.5
Cotton textiles	26.5	73.5	62.5
Clothing industry	16.7	86.9	61.0
Leather industry	17.3	80.2	32.1
Papermaking, cultural, and educational articles	31.7	67.7	27.8
Papermaking	26.1	77.7	21.6

[1] Note: Asset valuation refers to the original value of assets.

Sources: State Statistical Bureau, Statistical Yearbook of China, 1983, various pages.

To summarize the major characteristics of China's coal industry, it is important to remember that the value of China's very large coal reserves is diminished by their isolation. Furthermore, at a time when energy shortages cost the country as much as 75 billion yuan annually in the early 1980's, with 20–30 percent of industrial capacity idled,[11] China's overwhelming energy dependence on coal points to conservation and improved productivity as the preeminent needs, perhaps overshadowing the importance of increases in crude output.

The extremely poor financial position of the industry as a whole points to reform in coal prices as the critical corrective mechanism. Higher relative prices for coal would help finance coal's mechaniza-

[11] Li Shaoxun and Ji Zhongshi, *op.cit.* pp. 54-56, and a 1978 survey of industrial power use reported in *China Coal Industry Yearbook, 1982* p. 129.

tion and bring needed consumption discipline to end-users. Fundamental price reform, however, may come fairly quickly, almost naturally, as management throughout the economy is made accountable for enterprise profits and begins competing for scarce energy.

II. China's Coal Industry, 1949-83

A. Historical Output Patterns

China's coal industry since 1949 has shown sustained rapid growth in output, averaging over 10 percent per year for the entire period. The growth has been uneven, however, with output falling at times of political or economic stress, and surging in periods of recovery or political enthusiasm. This pattern of rapid but uneven growth can be seen in Table 4 below, "Energy Supply and Demand in China, 1949-1983." The first column presents coal output over time, measured in tons of standard coal equivalent fuel.

In 1949, China's raw coal mining capacity was roughly 46.6 million metric tons and the industry was operating at 69.7 percent capacity.[12] By 1953, a program to "transform" 32 old mines and build 21 new ones had raised total capacity to 71.3 million tons, with output at 66.5 million tons. With recovery completed, a program of long-run output expansion began, but the expansion was punctuated by bursts of acceleration followed by sudden declines.

The major surges in output came during 1958-60 (the Great Leap Forward), 1964-66 (recovery from early 1960s), and 1970-72 (recovery from the Cultural Revolution's early years), but it is difficult to know how reliable the data are for the late 1950s. For example, in the fervor of the Great Leap Forward, 1,360 new shafts were reportedly put under construction, with a combined capacity of 320 million tons. This was at a time when output had tripled in three years, from 131 million tons in 1957. During the major output slump that followed, coal production fell by nearly 50%, and only recovered in the few years (1965-66) before the onset of the Cultural Revolution.

The 1970s and early 1980s have again shown uneven growth, but with the swings being much less severe than in the previous two decades. The slowdowns (1974, 1976, 1980-81) followed short bursts of output acceleration and coincided with important political and policy events (such as Mao's death in 1976 and the state budget crisis of 1979-80). With recovery again under way in 1981-83, it is important to consider the chances for further instabilities in the output pattern in the late 1980's.

B. Coal's Historical Dominance of China's Energy Balance

The historical importance of coal relative to other forms of energy in China is also illustrated in Table 4. Petroleum output constituted a minor share of the total until the latter 1960s, and China seems to have been a net importer of petroleum and petroleum products through the end of that decade. Since that time, petroleum's importance has increased rapidly, but not enough to challenge coal's overall dominant position. Other sources of primary

[12] Calculated from data in the *Chinese Coal Industry Yearbook, 1983*, p. 50.

energy, natual gas and hydroelectric power, are very small by comparison and are included only in the total production column of Table 4.

The general conclusion to be drawn from Table 4, however, is that since the 1970s, China's overall energy supply position has in general improved. In particular, since 1975, the combination of stock changes and net exports has been strongly positive. The coal and petroleum series show that both energy sources, rather than just petroleum, are responsible for the trend, although the significance of the oil balance surplus is quite large relative to its output share.

The upward trend in China's domestic energy balance was temporarily reversed in 1980–81, as a result of the fiscal crisis and related general heavy industrial contraction in those years. The 1980–81 energy output decline was a combination of a coal decline in 1980 and a petroleum decline in 1981. After 1981, the recovery in energy production was more rapid for coal than for oil, but by 1984, output growth in both sectors was relatively even.

TABLE 4.—ENERGY SUPPLY AND DEMAND IN CHINA, 1949–83

[Million tons standard coal equivalent]

	Coal			Crude oil			Total energy [1]		
	Production	Consumption	Stock changes and net exports	Production	Consumption	Stock changes and net exports	Production	Consumption	Stock changes and net exports
1949	22.86			0.17			23.12		
1950	30.72			.29			31.11		
1951	37.86			.43			38.40		
1952	47.10			.63			47.89		
1953	50.00	51.04	−1.04	.88	2.06	−1.18	51.06	53.29	−2.22
1954	59.99	58.26	1.73	1.13	2.70	−1.57	61.39	61.22	.17
1955	69.96	64.76	5.20	1.39	3.42	−2.03	71.65	68.47	3.17
1956	78.55	81.60	−3.05	1.65	4.25	−2.60	80.63	86.29	−5.66
1957	93.58	89.03	4.55	2.07	4.43	−2.36	96.34	94.14	2.20
1958	192.69	166.52	26.17	3.18	6.90	−3.72	196.57	174.05	22.52
1959	263.46	226.53	36.93	5.43	9.69	−4.26	269.70	237.15	32.55
1960	283.33	283.47	−.14	7.41	12.41	−5.00	293.13	298.26	−5.13
1961	198.44	186.18	12.26	7.64	11.15	−3.51	208.90	200.25	8.65
1962	157.07	147.59	9.48	8.25	10.93	−2.68	167.98	161.25	6.73
1963	154.95	138.44	16.51	9.18	11.21	−2.03	166.56	152.02	14.54
1964	153.54	146.36	7.18	12.06	13.38	−1.32	168.28	162.27	6.01
1965	165.65	163.40	2.25	16.19	19.41	−3.22	184.63	185.31	−.68
1966	180.00	174.80	5.20	20.83	20.61	.22	204.05	198.34	5.71
1967	147.12	155.37	−8.25	19.77	19.96	−.19	170.42	178.56	−8.14
1968	157.02	154.22	2.80	22.83	22.25	.58	183.13	179.48	3.65
1969	189.91	186.23	3.68	31.19	31.28	−.09	225.61	221.48	4.13
1970	252.88	236.93	15.95	43.70	42.97	.73	302.82	285.29	17.53
1971	279.84	273.17	6.67	56.46	55.19	1.27	344.32	336.41	7.92
1972	292.83	288.90	3.93	65.37	64.00	1.37	368.16	362.93	5.23
1973	297.70	292.69	5.01	76.82	72.66	4.16	387.30	378.12	9.18
1974	294.71	289.60	5.11	92.83	83.18	9.65	402.62	387.85	14.76
1975	344.20	326.38	17.82	110.18	95.71	14.47	471.93	439.15	32.78
1976	344.83	332.95	11.88	124.34	110.01	14.33	488.36	461.96	26.40
1977	392.52	367.79	24.73	133.66	118.37	15.29	548.38	508.10	40.28
1978	441.27	403.84	37.43	148.76	129.89	18.87	613.71	557.49	56.22
1979	453.23	417.79	35.44	151.72	127.66	24.06	630.48	570.88	59.60

TABLE 4.—ENERGY SUPPLY AND DEMAND IN CHINA, 1949–83—Continued

[Million tons standard coal equivalent]

	Coal			Crude oil			Total energy[1]		
	Production	Consumption	Stock changes and net exports	Production	Consumption	Stock changes and net exports	Production	Consumption	Stock changes and net exports
1980	442.22	432.83	9.39	151.66	126.88	24.78	620.15	585.75	34.40
1981	443.83	432.42	11.41	144.78	118.42	26.36	613.73	575.87	37.86
1982	475.42	457.84	17.58	146.23	115.64	30.59	646.82	600.32	46.50
1983	510.24	483.89	26.35	151.79	121.84	29.95	689.04	632.67	56.36

[1] The total also includes data for natural gas and hydroelectric power.

Note: Standard coal is based on 7,000 kilocalories per kilogram. The total includes primary energy and output from natural gas and hydroelectricity, which are not shown in the table. Hydropower output as included is actual output converted to the standard coal equivalent, rather than to its equivalent thermal power opportunity cost in coal inputs, as found in some Chinese energy balance statistics.

Sources: Data and calculations based on the State Statistical Bureau, 1984 China Statistical Yearbook, various pages.

C. HISTORICAL PATTERN OF INVESTMENT IN COAL

Given the considerable construction and machinery requirements for coal production, major long-term output gains can only come from sizeable investments. The most important generalizations that can be made from the long-term historical investment data are that investment in coal has increased rapidly since the early 1950s (roughly 7 percent a year based on 5-year averages of beginning and ending periods) and that investment in coal is highly political, with levels varying widely from year to year and from political movement to political movement.

In general, the years of the Second Five Year Plan (1958-62), which included the Great Leap Forward, were ones of almost frantic investment activity, during which average annual investment in coal tripled from the level in the early and middle 1950s. Investment in the remainder of the 1960s fell back to roughly half the Great Leap level. In the early 1970s, investment recovered very quickly, growing roughly 14 percent per year over the late 1960s and 8.5 percent per year from the early to the latter 1970s.

Investment patterns in the late 1970s and early 1980s, however, show a fairly significant degree of instability, with a sudden jump from 1977 to 1978, followed by a leveling off through 1980, a decline in 1981, and another jump in 1983. These patterns coincide with the record of rapid changes in China's political and economic circumstances during these years, and their significance is discussed in detail in the following section on the post-Mao "Crisis Years" for coal.

A final important point about trends in coal investment is the geographical preference shown for the South and Southwest during the Cultural Revolution, in spite of the fact that these regions have poor coal reserves. The Cultural Revolution's goal of promoting regional and jurisdictional self-sufficiency, as well as relative regional equality, resulted in 70 percent of 1970's investment funds going to the South, Southwest, and East, regions very poor in coal. By 1975 the share had fallen to 49 percent, where it remained for the rest of the decade.[13] By 1982 construction of mines in poor or difficult areas had been stopped.[14] Prospecting for new reserves also suffered from the same bias.

In short, Chinese investment in coal has been a major long-term financial commitment, in spite of the sometimes major variations from year to year. This irregularity, in output as well as investment, has also been an important characteristic of the coal industry since the death of Mao.

TABLE 5.—HISTORICAL INVESTMENT AND CAPITAL FORMATION IN COAL, 1953-83

	Average annual investment in coal (mil yuan)	Average annual increase in assets[1] (mil yuan)	Average annual capacity increase (mil raw tons)
1953-57	594	487	12.8
1958-62	1,740	1,222	29.8
1963-65	838	801	8.0

[13] The World Bank, *China's Socialist Economy*, 1983, Volume II, Appendix E, p. 254.
[14] Ministry of Coal, *1982 China Coal Industry Yearbook*, p. 107.

TABLE 5.—HISTORICAL INVESTMENT AND.CAPITAL FORMATION IN COAL, 1953-83—Continued

	Average annual investment in coal (mil yuan)	Average annual increase in assets [1] (mil yuan)	Average annual capacity increase (mil raw tons)
1966-70	933	519	13.6
1971-75	1,815	1,043	16.2
1976-77 [2]	1,956	1,738	15.6
1978	3,180	n/a	11.5
1979	3,186	n/a	13.9
1980	3,347	n/a	8.3
1981	2,315	2,127	13.7
1982	2,985	1,709	8.2
1983	4,007	2,866	18.5

[1] The increased assets column refers to newly increased fixed assets through capital construction.
[2] For the increase in assets column, this row refers to 1976-80 data.

Sources: Calculated from the State Statistical Bureau, Statistical Yearbook of China, 1984, Peking, 1984, various pages.

D. COAL'S 1980-81 CRISIS

In 1980, China's coal industry entered a period of both investment and output crisis as production dropped to 620 million tons for both years and as investment declined significantly. The official explanation for this crisis has been a conscious policy decision to retrench in the industry and to allow for investments to correct for previous overexploitation of mining capacity. This explanation, however, is not entirely consistent with a closer examination of the data and the circumstances surrounding the crisis. The output drop, in particular, was most likely due to suddenly reduced subsidies from the central government, which was itself caught in a major budgetary crisis.

The official reason given for the 1980-81 "readjustment" in the coal industry is that a chronic imbalance had developed between investment and output, between mine construction and coal extractions. Specifically, in April, 1979, it was "found" that in 96 mines there was a serious imbalance between coal extraction and coal mine development.[15] In June, 1979, a special mine development conference discussed the work of making an adjustment in this balance, which would take three years.[16] However, the real crisis came in the following year, 1980, when it was decided, as part of the "adjustment" program, that it was necessary to hold coal output stable for two years.[17] It was this 1980-81 crisis in output which prompted so many Western analysts to speculate about a chronic long-term energy shortage for China.

A closer examination of the crisis raises doubts about the official explanation and points instead to the underlining state financial crisis as the major factor, with all its accompanying interministerial political manueverings.

The principal statistical measure used by Chinese researchers to prove the seriousness of "imbalance" in the industry is itself biased in favor of showing a growing excess of output over designed capacity. The measure they use is a "marginal" exploitation rate, the

[15] Ministry of Coal, *Chinese Coal Industry Yearbook 1983*, page 83.
[16] *Ibid.*
[17] Ministry of Coal, *Chinese Coal Industry Yearbook 1982*, page 99.

ratio of increased output in any period to the increase of output capacity through new mine construction.[18] This ratio of new output to new capacity shows steadily climbing extraction relative to mine construction.

This traditional Chinese measure, however, may seriously overstate the degree of extraction imbalance, if indeed there was any imbalance at all. In almost any industry, productivity of existing capacity increases with time. For coal, this natural increase is counterbalanced by removal from production of depleted mines. In general, however, the marginal exploitation ratio, the ratio of new output to new capacity, would normally increase, and even accelerate, over time, as productivity gains from a larger and larger output base is compared with new capacity added through capital construction. Relatively small changes in productivity for the industry as a whole could produce very large changes in the marginal exploitation rate.

As a result, the traditional Chinese measure of extraction imbalance is highly unstable for annual data, illustrating the disproportionate influence of annual output variations on what is supposed to be a measure of imbalance for the industry as a whole. This instability and the historical trend of the official "marginal" exploitation measure are shown in the fourth column ("Marginal Output Capacity Ratio") of Table 6 below. Beginning with rough parity during the first Five Year Plan (1952–57) and declining through 1965, the traditional measure of extraction imbalance grew quite rapidly through the latter 1970s, before becoming highly unstable for recent annual data.

Another interpretation of this traditional measure points to conclusions very different from the official one of over-extraction during the Cultural Revolution. The relatively high ratios for 1970 and 1975 might easily represent the return to productivity of mining capacity left idle in the aftermath of the disastrous Great Leap Forward. In any event, using the traditional marginal exploitation measure, it is difficult to draw any dependable conclusions about the 1980–81 need for "readjustment" in the coal industry.

TABLE 6.—COAL CAPACITY AND OUTPUT COMPARISONS

	New[1] capacity (mil tons)	Total accumulated capacity[1] (mil tons)	Total output[1] (mil tons)	Marginal output-capacity ratio[1] (percent)	Total output-capacity ratio[1] (percent)
1952	71	71	67		93
1957	64	135	131	101	97
1962	149	284	220	60	77
1965	24	308	232	50	75
1970	68	376	254	179	94
1975	81	457	482	158	105
1977	31	489	550	218	113
1978	12	500	618	591	124
1979	14	514	635	122	124
1980	8	522	620	−181	119
1981	14	536	622	15	116
1982	8	544	666	537	122

[18] Hao Bin, "Present Status and Outlook of China's Energy Structure," in *Wen Wei Po*, January 6, 1983.

TABLE 6.—COAL CAPACITY AND OUTPUT COMPARISONS—Continued

	New[1] capacity (mil tons)	Total accumulated capacity[1] (mil tons)	Total output[1] (mil tons)	Marginal output-capacity ratio[1] (percent)	Total output-capacity ratio[1] (percent)
1983	19	563	715	265	127
1984	18	581	772	315	133

[1] New capacity for 1952 is existing capacity for that year. New capacity for 1957–62 refers to the total for the period following the previous year listed. Total accumulated capacity is gross of depleted capacity, for which no data are available. The marginal output-capacity Ratio is new ouput per new capacity. The total ouput-capacity ratio is total ouput per total accumulated capacity.

Sources: Calculated from data in the State Statistical Bureau, Statistical Yearbook of China, 1984, Peking, 1984, various pages. 1984 calculated from the Communique on the 1984 Plan Fulfillment, Peking, March 1985.

An alternative and conceptually more accurate measure of the degree of "imbalance" in the industry is the total output-capacity rate, the ratio of total output to total accumulated capacity. Some gradual increase in this ratio is to be expected, and even applauded, and judgment must be exercised to determine if the output-capacity ratio is so large that it represents a squandering of overall output potential. The historical trend of Chinese coal's total output-capacity ratio is given in the final column of Table 6, above. Beginning with the official ratio for 1952 of 93 percent, capacity use by this measure is shown to have fallen to 75 percent by 1962 and 1965, the years following the Great Leap Forward. By 1975, the output-capacity ratio was just past 100 percent and continued to grow, indeed accelerate, through 1978. The ratio stabilized and declined during the years of official adjustment (1979–81), but by 1983 and 1984, output was at an all-time high in comparison to accumulated total capacity.

The clearest lesson from these data is that the 1980–81 coal crisis years did not bring about any lasting adjustment in coal's output-capacity ratio. Rather, by 1984, the ratio was higher than it had ever been. A second lesson is that output relative to capacity grew much more rapidly after the end of the Cultural Revolution than before. If there was any major over-exploitation of the mines, it was from 1976 to 1979. The quick recovery of the output capacity ratio in 1982–83, however, indicates that the over-exploitation was probably not as serious as officially announced, and certainly not serious enough to have caused the 1980–81 output reduction.

A more plausible explanation of the crisis has its roots in the general state financial contraction of 1980–81, following the very large budget deficits of 1979–80. These deficits were apparently brought on by a combination of expenditures for the fighting in Vietnam, food subsidies following major farm price increases, and over-ambitious investment programs in 1978–79. The deficits were reduced by lowering national defense expenditures and by drastic cuts in appropriations for capital construction, returning them to roughly their pre-1977 level.

State budgetary discipline had a clear influence on decision-making in the coal industry and precipitated the policy to hold output stable for two years (1980–81). In July 1980, the Second National Coal Working Conference was held in Benxi, Liaoning province. The major purpose of the conference was to relay and implement the policies of the Central Financial and Economic Leading Group (of the party's Central Committee) concerning energy and the coal industry, and the major decision at the conference was to keep output stable while carrying out readjustment.[19] The Central Financial and Economic Leading Group had promulgated six policies for the coal industry, including consolidation of the industry in the second half of 1980. In addition, the conference decided on major management changes, including a 6-hour shift and a 4-shift day, improvements in the piece-rate wage system, and implementation of an office workers' responsibility system.[20]

These agenda and decisions of the 1980 Coal Working Conference make it clear that the final impetus for 1980–81 output stagnation came from financial authorities at the national level. Already in chronic financial difficulty because of coal's pricing, the Ministry of Coal was evidently forced to decide how to operate with greatly reduced allocations from the state budget. Any solution to the problem required division of available funds between investment in new capacity and subsidy of on-going production operations. The decision at the 1980 Working Conference was made in favor of investment, and output was kept stable.

Although this policy was undoubtedly influenced by the perceived degree of over-exploitation in the late 1970s, the decision to hold output stable may also have been a political one, designed to emphasize China's critical energy supply problem and strengthen Ministry lobbying efforts to restore previous subsidy levels. Indeed, by 1981 the Ministry was apparently under heavy pressure to correct the output situation, and recovery began after the third quarter of that year.[21] It is probable that some restoration of lost subsidies was involved in the decision to expand output, but investment declines in 1981–82 point to continued financial straits for the industry.

To summarize the 1980–81 crisis, a combination of the state's financial crisis and the coal industry's need for both major investments and subsidized output growth forced a choice in 1980 which held coal output constant. With the relaxation of the state budget crisis in 1982–83, both output and investment returned quickly to respectable growth paths and earlier levels of capacity utilization. Some correction in the degree of over-exploitation undoubtedly occurred, but premature mine depletion could not have been the major precipitating cause of output stagnation. Budget deficits outside the industry, at the state level, forced the output contraction. Moreover, and most importantly, this analysis of the 1980–81 crisis implies that China's coal industry is basically healthier than such a contraction would otherwise imply. Fundamental failure of the coal industry cannot be considered a serious threat to China's overall economic modernization program. Management and price reforms in the mid-1980s (discussed below) make up the next appropriate policy step and should enable the industry to free itself from such excessive dependence on the state's finances.

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[19] Ministry of Coal, *China Coal Industry Yearbook, 1982*, p. 99.
[20] *Ibid.*
[21] Martin Weil, "China's Coal," in *the China Business Review*, March–April, 1982.

III. Coal Development Policy

The Chinese overall coal development strategy assumes that the energy shocks of the 1970s point to coal as the energy of the future, not only for China, but for the world in general.[22] Policy-makers also want to maximize foreign exchange earnings and to recognize the importance of petroleum. Within this analytical framework, China's overall energy strategy was first developed by Deng Xiaoping as early as 1975,[23] a strategy stressing the mechanization of coal production using foreign technology and emphasizing coal exports. In 1981 the strategy was modified in a party Central Committee decision to export coal indirectly, by substituting coal for petroleum in traditional domestic uses and exporting the petroleum saved.[24] With the large increases in petroleum exports apparent by mid-1984, the strategy seems to have been fully implemented. Hence, the historical energy balance trends and relationships shown in Table 2 above are likely to continue in force, and coal's importance for China's domestic economic transformation will, if anything grow.

The specific elements of China's coal strategy combine both quantitative and qualitative targets. In addition to calling for a doubling of output in this century's last two decades, coal development will also stress price and management reforms, mechanization, improved mine safety, more appropriate consumption patterns, transport investment, and expanded coal exports. It is fair to say that all aspects of China's coal development are under new and careful scrutiny, while the diversity and flexibility of solutions being explored may be the most important element in the program's long-run success.

A. The Coal Industry's Slogan: Double Output by the Year 2000

The most widely publicized coal industry target is the doubling of output from roughly 600 million raw tons in 1980 to 1.2 billion tons in the year 2000. This target appears to be very conservative. It is in fact little more than a rallying cry for the overall coal development effort, and subsidiary output targets and the means for achieving them are only vaguely discussed. Furthermore, the output target of 1.2 billion tons is a scaled-down goal from that of the very early 1980s, and even the most recent targets for components of overall output sum to 1.4 billion tons rather than 1.2. Finally, growth in the early 1980s is already outstripping the necessary doubling annual average growth rate of 3.5 percent. In spite of output stagnation in 1981, the average growth rate for 1980–83 would result in 1.5 billion tons by 2000, and the average 1980–84 growth rate would bring 1.8 billion tons. These recent trends are all the more significant when it is remembered that the 1980s are envisioned as a period of slower growth, with acceleration coming in the 1990s.

The officially published plan for doubling output by the year 2000 calls for 2.5 percent growth through 1985 for 700 million tons

[22] Ministry of Coal, *Chinese Coal Industry Yearbook, 1983*, p. 131.
[23] *Ibid.*, page 67.
[24] Ministry of Coal, *Chinese Coal Industry Yearbook, 1982*, p. 107.

of output (1983 output was already 715 million tons), 2.7 percent growth through 1990 for 800 million tons, and then 4.1 percent growth in the 1990s.[25] Other scenarios call for 3 percent growth to 1985, 4.6 percent through 1990, and 4.5 percent through 2000, for a final target output of 1.4 billion tons rather than 1.2 billion.[26]

Official projections for output by type of mine also exceed the 1.2 billion ton target. Output from existing state mines is to increase from 344 million tons in 1980 to 400 million tons in 2000, which also allows for 70 million tons in capacity lost from depleted mines. Output from locally-owned mines (county and village mines) is to grow from 276 to 500 million tons, and output from new mines, largely mechanized and open-pit mines, is to reach 400 million tons by 2000, for a total of 1.3 billion tons.[27] The extra 100 million tons is supposedly to account for the uncertainty about output from local mines, but given the historically rapid pace of local mine development, they are just as likely to exceed their target. The record of mines by ownership category is given in Table 7, below.

The share of total output produced by local mines increased dramatically during the Cultural Revolution years and continued to increase slightly from 1980 through 1982. With the incentive reforms in industry encouraging even more decentralized mining activity, the local component of total output seems to have excellent prospects. Furthermore, in addition to stressing development of open-pit mining, the overall official strategy encourages output of small mines in the early years of the program, because of the shorter investment lead time required.[28]

In short, the call to double coal output by the year 2000 is for the most part a slogan similar to that calling for the quadrupling of gross value of agriculture and industry in the same period. Whole number growth targets are presumably easier to promote than fractional ones. But just as the quadrupling goal seems conservative (quadrupling gross value output is much easier than quadrupling GNP), so doubling coal output by the year 2000 also may be scaled back from more serious estimates of output potential.

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[25] Ministry of Coal, *China Coal Industry Yearbook, 1983*, p. 93.
[26] Hao Bin, "Present Status and Outlook of China's Energy Structure," in *Wen Wei Po*, January 6, 1983.
[27] Ministry of Coal, *China Coal Industry Yearbook, 1983*, p. 92.
[28] *Ibid.*

TABLE 7.—HISTORICAL OUTPUT OF COAL BY OWNERSHIP TYPE

	1949	1957	1965	1979	1980	1981	1982	1983	1984
Total production (million tons)	32.43	130.73	231.80	635.54	620.00	621.63	666.32	715.00	772.0
State controlled mines	23.53	94.33	164.28	357.77	344.38	335.05	349.90	382.27	[1] 394.3
Local mines of which	8.90	36.40	67.52	277.77	275.62	286.58	316.42	332.73	377.7
Commune and brigade mines	1.45	6.49	9.73	106.31	N/A	126.59	146.07	N/A	N/A
Other local	7.45	29.91	57.79	171.46	N/A	159.99	170.35	N/A	N/A
Share of total (percentage)	100	100	100	100	100	100	100	100	100
State controlled mines	73	72	71	56	56	54	53	53	51
Local mines of which	27	28	29	44	44	46	47	47	49
Commune and brigade mines	4	5	4	17	N/A	20	22	N/A	N/A
Other local	23	23	25	27	N/A	26	26	N/A	N/A

[1] Preliminary 1984 breakdown, see FBIS, November 27, 1984 page K22.

Sources: 1949-1979 data from "China Coal Industry Yearbook, 1982" page 25; 1980-82 from "China Coal Industry Yearbook, 1983," pages 130-31. 1983 from "1984 Chinese Statistical Abstracts," page 47.

B. PRICE, INCENTIVE, AND MANAGEMENT REFORMS

By 1983 and 1984, China has already begun to take significant steps in price and management incentive reforms, reforms which in many ways give a preview of how China's overall industrial management and price reform might proceed. At the same time, coal's experience with these reforms has already brought out dislocation problems which will have to be solved not only for coal but for the economy as a whole if the use of financial incentives is to succeed.

Just as for the earlier and very successful reforms in agriculture, coal's reforms were first experimented with in a small subset of coal mining locations. In 1983, for 22 mining administrations in China's eastern region, a trial program was introduced allowing higher prices for coal production in excess of quotas.[29] In addition, mines were allowed to sell this over-quota coal to whomever they wished. A second part of the experiment involved fixing a standard delivery order for individual end-users, both local and state, and then charging higher prices for any deliveries over the standard order.[30] The ingenuity of the system is in its influence over decisions at the margin, decisions about additional output and increased consumption, without disturbing the financial positions of existing enterprises. The reform seems based on the principle that for large enterprises, changes at the margin are more feasible than changes in average parameters.

A second major aspect of the experimental reforms involved greater freedom for coal mines, power companies, chemical plants, and other end-users to form joint ventures and compensatory ventures to coordinate production, transport and marketing.

In 1984 certain aspects of the experimental reforms were introduced nationwide, but by late in the year problems developed in supplies to existing end-users. Apparently the profit incentive and the return to new cooperative ventures were enough to divert coal deliveries from traditional customers with a standing order to affiliates and other customers willing to pay higher prices.

Specifically, although reforms in the first six months of 1984 seemed to improve deliveries of coal to electric power companies, by the second half of the year coal departments and mines had found their joint ventures and compensatory schemes so profitable that they fell behind in deliveries to traditional electric power plant customers.[31] Although it is too early to tell how far and how fast the repercussions of these 1984 changes will push reforms in the rest of industry, it is clear that the reforms in the coal industry and coal markets are innovative and bold. They address the problems of both prices and incentives with a flexible formula for cushioning the adverse financial impact of such a fundamental decontrol. If such a reform program in coal can adjust to the unexpected swiftness of the profit incentive response, then similar fundamental management and pricing reforms will undoubtedly also succeed in other industrial subsectors. The incentive reforms in coal, be-

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[29] Ministry of Coal, *China Coal Industry Yearbook, 1983*, p. 183

[30] *Ibid.*

[31] *China Daily*, December 7, 1984, p. 3, from an article originally in the *Jingji Ribao* [Economic Daily]. (FBIS 12/10/84).

cause of coal's central role as an industrial fuel and because of its relatively poor financial condition, may well be the most critical test of the entire industrial and urban reform movement.

C. TECHNICAL MODERNIZATION: MECHANIZATION AND MINE SAFETY

In spite of the official emphasis placed on mechanization and the transfer of foreign technology for coal production, the larger part of growth in output has come from local mines with little if any modern techniques and with extremely poor safety records. This can be explained in large part by the time required for difficult negotiations with foreign investors and the longer lead time needed for the large-scale investments envisioned for state mines. But the recent pattern of development may also suggest that large-scale coal technology transfer is more difficult than previously thought. This difficulty, when coupled with Chinese resistance to the very large investments needed in transport systems, points to a continued important and growing role for the traditional labor-intensive extraction methods of the county and village mines. Technology transfer programs which concentrate on the technical needs and absorptive capacity of these local mines rather than only the large and ambitious state programs might find both an eager market and considerable opportunity to increase overall output.

The local mines, however, are the focus of the mining system's most serious labor and mine safety problems. Safety standards in China's mines are poor in general, with overall fatalities even in state mines as high as 2 persons killed per million tons of coal mined (roughly ten times higher than in the United States).[32] In local mines, fatalities for 1980, 81, and 82 were 11.5, 8.3, and 7.1 deaths per million tons mined, respectively. The decline in the fatality rate for these reported years was due to the closing of numerous small mines which did not meet official safety standards. In coal-rich Shanxi province, of the more than 2,600 sanctioned commune mines, 77.6 percent had not been in compliance with safe technical standards.[33]

The import of technology, however, has focused on large visible projects and on the importation of whole sets of equipment. As early as 1974, 30 fully mechanized English and French systems were imported, and in 1978 an additional 100 sets were purchased.[34] Recent attention has been given to very large and highly visible projects for foreign investment in open-pit mines, which are expected to give large output increases in a shortened investment period. But mutually satisfactory cooperative agreements have been difficult to conclude, in part because of the fluctuations in the world price of coal.

In general, the technical transfer is part of many different programs for economic cooperation: compensatory trade projects such as the Southwest Energy Development program in Guizhou and Yunnan, joint enterprises, invitations for design, and World Bank Loan projects. Narrower technical cooperation is also being carried

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[32] Martin Weil, "China's Coal," *China Business Review*, March-April, 1982.

[33] Zhang Hongshun, "Building a Chinese Energy Base," in *Jishu Jingji yu Guanli Yanjiu* [Research on the Economics and Management of Technology] No. 4, December 31, 1983.

[34] Martin Weil, *op. cit.*

out in projects with the United Nations Development Project, such as coal liquification, and various coal science research projects with Japan.

Many of the most ambitious projects are in rugged Shanxi province, with the largest proven reserves in China. In the South, where coal resources are poorer, the only significant concentrations are in isolated Guizhou and Yunnan provinces, where the State Council has founded a Joint Development Corporation to invest in both mines and transport. In Shanxi, for example, four large projects (total 12.5 million tons) are being financed with Japanese Ex-Im Bank loans, the first stage of the Pingshuo open pit project is to produce 15 million tons, and a relatively small Romanian project will have a 1.5 million tons coking coal capacity.[35] In the Southwest, 33 million tons of open-pit coal mining capacity are planned as part of the Development Corporation's output expansion from 7 million tons a year to between 60 and 80 million tons.[36]

Because of the inaccessibility of China's coal, most large programs for technical transfer combine mining with transport. The technical transfer in transport is concentrated in the electrification of railroads,[37] the use of slurry pipelines,[38] and development of electric power grids to transmit the output of large generators located at the mines.

The scale of interprovincial coal transfers is given below in Table 8, which illustrates the regional imbalances. The extremely large deficits in the industrial areas (Liaoning, Shanghai, Hubei, Guangdon, Jiangsu, Peking, Tianjin) are, in general, all matched with surpluses in Shanxi, with the exception of smaller surpluses in Hunan, Hebei and Heilongjiang. With the ambitious programs for injecting modern technology into Shanxi's mining and transport, this degree of national dependence on the output of a single province places even greater importance on transport. And because transport development seems to be very slow, the major focus for some time must come back to conservation in use.

[35] Xinhua Radio, April 29, 1983 (JPRS 6/24/83 p. 76).

[36] Ling Peihong, "Using Foreign Investment to Accelerate Development of Energy Resources in southwest China," in *Shijie Meitan Jishu* [World Coal Technology], June, 1983 pp. 5–6.

[37] See, for example, Jun Shi, "Electrification of the Multiple Track of the Shijiazhuang-Taiyuan Railroad, "*Tidao Zhishi* [Railway knowledge], No. 2, March 28, 1983.

[38] Xinhua May 29, 1983 mentions a coal slurry project from South Shanxi to Nantong at the mouth of the Yangtse River.

TABLE 8.—NET INTER-PROVINCIAL COAL FLOWS FROM STATE CONTROLLED COLLIERIES

[Thousand tons]

	1980			1981			1982		
	Inflows	Outflows	Net flows	Inflows	Outflows	Net flows	Inflows	Outflows	Net flows
Total	132,800	139,070	6,270	138,373	143,550	5,177	146,740	151,170	4,430
REGIONS									
Southwest:									
Sichuan	880	230	−650	1,320		−1,320	1,290		−1,290
Guizhou		2,290	2,290		2,330	2,330		2,580	2,580
Yunnan	270		−270	220		−220	320		−320
Tibet			0	3		−3			0
Northwest:									
Shaanxi	1,680	4,060	2,380	1,490	3,660	2,170	1,760	4,280	2,520
Gansu	3,980	660	−3,320	3,930	740	−3,190	4,180	700	−3,480
Qinghai	1,030		−1,030	1,020		−1,020	1,130		−1,130
Ningxia	180	5,830	5,650	140	5,530	5,390	210	5,250	5,040
Xinjiang		1,100	1,100		1,160	1,160		1,660	1,660
Center south:									
Henan	2,690	15,130	12,440	3,120	13,690	10,570	3,850	15,400	11,550
Hubei	11,890		−11,890	11,800		−11,800	10,740		−10,740
Hunan	3,040	60	−2,980	3,740	870	−2,870	3,100	140	−2,960
Guangxi	2,170		−2,170	1,910		−1,910	2,040		−2,040
Guangdong	4,710		−4,710	4,440		−4,440	4,910		−4,910
East:									
Shanghai	13,870		−13,870	14,200		−14,200	15,180		−15,180
Jiangsu	9,140	1,340	−7,800	11,010	2,410	−8,600	11,180	2,640	−8,540
Zhejiang	7,170		−7,170	7,300		−7,300	7,300		−7,300
Anhui	2,280	6,990	4,710	2,950	6,740	3,790	3,290	5,970	2,680
Fujian	2,300		−2,300	1,890		−1,890	2,350		−2,350
Jiangxi	1,570	530	−1,040	1,690	690	−1,000	1,660	770	−890
Shandong	4,020	7,140	3,120	4,980	6,100	1,120	5,440	5,860	420
North:									
Peking	13,220	2,660	−10,560	12,350	2,620	−9,730	12,760	2,650	−10,110
Tianjin	9,410		−9,410	9,130		−9,130	9,640		−9,640
Hebei	9,570	12,880	3,310	9,600	11,880	2,280	9,630	12,120	2,490

Shanxi		61,620	61,620		69,270	69,270		74,260	74,260
Inner Mongolia	3,700	5,740	2,040	3,880	5,760	1,880	4,520	6,120	1,600
Northeast:									
Liaoning	18,470	1,230	−17,240	19,940	920	−19,020	21,220	950	−20,270
Jilin	4,040	600	−3,440	4,850	490	−4,360	5,850	620	−5,230
Heilongjiang	1,520	8,980	7,460	1,470	8,690	7,220	3,190	9,200	6,010

Sources: Ministry of Coal, Coal Industry Yearbooks, 1982, 1983.

D. CHINA'S COAL EXPORTS

As we have seen in Table 8 above, and unlike many large developing countries, China is both a net energy exporter and a net coal exporter. Coal exports have been a major part of China's long-term coal development strategy, and coal exports are also an important part of the agreements anticipated with foreign investors. For the near future, because of China's own domestic needs and the difficulty of transporting coal from the interior to harbors, coal exports will not share the dramatic position in China's balance of payments now held by petroleum. By the middle or late 1990s, however, China may have supplanted traditional suppliers for such large markets as Japan.

TABLE 9.—1981 INTERNATIONAL TOTAL ENERGY AND COAL BALANCES

[Million metric tons of coal equivalent]

Country	Production	Consumption	Change in stock [1]	Unallocated	Net exports
1981 Total energy balances:					
World	9,095	8,493	274	384.8	−57.3
U.S.	2,088	2,345	67	14.2	−338.1
Brazil	37	92	1	7.8	−63.7
China	614	576	0	7.3	30.5
India	120	136	5	10.4	−30.9
Japan	43	421	12	24.2	−414.0
Korea, South	14	55	1	5.4	−47.2
Germany, West	166	346	8	−.3	−188.5
Poland	150	162	0	−16.2	4.3
U.S.S.R.	2,001	1,536	6	323.0	136.0

Country	Production	Consumption	Stock changes	Net exports
1981 Coal balances:				
World	2,718	2,708	9	.5
U.S.	652	578	−16	91.0
Brazil	4	8	0	−3.4
China	432	431	−2	3.3
India	90	88	2	−.3
Japan	16	93	−4	−72.7
Korea, South	19	26	0	−7.4
Germany, West	128	124	3	−.2
Poland	151	139	0	12.0
U.S.S.R.	520	501	0	19.0

[1] Total energy change in stock includes bunkers and domestic stock.

Sources: China data from table 4 and State Statistical Bureau, "Statistical Yearbook of China, 1983." Other data from "1981 Yearbook of World Energy Statistics," pages 2, 7, 9, 210, 235.

The energy and coal balances for China and various selected countries are presented in Table 9 above. In comparing the overall energy balances with the coal balances, it is interesting to note how many major industrial countries are major net importers of energy but self-sufficient in coal. Japan is the major exception, importing large supplies of coal. Of the countries listed, the United States is by far the largest exporter of coal, and China's growing port capability could be expected to compete directly for markets in Japan, South Korea, and elsewhere. For the time being, the official Chinese position is that coal is primarily for domestic consumption, and that exports will increase from their current level of about 6 million tons to only about 10 million tons by the 1990s.[39]

Data on China's international coal trade are given in Table 10, below, and reveal, among other trends, the much slower growth in domestic coal stocks which accompanied the crisis years of 1980-81. In general, coal exports have doubled since the latter 1970s, while coal imports have held stable, except for the contraction of 1980-81. The accumulation of coal stocks derived in Table 10 reflects in large part the inability of China's transport system to deliver all the coal mined. In many cases, coal output is slowed or stopped because of the lack of transport. According to one report, in 1980, over 14 million tons of coal accumulated in Shanxi.[40]

[39] Gao Yangwen, Minister of Coal, in *Shijie Jingji DaoBao*, February 21, 1983 (JPRS, 6/24/83 p. 58).

[40] Hu Guang Rong, "Transport Problems in Construction of a Coal Base in Shanxi," *Neng Yuan*, [Journal of Energy] No. 3, June 25, 1982 (JPRS 10/27/82).

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TABLE 10.—COAL: NET EXPORTS AND STOCK CHANGES

Year	Value trade balance (million U.S. dollars)						Physical trade balance (million tons crude coal)				
	CIA figures			Official statistics							
	Export	Import	Net export	Export	Import	Net export	Export	Import	Net export	Stock changes net exports	Changes in stock
1952											
1957				15	1	14	1.88	0.07	1.81	6.37	4.55
1962				32	21	11	2.60	1.41	1.19	13.28	12.09
1965				42	24	18	3.36	1.99	1.37	3.15	1.78
1970	50	29	21								
1975	163	86	77								
1976	128	55	73								
1977	147	87	60								
1978	178	118	60	100	71	29	3.12	2.44	0.68	52.41	51.73
1979	210	136	74	177	69	108	4.63	2.15	2.48	49.61	47.13
1980	246	123	123	265	75	191	6.32	1.99	4.33	13.14	8.82
1981	267	101	166	327	55	272	6.57	1.93	4.64	15.97	11.34
1982	323	129	194	335	58	276	6.44	2.19	4.25	24.61	20.36
1983	N/A	N/A	N/A	294	58	236	6.56	2.14	4.42	36.80	32.38

Note.—Stock Changes and Net Exports converted at 1.4 tons coal per standard ton (7,000 kcal).

Source: CIA from "China: International Trade Annual Statistical Supplement," February 1982 and March 1984. Official exports and imports from "1949-84 Guanghui Sanshi Wu Nian, Tongji siliau" (35 Glorious Years, Statistical Materials), 1984 Peking: State Statistical Bureau, pages 124-126. Stock Changes and Net Exports from State Statistical Bureau, "Yearbook of China 1983" (SSBYB83) pages 249 and 250.

CHINA'S NUCLEAR POWER OPTION

By Richard P. Suttmeier*

CONTENTS

The initialling of an agreement for U.S.-Chinese cooperation in nuclear technology during President Reagan's visit to China in April, 1984, stimulated considerable interest in China's civilian nuclear power activities. The failure of the Reagan Administration to submit the agreement to Congress promptly fueled further Congressional interest, and more than a little distrust of the Administration's judgment, and of Chinese nuclear intentions. Although the agreement has now been signed, and reluctantly accepted by Congress, it remains controversial.

Unfortunately, there has been less analysis in the west of China's civilian nuclear aspirations than the importance of the subject calls for. Without addressing the wisdom of the U.S.-P.R.C. agreement,** this chapter represents an effort to broaden and deepen our understanding of China's nuclear activities. I will argue that the nuclear program must be understood in the contexts of Chinese energy, industrial, and national security policies, and as part of the evolving interplay of policy and politics characteristic of the "Four Modernizations" program. I will also suggest that the uniqueness of the Chinese situation poses interesting challenges to our thinking about the nuclear option in China, and the role of China in international nuclear development.

BACKGROUND

China's interest in, and commitment to, nuclear science and technology go back to the early 1950's, when research was begun in the areas of nuclear physics and nuclear chemistry. By 1954, China was in active discussions with the Soviet Union for assistance in

* Hamilton College, Clinton, NY. The author acknowledges with thanks the research assistance provided by Polly Diven, and helpful comments on an earlier draft from Justin Bloom and Michael Mastanduno.

** This subject is explored in U.S. Congress, Office of Technology Assessment, *Energy Technology Transfer to China,* September 1985, and in Richard P. Suttmeier, "Nuclear Power Issues." In U.S. Congress, Office of Technology Assessment, *Background Papers: Energy Technology Transfer to China,* September 1985.

atomic energy. In 1956, China initiated its 12 year science plan, with research on atomic energy listed first among the fields singled out for priority attention. The Soviets subsequently supplied China with a heavy water research reactor, assisted in the establishment, in 1958, of the Institute of Atomic Energy of the Chinese Academy of Sciences (CAS) and provided other forms of technical assistance.

The latter included the training of Chinese scientists and engineers in the Soviet Union. Among those trained were 140 at the advanced research facility at Dubna, where physicist Wang Ganchang served as deputy director during the height of Sino-Soviet collaboration. A number of China's current leaders in the nuclear field, such as Peng Shilu (Vice Minister of the Ministry of Water Conservancy and Electric Power) who has headed the Guangdong nuclear project, described below, were Soviet trained.

Chinese efforts in nuclear technology until the early 1970's were largely weapons related. It should be noted, however, that significant progress over the years had been made in the medical and agricultural uses of radioisotopes as well, and that over 1,700 instruments using radioisotopes are in use in a variety of industries.[1] There are reportedly some 20 research institutes specializing in radioisotopes, over 100 radiation facilities, and over 10,000 technical staff members working in this field.[2]

Over the years, therefore, China's commitment to nuclear science and technology has been substantial. In contrast to most countries just beginning a civilian nuclear power program, China has a developed infrastructure for nuclear technology, including a large community of nuclear scientists, engineers, and technicians. There are more than 20,000 members of the Chinese Nuclear Society, and the total number of individuals employed in the nuclear community is estimated to be 100,000–150,000. In addition, there are well-established R&D facilities, and industrial experience with nuclear grade manufacturing.[3]

China has constructed and operated over a dozen experimental, plutonium production, and prototype power reactors.[4] In 1980, the Chinese put into operation in Sichuan province a high flux test reactor to be used for irradiation research on nuclear fuels, materials for power reactors, and isotope production.[5] With capabilities ranging from uranium prospecting to reprocessing and waste management, a nearly complete nuclear fuel cycle is already in place.

While the weapons program provided the dynamic for China's scientists to become familiar with nuclear technology, it should also be noted that the technology of plutonium production reactors is not as demanding as the technology of power reactors. China's experience with the latter has its origins in work done to develop naval reactors for nuclear submarines, of which it now has four.

NOTES.—Frequently used abbreviations include: FBIS. (Washington. Foreign Broadcast Information Service. *Daily Report: China.*) JPRS (Washington. Joint Publications Research Service. *China Report.*)

[1] Xinhua. April 16, 1984. In FBIS. April 16, 1984. k14.

[2] *Nuclear News.* December 1983. 82.

[3] Xinhua. April 17, 1984. In FBIS. April 18, 1984. k5.

[4] Jiang Shengjie. "Developing Nuclear energy is a Major Strategic Measure in Economic Construction in China." *He Kexue Yu Gongcheng* V.4 #1 March 1, 1984. In JPRS-CST-84-018. 17.

[5] See, *Nuclear News.* February 1982. 77.

Work on an indigenous reactor for civilian electrical power generation, reportedly upon a directive from former Premier Zhou Enlai, began in August, 1972. This work, which is the basis for the Qinshan project near Shanghai on Hangzhou Bay, is also referred to as the "728" project, after the date of Zhou's directive.

The tempo for the development of nuclear power began to pick up in the late 1970's, after Mao's death and the reaffirmation of the "four modernizations" policy. In December 1977, Deng Xiaoping announced a decision to import two French built plants. However, the initial burst of enthusiasm gave way to caution in the face of domestic economic retrenchment, the cancellation of foreign contracts, and the accident at Three Mile Island.[6] The Chinese reasoned at the time that they had abundant non-nuclear energy resources which made nuclear power unnecessary, that nuclear plant construction would take a long time, and that the safety of nuclear power was still uncertain. Perhaps most importantly, they were concerned about the expense of nuclear plant construction.[7] The Chinese reportedly then went through 3 years of "investigation and demonstration" which led to a consensus that nuclear development should proceed.[8]

This consensus was formally stated as policy in December, 1982, when the go ahead was given for (1) A 300 MWe plant of Chinese design (the "728" project) to be built at Qinshan in Zhejiang province; (2) Two 900MWe reactors to be built using foreign technology in Guangdong in collaboration with Hong Kong interests; (3) Planning for a 1800MWe facility to be located near Shanghai known as the "Huadong" (East China) project.[9] These projects are then to be the foundation for the Chinese hope of having 10,000 MWe of installed capacity by the year 2000. China's reaffirmation of the nuclear option seems to have been a function of ongoing analyses of, and a reexamination of assumptions about, energy supply and demand conditions, and the emergence of an influential group of nuclear proponents who some have referred to as the "nuclear lobby."

NUCLEAR POWER AND ENERGY OPTIONS

As China's scholars and officials began to undertake serious analyses of the nation's energy situation in the aftermath of the Cultural Revolution, the severity of China's immediate energy problems became more evident. The Chinese have come to realize that a substantial obstacle to economic growth is energy scarcity. Reportedly China has been short as much as 50 billion kwh in recent years, costing the economy as much as 70,000 million *yuan* in lost output.[10] For China to reach its goal of quadrupling the gross output value of the economy by the year 2000, hefty increases in energy supplies will be required. Because of the enormous oppor-

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[6] See, Dori Jones. "Nuclear Power Back On." *The China Business Review*. January/February 1981. 32.

[7] "The Chinese Society of Electrical Engineering Holds Academic Discussion Meeting on Nuclear Power in Suzhou. *Dianli Jishu*. #10 October 5, 1981. In JPRS 80157. 145-6

[8] Jiang. *op.cit.;* See also Jones. *Op.cit.*

[9] *Nuclear News*. December, 1983. 81.

[10] Jiang Shengjie. "Developing China's Nuclear Power Industry." *Beijing Review*. June 18, 1984. 17.

tunity for conservation, however, it is expected that the supply of primary energy need only double if the quadrupling goal is to be met.

However, in the electric power sub-sector, the requirements are more stringent; the electric power supply must also increase by a factor of four, according to recent analyses.[11] That is, installed capacity must rise from the 62 gigawatts (62,000 MWe) available in 1982, to approximately 250 gigawatts in 2000. It is expected that the energy source mix by 2000 will still be dominated by coal (75%), with hydro accounting for 20%, and nuclear providing the remaining 5%.[12] The severity of China's "underelectrification" can be further appreciated when it is recalled that the U.S., with a population one-fourth the size of China's, has an installed capacity (over 600,000 MWe) that is almost 10 times greater than China's. Indeed, China's total current capacity is roughly the same as the existing U.S. electricity generating capacity from its nuclear plants alone.

China's energy situation is somewhat anomalous by international standards. Its factories must run at levels far below capacity because of energy shortages. Yet, China has the world's richest hydroelectric potential, it has the world's third largest proven reserves of coal, and it is a major oil producer. It also has a unique potential for conservation. Its record of using energy efficiently is among the worst in the developing nation category, and is far from the performance of the industrialized countries.

Apart from the problem of energy waste, which is a function of irrational prices and obsolete equipment, the basic dilemma China faces is how to get its abundant primary energy in a useable form to where it is needed. The former is located mainly in the northwestern (coal, some hydro) and southwestern (hydro) parts of the country, while the demand is greatest along the industrialized eastern coast. Sixty-one percent of the coal, for instance, is located in Shanxi province and Inner Mongolia, while only 1.6% is found in the southeastern provinces and in the Shanghai region. For hydro, 71% of the resources are located in the southwest, and 11% in the northwest.[13]

Electric power supply problems are exacerbated by the limited development of transportation and transmission capabilities. Coal transport already accounts for 43% of China's total railway freight and 47% of its water borne freight. Although there is much room for improving the efficiency of coal transport, since most coal is transported unwashed, major new railway construction is necessary for increased coal-fired electrical generation.

In terms of electrical transmission, China is a long way from having the long distance high voltage lines needed to realize the benefits of its hydro potential and its plans for mine mouth, coal fired generation. It also has a way to go in constructing a national power grid. At present, there are four main grids, those in the northwest, in the north, in the southwest, and in central China. Whereas the northwest has a yearly surplus of power amounting to

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[11] *Dianli Jishu* #11. November 1983. In JPRS-CEA-84-026. 1.
[12] *Nuclear News*. December 1983. 80.
[13] *Ibid.*

2–3 billion kilowatt hours, the other three grids regularly experience severe scarcities of power. The Northwest Electric Power Administration Bureau has proposed a scheme for sharing power, but it also acknowledges a serious lack of coordination and cooperation among the regional power authorities.[14]

Grid size and capacity are also important considerations for the nuclear program. International experience suggests that a grid of at least 7000 MWe capacity is needed for the economical operation of a 600 MWe reactor, whereas for a 900 MWe reactor, the grid size should be some 14,000 MWe.[15] While grid size limitations will probably not be factors for the first few nuclear plants, nuclear power will be unable to make a contribution to the solution of the energy problems of small cities (where supply conditions are often worse than in the big cities) without the development of transmission integration.[16]

While China's energy planners are committed to programs to bridge the geographical and technological gaps between supply and demand, their efforts to find solutions promptly are hindered by serious problems. These include underdeveloped power transmission and transportation systems, shortages of financial and technological resources for massive energy development projects, and the long lead times required to bring such projects "on stream."

In addition, China's nuclear proponents point out that non-nuclear solutions also have undesirable secondary effects. Hydro development often leads to the loss of farmland, and additions to coal burning facilities must be undertaken with due regard to the already severe air pollution problems resulting from the present extensive use of coal.

Under these conditions, the nuclear option has begun to appear more attractive to the Chinese in the last few years. Its appeal can be brought into sharper focus if, for purposes of energy supply and demand, we think of coastal China as a separate country. When this conceptual move is made, contemporary coastal China bears a certain resemblance to Japan of the late 1950's and early 1960's. It is an energy poor, technology rich region committed to rapid industrial growth and to participation in the world economy through export promotion and technology imports.

Nuclear power uniquely offers opportunities to substitute technical knowledge for primary energy, as the Japanese have also realized. Unlike Japan at the earlier period, China has not had the intimate working relations with foreign suppliers of advanced nuclear and non-nuclear electrical generating equipment. But, China has had almost 30 years of experience with nuclear technology, a resource not available to the Japanese when they embarked on their nuclear power development program in the late 1950's.

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[14] Xiao Genxing. "Electric Power Construction in the Northwest—An Overall View." *Liaowang.* February 20, 1984. In FBIS. March 20, 1984. k5.

[15] Kirk R. Smith. "Nuclear Power in the Asia-Pacific Region." In Fereidun Fesharaki, et al. (eds.). *Critical Energy Issues in Asia and the Pacific.* Boulder, Colo. Westview Press, 1982. 133.

[16] See, *Far Eastern Economic Review.* July 5, 1984. 50.

THE NUCLEAR LOBBY

While a *prima facie* case for nuclear power in eastern China can thus be made, it is by no means clear that China's energy planners and energy analysts have performed exhaustive analyses of the advantages of nuclear power over other options. Reportedly, analysts have concluded that nuclear power enjoys a 10 percent cost advantage over coal in Guangdong, and a 5 percent advantage in East China.[17] However, there have also been reports that some in China have questioned the need for the Guangdong project on the grounds that hydropower development on the Hongshui River could more effectively serve the needs projected to be met by the nuclear project.

As in most countries, policy analysis (including energy policy analysis) represents something of a "best estimate" at a given time. Analysis thus becomes one, among a number of other—usually political—factors, leading to a decision. The existence of a group with intense interests in a given policy area can often be a force shaping the content of analysis, and at times overriding it.

Such an intense group has emerged in China. Its activities first became public at the first congress of the Chinese Nuclear Society in February, 1980, a time when the nuclear option had lost the prominence it had in 1978. Organized pro-nuclear sentiments were also evident in March, at the second national congress of the China Association for Science and Technology, a national organization of professional societies comparable to the American Association for the Advancement of Science. During the summer of 1980, leading nuclear scientists gave lectures on nuclear energy to the top Party leaders, and by the fall, the establishment of an interministerial working group was set up to prepare concrete policy proposals, indicating that nuclear power was back on the national agenda.[18]

Although the most visible manifestation of the nuclear lobby is in the activities of the Chinese Nuclear Society, the pro-nuclear constituency extends well beyond the membership in the CNS. The CNS, like other professional societies, is an important forum for horizontal communications among technical personnel who are employed in China's diverse, vertically organized ministries and academies. However, as with other professional societies in areas of technology (in contrast to science), it has a strong identification with that ministry chiefly responsible for the development of the technology in which members have a professional interest.

In this case, this is the Ministry of the Nuclear Industry (MNI) led by Jiang Xinxiong, which until 1982 was known as the Second Ministry of Machine Building (SMMB), the center of the nuclear weapons program. The change from SMMB to MNI involves more than a change in name. It represents a redirection of work in the nuclear field from the purely military to the establishment of a civilian industry. This change in the nuclear arena parallels movements in other areas of military production and R&D which have involved the conversion or redeployment of resources in the defense sector to serve the civilian sector.

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[17] Jones. *op. cit.*
[18] *Ibid.*

These moves are a combination of explicit policy directing the military establishment to serve civilian industry, and a function of changed budget priorities following the decision to make defense modernization the lowest priority of the four modernizations. Thus, the nuclear community, like other parts of the defense establishment, may have had, of necessity, to define for itself a new mission. China's energy problem, thus, was a convenient target of opportunity.

The bureaucratic constituency for nuclear power is not limited to those in the MNI. It also includes those concerned with nuclear matters in the Chinese Academy of Sciences, the (First) Ministry of Machine Building, the Ministry of Water Conservancy and Electric Power (MWCEP), the Ministry of the Electronics Industry, and regional power authorities. According to one report, there are more than 100 organizations involved in the "728" project alone.[19] Although not all of these units, as we shall see below, necessarily see the nuclear development plans through the same lenses, the nuclear lobby, with some of its roots in the defense sector, is nevertheless a formidable coalition of bureaucratic interests.

NUCLEAR ADMINISTRATION

Nuclear power in all countries is a particularly "administered" technology. Even in the most *laissez faire* society, the peculiar issues surrounding nuclear technology make the question of the institutional arrangements for administering nuclear programs especially salient.

For the outside observer, the details of Chinese nuclear administration are still not entirely clear. It would appear that the Chinese themselves are still feeling their way through this problem. In part, this is because the initiation of an active nuclear program in China comes at a time when widespread administrative reform and reorganization is under way in the government as a whole.

Some of the problems of nuclear administration can be inferred from the description of the "nuclear lobby," above. That is, there clearly are multiple "agency interests" in the nuclear program, which are not necessarily in harmony. For instance, experience in other countries would suggest that there may be differences of interest between the domestic producers of nuclear technology (R&D establishments and industrial producers of equipment) and those responsible for using the technology to generate electricity (in this case, the MWCEP).

The former typically have an interest in acquiring their own mastery of the technology, and become proponents of the domestic technology they have produced. The latter sees its mission in terms of satisfying in a reliable way the power requirements of customers. They thus opt for the most reliable technology available, typically that offered by a foreign vendor.

In China, such differences also seem to exist. MNI and MWCEP reportedly differ on the "mixes" of technologies to be used.[20] The

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[19] Feng Zejun. "China's First Nuclear Power Plant." *Xiandaihua*. 5 #1. January 25, 1983. In JPRS 83436.

[20] W. P. Geddes. "The Uranium and Nuclear Industries in China." *Resources Policy*. 9 #4 (December 1983). 243.

MWCEP reportedly is reluctant to commit fully to PWR technology at this time, in part one suspects, because its leaders believe that by diversifying technologies, they will also be able to diversify, and improve the chances of obtaining, foreign credits.[21] Interministerial differences may also be reflected in the particular commitment China has made to nuclear power to date. These can be viewed as a nice balance between reliance on foreign technology to expedite the generation of power (the Guangdong project), and what is largely a domestic, "experience acquiring" effort at Qinshan.

The administrative picture is also complicated by the division of responsibilities between the central and local authorities. The Chinese have at times referred to the administrative patterns resulting from divided center-local authorities as that of a "chessboard." In many policy areas, the chessboard has resulted in a tolerable, and at times useful, ambiguity as to who has responsibility for what. In the nuclear field, however, one would expect that these ambiguities probably cannot be allowed.

Foreign nuclear suppliers report that they have negotiated with both central, and a variety of local, authorities. However, during the last year, they have sensed that the local authorities have been reined in by the center.[22] Nevertheless, evidence of a diffusion of responsibilities remains. The Guangdong project is under supervision of a special local authority (albeit one that is closely supervised from the center), and it appears that local units are often given the first line of responsibility for assessing the suitability of plant sites. In addition, provincial governments are well represented at technical seminars given by foreign nuclear groups. At one discussion held during a visit from members of the American Nuclear Society, for instance, the provinces of Jiangsu, Jiangxi, Shandong, Guangxi, Liaoning, Yunnan, and Fujian were all represented.[23]

A fundamental issue of nuclear administration in a number of countries is the question of whether the agency that promotes the technology should also regulate it for safety objectives. Until recently, there was no organization charged with responsibility for nuclear safety, although the Nuclear Power Institute of the MWCEP reportedly took the initiative in preparing standards for plant site selection.[24] In May, 1984, however, it was announced that a new nuclear energy safety bureau is to be established in preparation for the operation of the Guangdong plant, but with responsibility for the Qinshan plant and other projects as well. In November, the establishment of a new Nuclear Safety Bureau was formally announced. The Bureau is directly subordinate to the State Council, and is headed by Jiang Shengjie (Ph.D., Columbia), who is concurrently president of the Chinese Nuclear Society (see below).[25]

There is now organized research on nuclear safety, and a special budget line to support it.[26] In addition, the government has al-

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[21] Personal communication.
[22] Personal communication.
[23] *Nuclear News*. December, 1983. 80.
[24] "The Chinese Society of Electrical Engineering. . . ."
[25] "China Sets Up State Nuclear Safety Bureau." *Zhongguo Xinwen She*. November 9, 1984. In FBIS. November 13, 1984. k22.
[26] Jiang. "Developing. . . ." 18.

ready worked out provisional safety standards which were based on U.S. standards. (The Chinese have had an agreement with the U.S. NRC for cooperation in nuclear safety since 1981, under which the main activities have been to transfer documentation to China, and to provide for visits of Chinese to U.S. facilities). It remains to be seen what the division of responsibilities between the center and local governments will be on safety and environmental protection matters.

On the nuclear promotion side, since there are at least four central ministries with an interest in nuclear power, there is a need for interministerial coordination. While there was in the early post-Mao period a special group for this purpose, it now seems to have been replaced by the Nuclear Industry Department, apparently a staff office under the State Council. The highest ranking official with responsibility for nuclear power is Vice Premier (one of four) Li Peng, a former vice minister in the MWCEP.

Some degree of interministerial coordination also is provided by the State Science and Technology Commission. Although the SSTC has not been visible in discussions with foreign nuclear vendors, the Commission is active in coordinating nuclear R&D and it was an official of the SSTC, Jia Weiwen, who represented China in its negotiations with the U.S. on the nuclear cooperation agreement.

Unofficial coordination, of course, is realized through the activities of the CNS, which is formally a non-governmental body. Its current president, Jiang Shengjie, now the head of the Safety Bureau, was also the head of the Science and Technology Commission of the MNI. Jiang, more than any other figure, has been the most active publicist for the nuclear option during the last two years.

Under the State Council, the two most influential ministries on nuclear matters are the MNI and the MWCEP. The MWCEP, of course, has areas of responsibility other than nuclear power that have nothing to do with the former. Nevertheless, the Ministry has taken steps to acquire expertise in nuclear matters, although the extent of its nuclear capabilities cannot be readily assessed.

The MNI, on the other hand, is the center of the government's nuclear expertise. It is organized into six main bureaus: nuclear fuel, uranium geology, construction, science and technology, safety and radiation protection, and foreign affairs. In addition, the MNI sponsors and oversees the China Nuclear Energy Industry Corporation, established to facilitate the construction of the Guangdong plant. Providing technical guidance for the MNI is its Science and Technology Commission, headed until recently by Jiang Shengjie.

Under the MNI's Bureau of Science and Technology (not to be confused with its Commission), there are divisions dealing with reactor research, nuclear power, and nuclear physics. The Bureau also oversees the work of MNI's main research institutes. These include the Beijing Institute of Reactor Engineering and Design (which has responsibility for reviewing the design of the Guangdong plant), the "728" Institute in Shanghai, the Southwest Institute of Reactor Engineering and Design in Chengdu (Sichuan province), the Southwest Institute of Physics in Leshan (Sichuan), and the project management team for the 728 project, located in Qinshan. In addition, the MNI is linked to the CAS' Institute of Atomic Energy through the S&T Bureau.[27]

Apart from the Academy of Sciences, interest in nuclear affairs from two other sources should be noted. The first of these is the Ministry of Machine Building which possesses the facilities, and has the responsibility for providing most of the components for a nuclear plant. While the MMB's capabilities for manufacturing nuclear-grade components do have limits—as evidenced by the decision to go to foreign suppliers for the pressure vessel and certain critical pumps for the Qinshan plant—foreign observers note that much of the needed industrial capability already exists in MMB facilities.

The involvement of the Ministry of the Electronics Industry in discussions with foreign suppliers is also notable. Since many of the refinements in the western nuclear industry in recent years have come in new computer technologies for plant design and in the electronics of operational control, it is to be expected that the electronics industry would be actively interested in the nuclear industry. Since electronics has been identified as a priority industry for development, it is likely that the leaders of the latter would see foreign assistance in nuclear energy as an additional opportunity to have access to foreign advanced electronics as well.

NUCLEAR POLICY

China's policy for nuclear development can be viewed from a number of different perspectives. On one hand, we can view nuclear development as a component part of Chinese energy development plans. We can also view it in terms of technology policy involving decisions on the relative degree to which foreign technology should be relied upon in establishing a complete nuclear fuel cycle. Finally, China's nuclear development can be seen in terms of its international economic, technological and political implications.

From the energy policy perspective, China's policy is to install 10,000 MWe of nuclear capacity by the year 2000. This amount of power would represent a small percentage of anticipated electrical energy supply (the largest source for which will still be coal burning, but with an increasing share coming from water power as well). However, as we have seen above, when we break down China's energy supply/demand problems by region, nuclear can be expected to play an especially important role in eastern China.

To achieve these energy policy goals, China plans to build 10–15 reactors in the next 15 years. In addition to those plants on which work has already begun, the first few additional plants are likely to be located in the Shanghai area, and in the northeast. China's ability to achieve these capacity objectives will be a function of its technology policy.

In recent years, expert opinion in China has favored a seven point nuclear technology policy, the elements of which are as follows: [28]

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[27] Personal Communication.
[28] Jiang. "Developing . . . ."

1. In the building program envisioned for the next 15 years, pressurized water reactors should be the reactor type of choice. (It should be noted, however, that there is in some quarters interest in boiling water reactors as well.) [29]

2. China should aim to install reactors in the 1 million KWe (1000 MWe) range. For China's domestic reactor development program, reactor size will be increased gradually, from 300, to 600, to 900 MWe. Design work on a 600 MWe plant has now begun at the Southwest Research Institute of the MNI in Sichuan.[30]

3. In order to speed development of reactors in the 1000 MWe range, foreign technology and equipment should be imported.

4. The coastal areas should be the target areas for the initial phase of development.

5. China must rely on her own resources for nuclear fuels. Uranium exploration and mine development must be stepped up, and enrichment services expanded, including the development of the centrifuge method.

6. Reprocessing should be promoted in the interests of fuel conservation.

7. Nuclear development should proceed with the objective of providing not only electric power, but also industrial heat. In addition, research on waste management should be accelerated.

Finally, it is reported that a special fund for nuclear R&D has been established in order to support work on breeder reactors (in preparation for building them in the early 21st century), on high-temperature gas-cooled reactors for industrial process heat (for use in coal liquefaction and gasification, and for petroleum extraction, among other purposes), and on nuclear fusion (including the achievement of the design performance characteristics of the "451" Tokamak already built).

China clearly wishes to be as self-reliant in its nuclear industry as possible. However, as indicated above, some reliance on foreign technology will be desirable. As Li Peng has put it, "We must pay attention to improving the economic results in nuclear industry production. At the same time, we must pay attention to technological reforms and apply microelectronic technology to data processing, safety control, and economic operation." [31]

To achieve these objectives, China's self-reliance must be leavened with some foreign technology. Assuming that the legal and financial framework is in place, it would appear that the Chinese program would be one of heavy reliance on foreign suppliers in the short run, with an ever increasing Chinese "domestic content" with each successive project. Because of the considerable domestic nuclear capability, the Chinese are confident that the technology transfer process would move forward smoothly and rapidly. Representatives from American companies are inclined to agree.

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[29] See, *Dianli Jishu.* #11 November 5, 1983, In JPRS-CEA-84-026. 1-6.

[30] *Nuclear News.* February 1982.

[31] "The Development of Nuclear Energy Supplements the Energy Shortage in Coastal Areas." *Renmin Ribao* March 16, 1984. In FBIS March 20, 1984. k5.

It is in this connection that working with American (in contrast to European) companies has its appeal. The Chinese are interested in relations with companies like Westinghouse and General Electric not only, as has often been noted, because the technology originated with them. More importantly, the American technology transfer experience in aiding the development of indigenous industries elsewhere, as indicated by the successful European and Japanese experiences, is of considerable interest to the Chinese.

Members of the Chinese nuclear community have attempted to familiarize themselves with the world nuclear literature. In their design of the Qinshan plant for instance, they have studied the design features and operating experience of 300 MWe reactors in other countries.[32] They have also shown interest in reactor types which, for other than technical reasons, haven't been pursued in the west. They are familiar with the arguments for the advanced conversion reactor (ACR) as a follow on to the LWR. As we have seen, they have a modest breeder R&D project going. Commitment to the fusion program appears to be strong, although the Chinese recognize that it is 10–20 years behind the world leaders.

Of particular interest are the Chinese plans for the use of nuclear power as a source of industrial process heat. The first such plant—using a 450MWt reactor—is to be built in the Shanghai suburbs to provide process steam and electric power for the Jinshan Petrochemical Plant. The overall design and site survey work for this plant has begun, indicating that its proposed inclusion in the next economic plan has been approved.

China's scientists have also followed the progress of the Soviet nuclear program.[33] Reportedly, the Soviets have offered to sell a plant to China at 20% below the cost of a Western plant as part of a $20 billion, 5 year trade agreement.[34]

China's technology policy choices are, of course, conditioned by its weapons program fuel cycle development, and by its reserves of natural uranium. These factors make China quite distinct from other developing countries seeking to initiate a nuclear power program. Although China has not revealed a great amount of information about most aspects of its fuel cycle, a review of what we do know is in order.

In terms of known uranium reserves, Chinese spokesmen have indicated that in addition to satisfying military requirements, it has sufficient reserves to fuel 15,000 MW of installed capacity for 30 years (or roughly, the current expected life of a nuclear plant).[35] Prospecting for additional uranium reserves continues, and recently China entered into an agreement with the Japanese Power Reactor and Nuclear Fuel Corporation (PNC) for joint exploration activities in Yunnan province.[36] China's thorium reserves are also thought to be relatively abundant.

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[32] Pan Xiren and Zhao Jiarui. "The Main Design Features of 300MW PWR Power Stations." *Hedongli Gongchang*. 4 #4. 1983. In JPRS-CEA-84-040. 76-86.

[33] See, Dong Yin and Yang Shuiquan. "Development of Boiling Water Graphite Moderated Reactor in the U.S.S.R." *Hedongli Gongcheng*. 4 #4 1983. 72-79.

[34] *Nuclear News*. December 1983. 82; July 1984. 113.

[35] Jiang. "Developing . . . ."

[36] XINHUA. May 19, 1984. In FBIS May 21, 1984. dl.

China's weapons program required enrichment facilities, and the enrichment plant outside of Lanzhou continues to be the main facility for this work. China's enrichment capacity is uncertain; it is quite conceivable that it would not be sufficient to supply both the civilian and military sectors, should China decide to expand its weapons program.[37]

In terms of fuel fabrication, China again has experience on its side, although the production of power reactor fuels on a large scale is a more difficult technical problem than fuel fabrication for plutonium production and research reactors. The Chinese seem to be aware of this. According to Vice Premier Li Peng, there is a need to develop ". . . new technology in the production of nuclear fuel."[38]

China also has reprocessing capabilities, and for the moment, leaders in the nuclear industry subscribe to the logic of reprocessing for the sake of plutonium recovery for light water recycling, and for use in breeders. In an article strongly supporting reprocessing, Jiang Shengjie and Huang Qitao (Chief Engineer of the China Nuclear Energy Industry Company), not only argue for the desirability of recovering plutonium, but also support reprocessing in the interests of waste management and the recovery of transuranic elements and other rare elements and gases. In the words of the authors, "China mastered military-purpose spent fuel treatment techniques long ago, and has carried out a great deal of scientific research concerning the treatment of fuels from pressurized-water reactors."[39]

The prospects for waste disposal in China are of particular interest because of China's geographical characteristics, past history of dealing with wastes, and its political system. The Gobi desert has been mentioned as an especially suitable site for waste disposal because of its aridity and geological stability. These characteristics have not gone unnoticed by foreign nuclear interests.

Reportedly, a letter of intent for cooperation in the storage of wastes has been signed by the China Nuclear Energy Industry Corporation, and a consortium of three German firms (Nukem, Transnuclear, Alfred Hempel). The preliminary agreement calls for the storage of about 4,000 tons of waste. The Germans would pay $1,500 per kilogram for the service, which would mean about $5.45 billion in foreign exchange earnings for China for the amount of material being discussed.[40] In addition, waste disposal services in China would be of considerable interest to the Japanese.

SAFETY AND NUCLEAR OPPOSITION

The question of using Chinese territory for waste disposal has reportedly been questioned by some Chinese scientists. However, there is as yet no evidence of widespread opposition to nuclear power within the scientific community, or elsewhere. As we have

[37] See, Octave J. DuTemple. "China Prepares for Civilian Nuclear Power." *Nuclear news.*" 23 #15. December 1980. 53.
[38] "The Development."
[39] Jiang Shengjie and Huang Qitao. "A Talk on the Processing of Spent Fuels from Nuclear Power Plants." *Renmin Ribao.* April 18, 1984. In JPRS CEA-84-040. 70-73.
[40] Paul Lewis. "China Bids to Store Radioactive Waste." N.Y. Times. February 8, 1983. D1,D4.

seen, although concern for nuclear safety was expressed at the time of the Three Mile Island accident, the lesson now being drawn from TMI is that the technology is safe; the safety systems did in fact prevent a serious environmental insult.

One reason why there is not more of a nuclear opposition could be that China's existing record of nuclear safety is such that the nuclear industry enjoys the confidence of the technical community. There is unfortunately little good evidence to either support or disconfirm this hypothesis. There are some reports which, while generally supportive of China's safety record, do nevertheless point to the need for improvement. This is particularly so in the area of workplace radiation exposure.[41] Reports of serious accidents are rare, but one noted a serious pipe burst in 1969 in which at least 20 workers were exposed to high levels of radiation.[42]

A more compelling explanation for the absence of a visible nuclear opposition would focus on the military history of the program. Much of the information on the program has been secret, yet its high priority, and its achievements, have also given the nuclear community prestige, and one suspects, political influence. With these would come immunity from criticism from the non-nuclear intellectual elite. In addition, it is only recently that scientists have been urged to render technical judgments on public policy issues involving technology.

The growth of a nuclear program of the size envisioned by the Chinese is likely to stimulate considerably more discussion in the future. Expressed reservations about nuclear power are likely to come first from the technical community and from central government officials whose fortunes would be better served by alternative technologies. The prospects for an active nuclear opposition, however, probably turn on the attitudes of local officials, who, at the moment, appear to be supporters of nuclear power for their areas.

NUCLEAR FINANCE

The anomalous nature of the Chinese program also extends to the area of finances. In many countries, financial considerations more than any other have worked against nuclear development in recent years. That China will escape financial difficulties in its program is by no means clear. It seeks to launch the program at a time when investment in energy projects over the next 15 years is targeted to equal that of the previous 30 years. Yet, because of the country's needs, competition for funds for energy investments will be great.[43] Among the factors influencing Chinese thinking about nuclear finance are the following.

First, China has the capacity, and indeed has the intention, to do much of the non-nuclear manufacturing and construction work for nuclear power plants itself. The nuclear part of a large power

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[41] Zhang Yongxiang. "Radiation Protection Assessment of the Past 20 Years of Operation of the First Heavy Water Reactor in China." *Fushe Fanghu (Radiation Protection)* #5 September 1983. In JPRS-CST-84-016. 6-20.

[42] Mark Baker. "Peking Admits Accident at Atomic City." The Financial Times. December 9, 1983.

[43] Beijing Review. July 30, 1984. 30.

plant, typically, is only about 15–20% of the total cost.[44] This fact should temper the exaggerated expectations for Western nuclear exports which have run as high as $20 billion. A more realistic figure, when Chinese provision of site preparation, engineering and construction services are assumed, would be in the order of $4 billion.[45]

As a result of this domestic supply, China will also escape the worst consequences of high interest rates which have plagued the nuclear industry internationally. On those components and technology that I must import, China can dip into its comfortable reserve of foreign exchange, and/or seek financing at the concessionary rates proffered by foreign suppliers.

The financing of China's nuclear program must also be considered in relation to its export position and desire for foreign exchange. The Guangdong plant, for instance, is to sell 75% of its power to Hong Kong, and thus be self-financing in foreign exchange terms.[46] The Qinshan, and follow on plants in the Huadong region are to serve the heart of China's export economy, which is now severely under-powered. In addition, as a producer of exportable fossil fuels which are in greater demand internationally than uranium, the savings in petroleum and coal not consumed in China are seen by some as enhancing China's fossil fuel export capacity. Although the Chinese have indicated an interest in selling uranium internationally,[47] under current market conditions, substituting nuclear power for fossil fuels domestically is seen as a substitution of non-exportable electricity for exportable energy.

CONCLUSION

The Chinese decision to move forward with a nuclear power program raises a number of issues of international importance. As the discussion above indicates, China is something of an anomaly in the international nuclear community. It is an underdeveloped country, but is also a nuclear wespons state with an established history of technological self-reliance. While not all foreign observers share the optimism expressed by members of the Chinese nuclear community that the expertise developed in the weapons program can be readily redeployed to a major power reactor program, China is clearly a country that is not without capabilities in nuclear technology.

China has indicated that it is prepared, if necessary, to develop its nuclear power plant technology on its own. However, as with other areas of industrial technology where China has decided to pursue a new "open door" policy, it intends to do so in the nuclear area as well. The justification for this is to be found in the quotation from Li Peng above. That is, China wishes to learn foreign technology in order to speed the development of large reactors, to

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[44] Warren H. Donnelly. "Nuclear Energy: Congressional Consideration of the Proposed Agreement for U.S. Cooperation with China." Washington. Congressional Research Service. Issue Brief # IB84102. June 21, 1984. 3.

[45] Ibid.

[46] For more detailed discussions of the financial arrangements for the Guangdong plant, see, *Far Eastern Economic Review*. July 5, 1984. 47-48; and Asian Wall Street Journal. November 21, 1983.

[47] Geddes. *op. cit.* 247–249.

develop its program as economically as possible, and to employ the latest electronic control technology. In addition, China's goal of having 10,000 MWe installed capacity by 2000 will be difficult to reach in the best of circumstances; it is virtually unreachable without foreign technology.

China has therefore expanded its foreign nuclear contacts. It has entered into intergovernmental nuclear cooperation agreements with France, the U.K., West Germany, Brazil, Italy,[48] Belgium, Argentina, and most recently with Japan and the United States. It has, of course, also developed relations with private companies in these countries, and has begun to procure goods and services from them.[49] It has also entered into cooperative agreements with foreign professional societies, the most notable being the agreement between the CNS and the American Nuclear Society. Finally, in January, 1984, China joined the International Atomic Energy Agency.

In doing so, China has subscribed to the principle that its own nuclear exports would be subject to IAEA safeguards. Whether it has subscribed, or soon will subscribe to the principles of the London suppliers group forbidding the export of sensitive technology is not known. However, to date, it has not secured the full confidence of the backers of the international nonproliferation regime. China refuses to sign the NPT, and China's reliability as a supporter of non-proliferation objectives has been questioned because of persistent rumors that China has supplied information to Pakistan that would be useful for designing nuclear weapons, that it has been a party to the supply of enriched uranium to South Africa, and that it has sold heavy water to Argentina. Although China denies these rumors, and has asserted its support of non-proliferation objectives, supporters of a strengthened nonproliferation regime remain suspicious.

China thus poses a particularly complex problem for the multiple objectives of U.S. policy. As a nuclear weapons state, China takes the position that it should be exempt from the safeguards provisions that are applied to non-weapons state recipients of nuclear assistance.[50] As a developing country, it wishes to secure nuclear assistance. The U.S. would like to render such assistance for political and commerical reasons. However, in the face of proliferation issues and concerns that U.S. technology may be used in China's military programs (particularly for naval reactors), the stringent conditions set by U.S. law [51] have made the conclusion of a U.S.–PRC nuclear cooperation agreement difficult.

China's entry into the world of civilian nuclear power is symptomatic of its entry into the world's political and economic systems generally. A successfully modernizing China, active in the international economy, poses challenges and opportunities for the U.S. and its allies, and it also entails a degree of learning about the norms

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[48] Xinhua. August 16, 1984. In FBIS. August 16, 1984. jl; Xinhua. October 7, 1984. In FBIS. October 10, 1984. g7.

[49] See for instance report on the sale of monitoring equipment made by Krafwerk Union to the Nuclear Energy Industry Coproation. N.Y. Times. August 19, 1984. 5.

[50] However, China has agreed to IAEA safeguard provisions in its recent agreements with Brazil, Argentina, and Japan.

[51] For a discussion of these legal requirements, see Donnelly. *op. cit.*

of international regimes on the part of the Chinese. In the nuclear field, China is clearly emerging as an important force in the world nuclear industry—not only as a market for the products of that industry, but also as a potential supplier of nuclear technology. Its possible future role in spent fuel storage and waste disposal, however uncertain at this writing, is nevertheless intriguing. Increasingly, China's interests will have to be factored into international nuclear deliberations. The challenge to the U.S. as it considers the initiation of nuclear cooperation with the PRC is to insure that China's emerging role in nuclear affairs is one of a responsible supporter of non-proliferation norms and of safe nuclear operations.

CHINA'S ELECTRIC POWER INDUSTRY

By Jim Lewek*

CONTENTS

SUMMARY

China's electric power industry has developed considerably in recent years, but a prolonged slowdown in capacity growth now frustrates efforts to meet sharply rising industrial and residential demand for electricity. The slow capacity growth stems from investment cutbacks undertaken under readjustment policies begun in 1979, and the reduced funds being thinly spread over an overextended capital front. China has improved its utilization of existing capacity to minimize the adverse effects of power shortages, and conservation efforts have substantially reduced wasteful consumption of electricity. These factors have allowed China's economy to grow faster than its power supply over the last five years, a remarkable reversal of its historical record. Even so, continuing slow

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capacity growth through the mid-1980s is likely to pull light and heavy industry growth down from their present double-digit rates.

Qualitative improvements in the generation and transmission of electric power in China will in the 1980s mitigate the problems created by the disparity in growth rates between power and industry. In particular, improvements in the electric power grids will use existing capacity more efficiently, and will facilitate the development of power sources not previously considered economical: better grids will allow China to tap remote but substantial hydropower potential, and to build large power plants out near coal mines rather than adding to already serious coal transport and urban pollution problems. Immediate pressures for accelerating power supply growth may compel planners to promote thermal plant construction at the expense of hydro construction.

China's greatest obstacle to building adequate power supplies for the 1990s and beyond will be financial, not technical. Despite energy's priority thus far in China's post-Mao development efforts, financing for electric power is not growing fast enough. While plans through the year 2000 call for only doubling oil and coal production to meet the needs of a quadrupled economy, the present plans for the turn of the century call for a quadrupling of electric power generation. This target is admittedly optimistic, but given present growth trends in industry and the shortfalls already encountered, China's power supplies should be expanding much more rapidly than they do now. China's success in meeting its electric power needs will depend on its success in three different areas of financing: international financing at concessionary rates for coal, hydro, and nuclear projects; local government and industry funding of new power plant construction; and peasant financing and construction of small hydro stations to provide rural power supplies.

CURRENT POWER RESOURCES

China at present ranks eighth in the world in electric power generating capacity, and sixth in production of electricity (see Tables 1 and 2). China has 76,000 megawatts (MW) of generating capacity. This includes 52,000 MW of thermal plants which are mostly coal fired; some oil-fired capacity still exists, but much is planned for conversion back to use with coal. A very small fraction of thermal plants in China are fueled by natural gas. Of China's 24,000 MW of hydropower capacity, about two-thirds comes from larger projects and dams; small hydrostations, usually locally operated and occasionally privately owned, make up the remainder. China at present has no commercial nuclear power plants.

TABLES 1 AND 2.—ELECTRIC POWER PRODUCTION AND CAPACITY 1982

Country	Electricity output (billion kilowatthours)	Country	Electric power capacity (megawatts)
United States	2,386.69	United States	634.81
U.S.S.R	1,366.00	U.S.S.R	276.72
Japan	579.00	Japan	143.70
Canada	384.47	West Germany	84.86
West Germany	361.80	Canada	83.76
China	325.00	United Kingdom	71.70

TABLES 1 AND 2.—ELECTRIC POWER PRODUCTION AND CAPACITY 1982—Continued

Country	Electricity output (billion kilowatthours)	Country	Electric power capacity (megawatts)
United Kingdom	272.12	France	70.83
France	257.50	China	69.29
Italy	181.75	Italy	47.27
Poland	117.58	Poland	25.52

Electricity production from these plants is shown in Table 3. Thermal plants make up 68.5% of capacity but provide 75.4% of output, as hydro stations are subject to seasonal and other variations in water flow that preclude regular operation at full capacity. A sizable variation also exists between utilization rates of large and small hydropower plants. Large plants generally have sizable reservoirs to help offset seasonal variations.

TABLE 3.—SOURCE BREAKDOWN OF CHINA'S POWER CAPACITY AND OUTPUT, 1983

	Capacity (megawatts)	Share	Output (billion kilowatthours)	Share
Thermal	52,475	68.47	265.04	75.42
Hydro	24,165	31.53	86.36	24.58
Total	76,640		351.40	

SLOW POWER CAPACITY GROWTH IN THE 1980'S

Table 4 shows the disparity in China in the 1980s between growth in industry and growth in power generation capacity. It also shows that China has increased electricity output faster than capacity growth. China has been able to improve the utilization of its hydroplants considerably in order to minimize the power constraint. Thermal plants, however, have had their operations constrained by the increasing inability of the rail systems to handle the massive shipments of coal required to fuel them.

TABLE 4.—GROWTH RATES IN SELECTED INDUSTRIAL ITEMS

	Light industry	Heavy industry	Electricity production	Generating capacity
1976	2.4	0.6	3.7	8.6
1977	14.3	14.3	10.0	9.1
1978	10.8	15.6	14.8	11.0
1979	9.6	7.7	9.9	10.3
1980	18.4	1.5	6.6	4.6
1981	14.1	−4.7	2.9	5.2
1982	5.7	9.8	6.0	4.4
1983	8.4	12.1	7.2	5.4
1984 January to May	11.6	11.8	7.5	[1] 4.2

[1] Estimated.

The slow growth in electric power capacity now hitting China stems from investment cutbacks during the readjustment policies begun in 1979-1980. The aim of readjustment policies was to reduce overall capital construction in order to increase consumption and living standards, and to shift the emphasis of development away from heavy industry and more into light industry and consumer goods sectors. Although energy and transport were designated as key sectors and roughly maintained their overall shares of investment, their investment allocations fell in 1981 with investment in other industries.

In electric power, two factors combined to create a serious slowdown in capacity growth. First, like many other heavy industries, electric power had embarked upon an extensive capital construction program that had far too many projects underway, considering the construction resources available. Even without a cutback in funding, capacity additions were slowing as an increasing number of construction projects competed for funds and materials. Second, the cutbacks in electric power hit power plant construction particularly hard (Table 5). Investment in electric power transmission systems actually increased in 1981, so the cutback in power funds fell entirely on an already overextended power plant construction effort. Despite electric power's priority in China's development plans, funds for power plant construction fell by 24.3% compared to 18.42% for other energy investment, and 22.70% for non-energy industry.

TABLE 5.—INVESTMENT IN ELECTRIC POWER

[Billions of yuan]

	Investment in electric power	Investment in thermal plants	Investment in hydro plants	Investment in generation	Investment in distribution [1]
1975	2.87			2.29	(0.58)
1976	3.22			2.65	(0.57)
1977	3.31			2.70	(0.61)
1978	4.93			3.99	(0.94)
1979	4.78			3.75	(1.04)
1980	4.81	1.91	1.80	3.71	1.10
1981	4.01	1.46	1.35	2.80	1.21
1982	4.62	1.82	1.54	3.36	1.27
1983 [2]	5.4	NA	NA	NA	NA

[1] Figures in parentheses were not given by the Chinese, but distribution investment in these years is assumed to be the residual after subtracting investment in generation from total electric power investment, as is the case with Chinese-supplied figures from 1980-82.

[2] Plan amount.

Note.—Totals may differ due to rounding.

Plans to allocate the reduced flow of funds to priority projects were largely thwarted at the local level, whose interests were best served by maximizing the number of state construction projects under their jurisdiction. Power industry investment funds were spread more thinly than intended. The results are evident in Table 6. Capacity additions to China's electric power industry in the 1980s, even in 1983, fall well below additions in the late 1970s in absolute as well as percentage terms. Capacity growth in the 1980s has averaged only 4.8% annually, compared to 11.4% annual growth for the 1970s.

TABLE 6.—ADDITIONS TO ELECTRIC POWER CAPACITY

	New capacity online (megawatts)	Growth of capacity (percent)	Total capacity end-of-year (megawatts)
1971	2,512	10.6	26,282
1972	3,219	12.2	29,501
1973	4,424	15.0	33,925
1974	4,183	12.3	38,108
1975	5,298	13.9	43,406
1976	3,741	8.6	47,147
1977	4,303	9.1	51,451
1978	5,672	11.0	57,122
1979	5,894	10.3	63,016
1980	2,854	4.5	65,870
1981	3,420	5.2	69,290
1982	3,070	4.4	72,360
1983	4,281	5.4	76,640
1984	[1] 3,200	4.2	79,540

[1] Estimated.

FAST GROWTH IN POWER DEMAND

Changes in economic policy in the post-Mao era caused overall demand for electric power to grow unexpectedly fast in 1982–83. Readjustment policies put into place after 1978 strove to de-emphasize the role of heavy industry in China's development strategy. Planners felt too much of heavy industry's output was either surplus or obsolete, while the country's needs for light industrial output, especially consumer goods, went unfilled. From 1978 to 1980, annual growth in heavy industry slowed from 15.6 percent annually down to 1.5 percent, and in 1981 heavy industrial output actually declined 4.7 percent. At the same time, the new emphasis on developing light industry, combined with reform efforts that spurred production by collective enterprise, created a new set of power consumers who suddenly had easier access to electricity.

In terms of shifting China's heavy industrial orientation, the readjustment policy was largely successful in 1980–1981. In these years, light industry grew 35 percent as heavy industry declined 3.3 percent. The cutbacks in heavy industry, however, severely depressed the flow of revenues from industry into the national budget. Successive large deficits in 1980 and 1981 led Beijing to re-emphasize the importance of heavy industry to China's economic well-being. In 1982 the new campaign to reaffirm the importance of heavy industry quickly restored output in that sector to previous levels, and in 1983 it continued to rise. Heavy industry grew 12.1 percent in 1983, more than triple the 3.9 percent target set by the annual economic plan. Light industry grew 8.4 percent in 1983, well above its target of 4.1 percent. Thus, in the mid-1980s, the electric power supply in China is being stretched to satisfy not only planned growth in light industry, but also unplanned and phenomenal growth in heavy industry, its most voracious consumer. The Chinese estimate that heavy industry on average uses six times as much electricity as light industry does to produce output of equivalent value. The *excess* of heavy industry above its targeted output in 1983 may have consumed power equal to about half the electricity consumed by *all* of light industry.

SUPPLY PROSPECTS FOR THE SHORT RUN

In the short run, China must rely on efficiency measures to accelerate the growth of electric power supplies. Capacity additions through 1986-1987 are already largely determined by present levels of investment and construction. Table 7 shows estimated additions to capacity through 1987. Additions in 1988 and beyond will be determined by funding levels and the pace of construction in 1984 and 1985. Thermal plants not yet under construction but begun this year and next could easily be completed by 1988. Using the estimates in Table 7 provides an estimate of 5.9% capacity growth in 1984-1987.

TABLE 7.—ADDITIONS TO GENERATING CAPACITY

[Megawatts]

Fifth year plan		Sixth 5-year plan		Seventh 5-year plan	
1976	3,741	1981	3,420	1986	6,160
1977	4,303	1982	3,070	1987	6,600
1978	5,672	1983	4,280		
1979	5,894	1984	3,600		
1980	2,845	1985	3,675		
Total	22,464		18,046		

Prospects for increased efficiency in exploiting existing capacity are mnixed. On one hand thermal plant utilization rates have fallen since 1978 (Table 8), primarily because of problems in rail shipments of coal to thermal plants. Thus far, in 1984, the Chinese have reported significant improvements in rail shipping of coal, and claim this is the leading reason for electric power generation's 7.2% growth in 1984, following capacity additions of only 5.9% in 1983. It is too soon to tell whether these supply improvements are permanent, but simply by re-achieving 1978 thermal plant utilization rates, China could increase thermal power production by as much as 17% this year, and overall power production by up to 13%.

TABLE 8.—UTILIZATION RATES OF THERMAL PLANT CAPACITY

Year	Thermal capacity [1] (megawatts)	Thermal power output (billion kilowatts)	Average hours/year of thermal plant capacity
1976	29,978	157.5	5,254
1977	32,492	175.8	5,411
1978	35,686	212.0	5,941
1979	39,845	231.9	5,820
1980	43,906	242.4	5,521
1981	45,360	243.8	5,375
1982	47,400	253.3	5,343
1983	49,400	265.0	5,364

[1] Previous year's end-of-year capacity.

Hydropower, on the other hand, poses a mild threat to China's abilities to maintain power growth greater than capacity growth (Tables 9 and 10). Large hydro plants in recent years have been pushed to their limit in raising hydroelectricity generation to offset slow growth in thermal production. Favorable rainfall patterns over the last three years have helped maintain reservoir levels while generating additional power. Utilization rates for large hydroprojects grew 14% in 1983 alone. Drought, or even several years of mediocre rainfall, could cut into or even obliterate this one-year improvement.

TABLE 9.—UTILIZATION RATE OF HYDROELECTRIC CAPACITY

Year	Capacity [1] (megawatts)	Hydro output (billion kilowatt-hours)	Average hours/year of operation of hydro capacity
1976	13,428	45.6	3,396
1977	14,655	47.6	3,248
1978	15,765	44.6	2,829
1979	17,277	50.1	2,900
1980	19,110	58.2	3,046
1981	20,510	65.6	3,198
1982	21,890	74.4	3,399
1983	22,960	86.4	3,763

[1] End-of-year capacity from previous year.

TABLE 10

Year	Large- and medium-sized hydroprojects			Small hydrostations		
	Output (BKWH)	Capacity (MW)	Hours/years in operation	Output	Capacity	Hours/years in operation
1982	58.1	14,250	4,077	16.3	7,640	2,134
1983	69.2	14,880	4,651	17.2	8,080	2,129
Percent change	+19.1	+4.4	+14.1	+5.5	+5.8	−0.2

LONG-RUN IMPROVEMENTS IN THE POWER SUPPLY

China in 1982 restored the earlier cuts in electric power investment, and increased funding even further in 1983 and apparently in 1984 as well. Over the same period, planners have revealed more detailed plans for grid improvements and capacity growth, for hydro and thermal power plant development strategies, for changes in the role of small hydrostations, and most importantly for new methods of financing power plant construction.

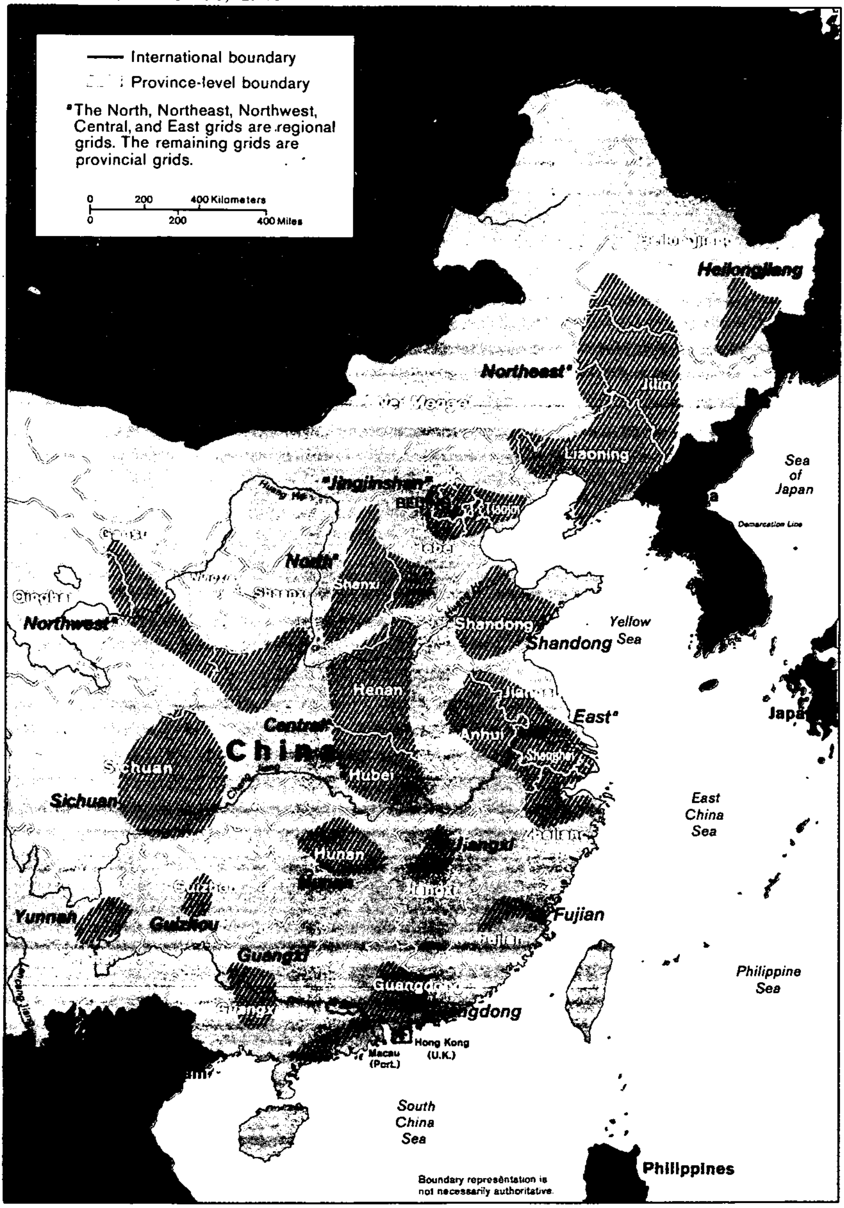
ELECTRIC POWER GRIDS

Recent Grid Developments.—China's developing power networks are fundamental to China's development and expansion of dependable power supplies for industry. Better grids and linkages will allow for tapping remote hydro sites and efficient utilization of mine-mouth thermal plants, two critical components of China's planned capacity additions. Grid upgrades reduce line losses, and better linkages among grids allow for more power sharing and thus tend to reduce capacities needed to meet peak load demand.

Map 1 shows China's power grids as they existed in 1979, with five major regional grids and seven large provincial grids. The highest voltage power line was 330-kilovolts (kv), found only in the northwest grid. Most grids had 220-kv trunk lines. These grids supplied 70 percent of China's electricity.

Since 1979, China has constructed over 20,000 kilometers of transmission lines of 110-kv and above. The Sichuan and Guizhou grids have been linked to form China's sixth regional grid, the Southwest grid, which will also include Yunnan Province. Hunan has been linked to the central grid, where China's first 500-kv lines went into operation to supply Wuhan with electricity from the partially complete Gezhouba hydropower plant. Other 500-kv lines, using domestically-manufactured equipment, are now in operation in the north and northeast grids, supplying costal cities with power from mine-mouth thermal plants. China's grids now supply three-fourths of all of its electricity.

Map 1
Electric Power Grids, 1979



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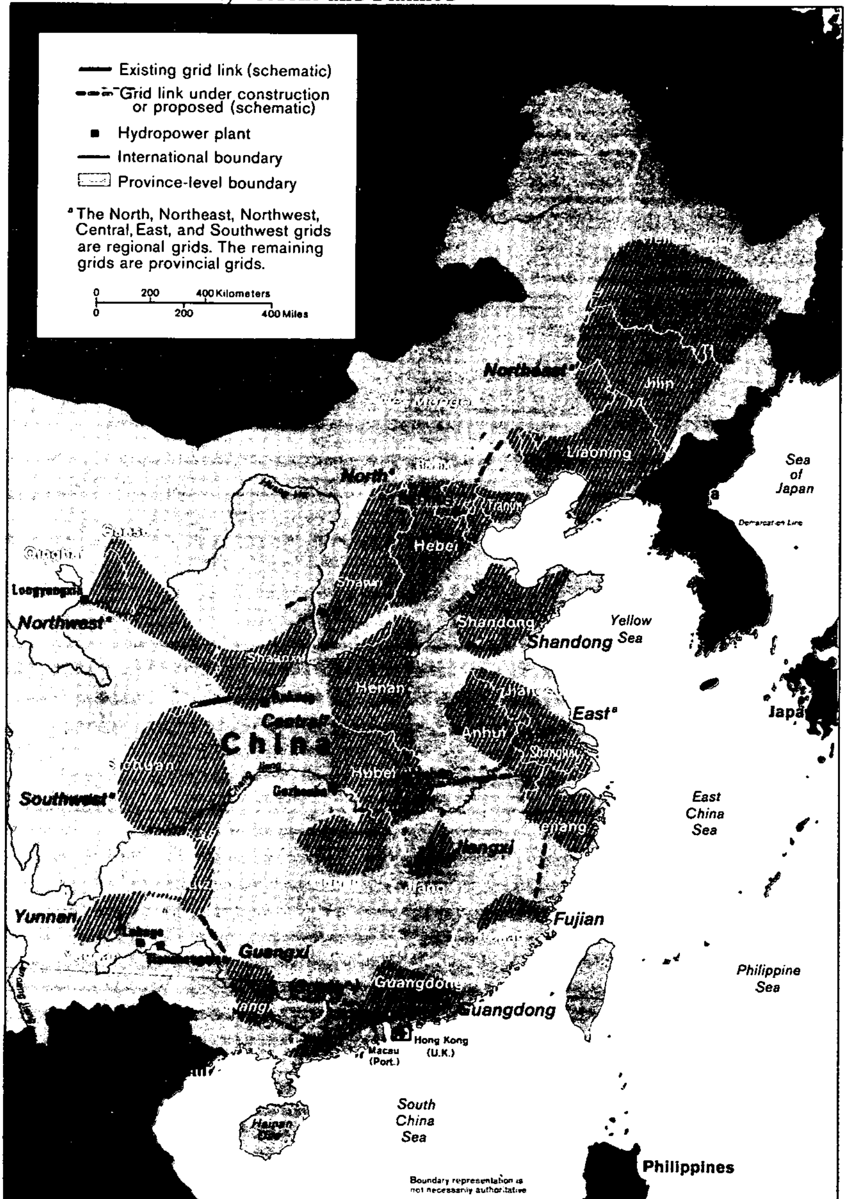
China's Grid Plans.—China's known plans for power grids during the Sixth Five Year Plan are virtually complete. All that remains is to link the Guangxi and Guangdong grids by 1985, to form China's seventh regional grid (the South Grid). Jiangxi Province will probably be linked to the central grid by 1985. Work is continuing, apparently on schedule, for completing the full lengths of 500-kv lines in the north and northeast that are listed as key construction projects.

Plans for the Seventh Five Year Plan are more ambitious. China hopes to distribute its power supplies a little more evenly by increasing its capability to transmit power eastward. The central grid is to be linked to the east grid; the northwest grid will be linked to the north grid and in turn the northeast; and the south and southwest grids will be tied together. 2700 kilometers of 500-kv powerlines are planned, with a total of twelve such lines either completed or under construction by 1990. Furthermore, China hopes to build its first direct-current power line, using imported equipment. Map 2 shows how China's grid plans for the remainder of the 1980s provides the basis of a national grid network.

Map 2
Electric Power Grids, Present and Planned



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Central-East.—The main objective in linking these grids is to allow Shanghai and the East grid to tap into hydroelectricity from Gezhouba as it becomes available. At present, 965 MW of Gezhouba's 2715 planned capacity are operational, with the remaining 1750 MW scheduled for completion after 1986. The first set of 500-kv lines will be direct current powerlines using largely imported equipment.

Northwest-North-Northeast.—Grid officials in Northwest China make the unique claim of enjoying a capacity surplus of 1000 MW during the high-water season, and expect to have an additional 2000 MW of capacity on line in 1989–1990 with the completion of hydroprojects at Longyangxia and Ankang. The grid links are designed to allow the Beijing-Tianjin area to tap this surplus and, at the same time, create load-sharing opportunities between the North and Northeast, areas with considerable power demands from heavy industry.

South-Southwest.—Although the southwest possesses immense hydropower potential, its poor grid structure and inadequate existing capacity have produced some of China's worst shortage conditions. Linking with the south grid will provide load-sharing opportunities and enable both regions to tap into the Tianshengqiao and Lubuge projects, now under construction and expected to provide almost 2000 MW of capacity by the early 1990s. Guangdong claims it will need power from these dams even if a nuclear plant is built there: although nominally China will receive three-fourths of the plant's electricity, it will sell more than half its share to Hong Kong to repay loans that will finance the plant's construction.

Grids as the Key.—China's Ministry of Water Resources and Electric Power has maintained steady growth in its investments in transmission equipment even through the cutbacks of the readjustment, and grid construction has proceeded in a timely fashion through the 1980s. The Chinese seem to have already mastered the technical problems associated with high-voltage lines that will lay the foundation for China's evolving national grid. These grid improvements are something of a sine qua non in China's power capacity expansion plans, in that China's plans for thermal and hydroplant expansion for the rest of the century would be impossible or useless without them.

CAPACITY GROWTH

As in other industries, China's modernization plans for the electric power sector through the end of the century call for moderate growth in the 1980s and more rapid growth in the 1990s. Additions to capacity are expected to grow at a 6.75% annual rate by 1990, rising to 9.6% by the year 2000. If attained, these growth rates will provide the Chinese with about four times their 1980 capacity by the year 2000. Table 11 gives a detailed breakdown of China's plans for capacity growth and additions to thermal and hydro capacity.

TABLE 11.—PLANNED CAPACITY GROWTH

[Thousands of megawatts]

	1983	1990	2000
Total capacity on-line	76	100–120	240–260
Thermal capacity	52	76–86	177–197
Share of capacity (percent)	68	69–72	74–76
Hydro capacity	24	34	63
Share (percent)	32	28–31	24–26
Large- and medium-size hydroprojects	15.5	22	45
Share (percent)	20	18–20	17–19
Small hydrostations	8.5	12	18
Share (percent)	11	10–11	7–8

Targets for the year 2000 appear overblown, but China can probably achieve its 1990 goal for overall electric power capacity of 110,000 to 120,000 MW. The most likely problem is construction delays in planned additions to hydropower capacity. If slowdowns become obvious, China could expand or accelerate thermal plant production as late as 1987 and still reasonably expect to achieve the lower 1990 target (110,000 MW) for overall capacity, with a smaller share in hydropower.

PLANS FOR THERMAL POWERPLANTS

China's plans for thermal power for 1984–1990 call for capacity additions of 24,000 to 34,000 MW. Despite increased priority given to long-run development of hydropower, thermal plants' share of overall capacity by 1990 will rise from 68% to 72%. In carrying out this expansion, the Chinese are pursuing several measures that may reduce many of the difficulties presently associated with China's thermal power plant generation.

Larger Generators.—China claims that a fourth of its coal-fired capacity consists of small boilers and generators of 50 MW or less, with an average of 12 MW. These small, inefficient facilities reportedly consume almost half of the coal delivered to the electric power industry. Most of China's planned additions to thermal capacity through the 1980s consist of generators in the 100- to 300-MW range. Given current known construction, electric power generators of 200 MW and above installed in the 1980s will double their share of China's overall electric power capacity.

Because of the greater efficiency of the new large generators, China's planned increase of 54% in coal-fired capacity by 1990 may increase the power industry's coal consumption by only 40%. If the 12,000 MW of small coal-fired plants also were replaced megawatt-for megawatt with larger, more efficient units, the 54% planned capacity growth would require only 13% more coal than the electric power industry now uses.

Mine-Mouth Plants.—The grid developments outlined above are making the construction and utilization of mine-mouth plants increasingly practical in China. By building large power plants near coal mines and running powerlines to the cities, China can reduce the need to haul coal to smaller urban plants where pollution problems are already a serious consideration. Existing mine-mouth plants account for about 7000 MW , or 13 percent of thermal capacity and 10 percent of overall capacity. Over the course of the 1980s, however, the total capacity of mine-mouth plants is likely to quintuple. For the 1984–1986 period, over half of expected thermal power plant capacity additions—5650 of 9930 MW—will be mine-mouth power plants.

The development of mine-mouth capacity carries a number of implications for industry beyond the electric power sector. Several influences are already at work on the coal industry, for example. First, a major push is on to allow small mines to group together to market coal to these power plants. Second, Vice Premier Li Peng has advocated the use of low quality coal and coal tailings (gangue coal) to power some mine-mouth capacity, and allow rail shipment of only higher-quality coal. Similarly, the railroads are likely to see growth in rail shipments of coal taper off as more power is produced at the mine-mouth plants.

PLANS FOR HYDROPOWER PLANTS

China has the world's largest supply of hydropower potential, but has harnessed barely 4% of the power available. Most hydro resources are in the southwest, and have been too remote from industrial consumers to be of value. With grid linkages now planned or under construction that will tie grids from southwest to northeast, efforts to exploit these hydro resources will increase.

China has publicized two sets of long-range development plans for hydroelectric power, one open-ended and one outlining capacity additions through the turn of the century:

Overall exploitation.—China has 680,000 MW of hydro potential, of which 370,000 MW are considered exploitable. China's plans for exploitation for the indeterminate future include 172,000 MW of this total situated in ten major hydropower bases (Table 12). Almost two-thirds of the targeted hydropotential are located in the southwest.

Development to the Year 2000.—Present plans for scheduled hydropower capacity growth call for additions of 10,000 MW of hydropower capacity by 1990, and another 29,000 MW in the 1990s.

TABLE 12.—HYDROPOWER DEVELOPMENT REGIONS

Area	Number of plants	MW capacity	Grid link
Upper Huang He	NA	13,000	Northwest.
Hongshui	NA	11,000	Southwest.
Upper Yangtse	4	30,000	Central.
Jinshajiang	8	50,000	Southwest.
Yalongjiang	12	19,000	Do.
Dadu He	11	19,000	Do.
Wujiang	9	5,000	Do.
Lancanjiang	4	6,000	Do.
West Hunan	30	5,000	Central.
East coast (Fujian, Zhejiang, Jiangxi)	80	10,000	East.

China's efforts to exploit its potential hydropower are likely to take longer, cost more, and deliver less than planned. Past efforts in hydropower, especially in the 1970s, suffered repeated engineering and construction bottlenecks that forced the Chinese to constantly reevaluate plans and change priorities for funding and resources. Four of eight major projects whose funding began in the mid-to-late 1970s were shelved for two years or more; two have yet to begin construction. The Chinese have been quite candid about their past problems in hydropower construction, and have described several policy changes in planning and constructing hydroprojects that they hope will improve their construction efficiency. If they proceed with their hydropower expansion as planned, the Chinese will have to manage a much larger effort in a dramatically improved fashion.

Capacity growth planned for hydropower might even be deliberately postponed. Although the Chinese now realize that many of the supposed cost advantages of thermal plants vis-a-vis hydro are negated once additional coal mining and transport costs are factored in, thermal plants are inarguably faster to construct than hydroprojects. A 600-MW thermal plant is often built in China within three years, while a similar-size hydroproject can take a decade or more. China's plans for increased utilization of hydropower may continually recede as the rapid growth of power demands in China's economy forces planners to adjust investments to maximize capacity growth in the short-run, i.e., give priority to thermal plants under construction.

Still other problems may threaten hydroelectric output itself, regardless of capacity completions. Chronic shortfalls of water flow in 1965–1981 kept hydropower output 10% below expectations for China's 46 large and medium hydroprojects. As mentioned earlier, rainfall in basins where China has developed hydroelectric generation has been quite favorable the last three years, and is subject to change.

Silting is also a major problem, reducing the water storage capacity of reservoirs behind many of China's major dams and cuting into their ability to generate electricity in dry seasons. Chinese power officials estimate that silting has already taken up 10 billion cubic meters of volume out of the 37 billion cubic meters of capacity built into China's 11 largest reserviors. Reservoirs are now apparently nearly useless at Yanguoxia, Qingtongxia, and Yilihe; these projects are largely restricted to generating power from existing water flow.

SMALL HYDROSTATIONS

One of the most important changes in China's development strategies for the electric power industry has been its redefinition of the role of small hydropower stations.

History.—Small hydrostations have a capacity of 12 MW or less (often only 1–2 MW), and typically furnish about enough power to run a large factory or to supply lighting for a small town. China's small hydro efforts began in the 1950s as a means of providing communes in remote areas with token amounts of electric power for lighting and irrigation. Small hydroprojects had to complete with larger hydroprojects for state funds. From 1949–1966, China focused its hydropower construction efforts on large projects within transmission range of major industrial areas. Over this period, while large- and medium-sized hydropower plants grew from 160 MW to perhaps 4,000 MW, small hydro capacity reached only 380 MW, accounting for less than 10 percent of total hydro capacity.

After 1966, investment priorities shifted. The self-reliance ideology of the Cultural Revolution emphasized local, small-scale production of many heavy industry items, including electric power. the emphasis in hydropower turned to medium- and small-scale installations, supplying local needs. Even after the Cultural Revolution, small hydro stations continued to enjoy funding priority and were cast as acceptable participants in provincial grids. Small hydro capacity increased by a third (from 5250 to 7750 MW) between 1979 and 1981 alone, and accounted for about one-third of total hydro capacity. Localities were guaranteed by the state that grids would purchase surplus power from their small hydrostations. As a result, more than one-third of these stations linked up with local or provincial grids.

What began as a supplemental source of power became a net burden to China's larger power grids. First, variation in power quality and supply from small hydro stations added immensely to grid operating problems. Secondly, most small hydrofacilities were built in areas where larger hydroprojects were also constructed, so these areas already enjoyed relatively abundant electric power in high-water seasons and didn't need additional electricity from small hydro stations. The grids were required to buy power from small hydro operators, however, which often meant that the more efficient large generators lay idle at high water. The electricity purchased from small hydro cost more than the power available in draining reservoir excesses that had to flow through the larger dams whether power was generated or not. Thirdly, the demands for electric power in communities with small hydro over time increased to the point where they needed more than they could produce in the dry season. This became an added drain on grid electricity supplies.

Redefining the Role of Small Hydro.—By 1983, MWREP had redefined the role of small hydrostations, limiting them primarily to supplying rural users with off-grid, self-generated power. Some small hydro stations were removed from grids and placed under local control, and grids were partially relieved of their obligation to buy the surplus power of small hydrostations. In Sichuan province, which possesses one-fifth of China's small hydro capacity, the new policies only require grids to pay 20 percent of the normal price for the power supplied by small hydrostations if the power goes unused.

Planned Expansion.—Although small hydro will be shifted to more off-grid applications, it will still play an important role. China hopes to more than double small hydro capacity by the end of the century, from 8500 MW at present up to 18,000 MW. In encouraging local financing and operation of off-grid small hydro, Beijing is hoping to utilize rural savings rather than state funds to advance rural electrification. The development of rural and sideline industry is expected to allow collective and township enterprise to finance their own power needs, allowing the state to keep the major grids relatively unfettered and focused on large-scale state-owned industry.

China is now publicizing an experiment that they hope will dramatize the potential for small hydrostations and help elicit local investment in small hydroprojects. One hundred counties have been selected to take the lead in building small hydropower stations. These counties have an average population of 40,000 and are located mainly in the water-rich provinces of Sichuan, Guangdong, Zhejiang, Fujian, and Hunan. The goal of the program is to develop 30 to 40 MW of installed small hydro capacity in each county, providing an average of 200 kilowatt-hours of electricity per capita per year. This is judged sufficient to provide 90% of each county's peasants with adequate electricity for lighting and farming needs, while enabling 20% of the county population to use electric power for cooking.

No time limit has been announced for this project, but China hopes to add 4000 MW of small hydro capacity by 1990; the 3–4000 MW capacity additions represented by this project are probably expected on-line by the end of the decade, and would account for most of the planned capacity additions for the 1980s. It is probable, however, that the stated goals for small hydro are both typically conservative for this decade, and fail to take fully into account the potential for local financing of added capacity.

The main benefits of the redefinition of small hydropower lie in improved grid performance and reduced grid responsibilities for rural electrification. China's figures for the extent of rural electrification have in the past presented an unwarrantedly bright picture. Statements that electric power has now been supplied to 90% of China's production brigades mask the fact that many brigades actually have only a few light bulbs for a minority of their work teams.

Freeing the grids of the coming costs of developing extensive local distribution systems will in all likelihood hasten the construction of these systems even while transferring the burden to consumers. If the rural housing boom is any indication of the willingness of the peasantry to spend its savings, significant rural investments in electric power can be expected. In July 1984, even after several years of heavy expenditure on housing, rural savings deposits totalled 43.4 billion yuan, eight times as much as the entire 1983 state electric power budget. Rural demand for consumer goods like refrigerators, washing machines, and television should combine with profit incentives in rural industry to finance a considerable expansion of local power generation. In the meantime, self-financing of rural power supplies will free up state budgeted funds for power transmission, and allow planners to focus on high-voltage lines linking the provincial and regional grids, better serving large-scale industry.

FUNDING POWER SUPPLY EXPANSION

The electric power expansions described above will require far greater investment than China has been able to devote thus far to electric power. China has begun to replace investment grants with loans to increase the efficiency of state-budgeted investment, and has dramatically increased state investment in electric power in 1983 and 1984. China now is also seeking to exploit several non-budget sources of funds in promoting construction of additional electric power generating capacity.

National Budget.—State investment in electric power rose dramatically in 1983 and 1984. As shown in Table 5 (following page 4), investment fell from 4.8 billion yuan in 1979 to 4.0 billion yuan in 1980 and 4.6 billion yuan in 1982. China's investment of 5.4 billion yuan in electric power in 1983 was the greatest amount since 1978. The *Jingji Ribao* has indicated that investment in 1984 will total 6.4 billion. This represents a 33 percent increase in funding in just two years. China will have to maintain this kind of investment growth through the 1980s if it hopes to achieve 9 percent annual capacity growth in the 1990s.

Local Funding.—According to Qian Zhengying, Minister of Water Resources and Electric Power, the State began experimenting with mobilizing local funds for the development of the power industry in 1980, and the 1.6 billion yuan collected since then has gone toward construction of 24 power stations with a combined generating capacity of 9900 MW, including 5 already built, 12 under construction, and others to begin construction after financing details have been worked out with local authorities. Qian described three basic procedures for raising funds.

First, local factories can invest in a project and receive a share of both profits and power. The investment share apparently can be maintained indefinitely. Second, locals can invest in individual projects and be repaid with interest over time, sometimes enjoying a claim on a share of the electricity during the repayment period. Finally, locals can invest in new projects and have loans repaid once the projects are completed and in operation. This option does not offer a claim on a share of electric power and it probably designed to tap household and collective light industry savings.

Qian provided no details about individual projects financed to date by local funds, but the Shandong provincial service announced that the Longkou power plant went on-line in August of 1984, with an eventual total capacity of 600 MW, and that this was the first collectively financed power plant in China. The Huangxian Thermal Plant in Shandong is being jointly financed by MWREP and the local cooperatives, communes, and government. Local financing covered 108 million yuan of the 168 million yuan needed.

In Guangdong Province in 1985, 100 MW of capacity on the grid will be distributed among localities in proportion to their investments in electric power. Three billion yuan are to be issued in 10,000 yuan shares, with proceeds used to build or expand power plants in Shajiao, Shaoguan, Huangpu, Maoming, and Changtan. The East China Grid, which includes Shanghai, estimates that it needs 6000 MW of new capacity during the Seventh Five Year Plan, 2000 MW more than planned state-budgeted additions, and hopes to collect two billion yuan locally to finance the additional capacity.

Increased emphasis on local financing would almost certainly serve to increase the efficiency of electric power consumption in China, even as it opens up new sources of funds. Only the more profitable factories will be able to invest their resources to guarantee a power supply, so that increments to China's inadequate power supply will be more likely to go to those firms that can best utilize it. And, with a guaranteed but fixed supply of electric power, a factory will be more likely to minimize wasted electricity.

INTERNATIONAL FUNDING

China has become increasingly active in world financial markets in seeking concessionary financing for energy projects, including power plants and their sources of fuel. The search for low-interest financing includes efforts by both state and local governments in targeting international organizations, and foreign governments, vendors, and banks. This year the World Bank loaned China $145 million for equipment and expertise to construct the 600 MW Lubuge hydropower project; Bank funding for a second hydroproject is planned for later in the decade. China now competes with India and other third world countries for low interest IDA loans.

In negotiating international commercial loans and vendor credits for the Guangdong Power Plant, the Chinese sought a financial package that included both concessionary financing and guaranteed purchases by Hong Kong of enough of China's share of the electricity to repay Chinese loans. Beijing will likely seek low-interest loans or direct foreign investment for other state-funded nuclear plants begun in the Seventh Five-Year Plan, and is encouraging provinces to build their own nuclear plants if they can finance them without state funds.

The Japanese have to date provided the lion's share of concessionary financing in funding Chinese energy development. Japan's Eximbank lending to China is estimated at $8 billion through the 1980s, including loans at 7.5 percent for coal mine development and rail expansions. Although these credits basically support Chinese coal exports to Japan, many of the projects funded also will improve fuel supplies for China's thermal power plants. Tokyo has also agreed to loan China $51 million to finance the Tianshengqiao hydroelectric power project, as part of $300 million loaned by its Overseas Economic Cooperation Fund at 3.5 percent interest in support of a variety of infrastructive projects.

China can be expected to press for additional loans of this nature from international sources, but they will not be sufficient to meet all of China's needs. As the decade progresses China may decide to press hard for direct investment in China's electric power expansion, from both international and domestic sources. Some evidence supporting this view can be found in recent press reports of the involvement of the Everbright Corporation, a Hong Kong-based Chinese corporation, in the construction and financing of thermal power plants for the Shenzhen Special Economic Zone and for Tianjin municipality.

CHINA'S HYDROPOWER DEVELOPMENT

By Don M. Bosco*

CONTENTS

I. Introduction

The People's Republic of China is aggressively developing its hydropower resources. Since 1949, at least 25 large[1] and 130 medium-size hydropower stations have been built, and about 90,000 small hydropower stations have been installed raising China's hydroelectric power capacity "from the 25th position in 1949 to 6th in the world".[2]

The 12th Congress of the Communist Party of China in 1981 set a national objective to quadruple the gross product of industry and agriculture and improve economic efficiency by the end of this century. Therefore, a greater and more rapid increase in electrical energy generation is required.

The primary PRC government organization responsible for meeting this goal is the Ministry of Water Resources and Electric Power (MWREP), under the dynamic leadership of Madam Qian Zhengying. The MWREP is the national water resource planner, and conducts surveys, studies, engineering design and construction, operation and maintenance of power plants and water projects. The MWREP is also responsible for the distribution and transmission of power.

According to the Ministry of Water Resources and Electric Power (MWREP), China's 1983 total installed electric power capacity reached 76,440 mW, of which 24,160 mW is hydropower.[3] The 1983 annual power output totaled 351.4 billion kWh, of which 86 billion

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[1] China defines large hydropower stations as those having a generation capacity of 250,000 kW or more, medium as 12,000 to 250,000 kW and small as 12,000 kW or less.

[2] "Facts and Figures" Column article entitled "Hydropower Generated in 3 Days is Equal to That in 1 Year", *People's Daily.(Renmin Rebao)*, August 28, 1984, p. 1.

[3] According to MWREP sources, the estimated 1984 total installed electric power capacity is nearly 80,000 mW, of which approximately 30% is hydropower.

kWh is generated by hydropower.[4] This hydropower capacity grew from a base of 400 mW in 1949.[5] Over the next fifteen years, China's ambitious hydropower construction program seeks to reach the goal of a hydroelectric generating capacity of 50 million kW.

Hydroelectric power generation is playing a vital role in meeting China's growing energy demands. China's hydropower potential theoretically approaches 680 million kW, of which an estimated 378 million kW is exploitable.[6] Of this amount, 70 million kW is exploitable through the development of small hydropower stations. China's hydropower resources are concentrated in the less populous areas of the Southwest, Northwest and Central regions. "To replace coal and electricity with hydropower as much as possible is China's long-term goal." [7]

II. Energy Policy

The Minister of Water Resources and Electric Power, Madam Qian Zhengying, stated that China's energy policy is to give equal attention to energy development and energy thrift, and to give priority to the development of coal and hydropower as energy sources and reduce oil and gas consumption.[8] MWREP's energy development plan is to concentrate on hydropower development for the long term, and to rapidly build up coal-fired thermal power plants for the short term to try to fill in gaps in China's power grids and in areas of short power supply. Since hydropower construction is so costly and protracted, coal-fired thermal plants with 300 and 600 mW units will be built to meet the immediate needs. MWREP officials stress that although hydropower is favored as a clean and reliable energy source, difficulties in funding and the great and immediate needs of the country require realism on their part as to what can be achieved with hydropower alone.[9]

China seeks to gradually accomplish the goal of using oil and natural gas primarily for raw materials in the textile, chemical and other light industry and for internal combustion engine fuel.[10]

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[4] The estimated 1984 annual power output was approximately 410 billion kWh, of which approximately 20% was produced by hydrostations. Of course, the hydropower output varies from year to year according to water availability.

[5] The 1949 power capacity was chiefly from the Fengman hydropower station on the Songhua River near the Korean border. The joint-owned PRC-North Korean Shuifeng hydropower station on the Yalu River is not included in installed capacity calculations.

[6] Lu Qinkan, "Exploration of China's Water Power", *Beijing Review*, November 7, 1983, p. 14.

[7] *China Daily*, March 30, 1984, p. 1.

[8] Address by Madam Qian Zhengying to the Austrian Power Association, Vienna, Austria, April 1984.

[9] "The following are some preliminary proposals for the improvement of the water resources and electric power industry: 1/ In order to prevent waste of manpower and material and financial resources, hydroelectric power stations are to be built one by one along successive river sections and not arbitrarily at separate spots, without overall planning. 2/ The economic responsibility system must be enforced in running hydroelectric power projects, and a thorough reform must be carried out in the construction administration system. Shitang hydroelectric power station in Zhejiang Province has been selected as a pilot project to be built by selected builders. 3/ Some unreasonable procedures of design work are to be revised so that project costs and raw materials consumption can be reduced. 4/ Great effort will be devoted to development of building technology. Yantan hydroelectric power station in Guangxi Region has been selected to carry out an experiment with the dam-building technique of roller-compacted concrete. The comrades of the Ministry of Water Resources and Electric Power are determined to strive for great progress in the electric power industry through party rectification." FBIS, March 30, 1984, p. K9.

[10] See footnote 8, *supra*.

Industrial planners are seeking to locate energy-intensive industries near exploitable coal and hydropower sources and encourage those industries to develop in "regions where electricity costs are low." [11] Further, the World Bank in 1981 suggested that the "least cost development plan is likely to include numerous hydroelectric projects, which would increase the proportion of hydroelectric generation. . . As most large hydro projects have an implementation period of about 8-10 years, and medium projects require at least 4-6 years, a vast and near-term effort both in terms of preparing projects and in terms of committing large capital resources for their implementation within the context of a long-term plan will be needed. The high priority now being given to small and medium-size projects with shorter construction periods appears appropriate. Attention is also rightly being given to mine-mouth coal-fired thermal plants . . . ."[12]

The principles of electric power construction are to gradually stress hydropower over thermal, to begin to develop nuclear power, and to conduct scientific research for other new energy resources and continuously enlarge the existing energy grids. The key areas for hydropower construction are the upper reaches of the Yellow River, the upper and middle stream tributaries and trunk of the Yangtze River, and the Hongshui River in the upper region of the Pearl River Basin. Clusters of large hydropower stations will be built in these areas, and medium-size stations will be built near the high consumption areas of the Eastern coastal regions.

A new South China grid will be constructed, utilizing 500 kV transmission lines to connect the large hydropower and thermal projects being build in South China with the high energy consuming areas of Guangdong Province. This grid will also connect to six other existing inter-provincial power grids.[13] A unified distribution system for each province, prefecture, county and enterprise will provide a fixed amount of electricity quarterly or monthly by metering the consumption of each end user.

Electricity rates have been readjusted in some regions. During the 1950's, rates varied sharply from region to region, but were cheapest in areas of hydropower generation. For example, electric rates in Southwest and Northwest China were two to three times higher than Northeast China. With additional hydro installed in the Southwest and Northwest, rates were reduced in those areas. However, Northeast China's rates are still approximately 45 percent lower.[14] Also, preferential rates to high energy consuming industries were put into practice in the 1960's, at a 10-15 percent rate reduction.[15] In regions short of energy resources, the policy of preferential rates was canceled in 1982. In addition, preferential rates were adopted in areas rich in hydropower, and seasonal pref-

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[11] *China: Socialist Economic Development,* Annex E: The Energy Sector, World Bank Report No. 3391-CHA, June 19, 1981, p. 53.

[12] *Id.*, pp. 53-54.

[13] The six major inter-provincial power grids are the Northeast, North, East, Central, Northwest and Southwest grids. "The standard long-distance transmission voltage in China is 220 kV.", and China is at least ten years behind other industrialized nations in transmission technology. See "Electric Power for China's Modernization: The Hydroelectric Options", National Foreign Assessment Center, Central Intelligence Agency, May 1980.

[14] See footnote 8, *supra.*

[15] Id.

erences have been instituted for hydroelectricity consumers during high water seasons.

Preferential rates for agriculture consumption have also been implemented in order to develop and encourage agricultural electrification, improve labor conditions and increase production. Preferential rates were also applied in the 1970's for electricity consumption to support drainage, irrigation, and food processing operations.

Domestic or household users' rates are maintained at relatively high levels, and the increasing use of domestic electrical appliances and educational audio-visual electronic equipment has increased public demand for lower rates.

Rural areas are served both by China's large power grids and by small local stations, since rural electrification solely from the large national power grids is not economically feasible in many areas at this time.[16] The almost 90,000 small hydropower stations supply about one-third of rural electricity demand,[17] and serve over 1560 of the 2300 counties of China.

III. SMALL HYDROPOWER DEVELOPMENT

In the 1950's approximately 9,000 small hydropower stations averaging 26 kW were built in conjunction with water conservation projects, although the engineering design and equipment were not very refined.[18]

During the 1960's, an average of 80,000 kW/year was added to China's installed capacity through the construction of larger-scale small hydropower stations. The then Ministry of Water Conservation and Power held the first national conference on small hydropower stations in 1969 and adopted measures to encourage the rapid development of small hydro sites through the use of subsidies to local equipment manufacturers for required materials.[19] In recent years, small hydropower stations have been built in most localities and localized power grids have been established. Small projects with a generating capacity of up to 500 kW, which can be constructed along streams with a low head, have been given a priority for funding.[20]

"The general policy for the development of small hydropower stations in China is one of self-reliance construction mainly by local people with the support of the state. The key points of this policy are: (1) local funding, with state aid if necessary through subsidies or long-term low-interest loans; (2) local ownership and administration, not to be taken over by the state, even if connected with a larger power grid; (3) power to be used locally."[21] The MWREP provides policy guidance, technical information, technical assistance and sometimes a financial contribution to small-hydropower developers. For the most part, however, small-hydro planning is left to the provinces and local organizations.

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[16] Zhu Xiaozhang, "Small Hydropower Stations", *Energy Resources in the Countryside*, published by China Reconstructs Magazine, Beijing, 1984, p. 16.
[17] *Id.*, p. 16.
[18] *Id.*, p. 18.
[19] *Id.*, p. 18.
[20] Xinhua News Agency Report, printed in FTIS, November 22, 1984.
[21] *Energy Resources in the Countryside*, op. cit., p. 22.

Although China has been active in international scientific and technical exchange programs on small hydropower in recent years, China has maintained a very self-reliant position on domestic small hydropower projects. There has been very little foreign public or private sector involvement in China's small hydro program. China's several small hydroturbine manufacturers under the Ministry of Machine Building Industry are working through several U.S., Hong Kong and PRC based commercial companies to begin marketing Chinese-built units for export sale. Complete sets of equipment have been sold in the U.S., Canada, Philippines, New Zealand, Indonesia, Thailand, Malaysia and Peru.[22-25]

IV. Present Hydropower Development Efforts

The MWREP, in coordination with the State Science and Technology, State Economic and State Planning Commissions has centralized the planning function of multipurpose hydropower projects into planning offices which span Ministry bounds in order to assure a unified and coordinated effort. Vice-Premier Wan Li reportedly stated during a July 1984 visit to the upper reaches of the Yellow River that "the planning, management and utilization of the Yellow River must focus on irrigation and flood control, while power generation should be supplementary".[26]

The MWREP directly administers five major regional planning offices and commissions which operate to coordinate water resource planning with the interests of other Ministeries, provincial organizations and the local community. These are the Yangtze Valley Planning office, located in Wuhan; the Pearl River Water Resources Commission, located in Guangzhou, the jurisdiction of which includes the Hongshui River; the Huai River Water Resources Commission; the Hai River Water Resources Commission; and the Sunhua and Liao Rivers Joint Water Resources Commission. Each office and commission also has its own design force. Also directly under MWREP is the China Hydropower and Water Resource Construction Administration (CHWRCA), which operates five major Hydropower Survey and Design Institutes (HSDI): Northeast China HSDI, located in Changchun; Northwest China HSDI, in Xian; Southwest China HSDI, with three major offices in Chengdu, Kunming and Guiyang; East China HSDI in Hangzhou; and Mid-China HSDI in Changshan.[27] Each Province also has its own hydropower institute which coordinates its activities and receives assistance and technical guidance from MWREP, such as the Guangxi Hydropower Institute, which is one of the major provincial institutes. There are also 14 hydropower construction bureaus, including a special unit of military engineers of the People's Liberation Army which provides a labor force and prepares access to construction sites in remote areas. There are an estimated 250,000 people working in the water power field in China, including over 10,000 engineers.

[22-25] Ren Rungu, "Small HEP Stations Flourishing", Intertrade, November 1984, p. 17.
[26] *China Daily*, July 12, 1984, p. 1.
[27] The CHWRCA, when dealing directly in a contractual or commercial relationship, substitutes the word "Corporation" for "Administration" in its name.

According to the MWREP, China has designated its hydropower development regions into eleven major "Hydropower Bases". The Northwest and Southwest Hydropower Bases are the largest hydropower resource areas comprising 80% of the nation's total resource base.

The Yangtze Hydropower Base covers the middle reach of the Yangtze (Changjiang) River, and includes the planned Three Gorge Project and the Gezhouba 97 m high dam which is nearing completion. The Gezhouba project was conducted completely by China and has provided the experience for Chinese engineers to undertake the monumental Three Gorge Project. The Jinsha Hydropower Base covers the upstream reaches of the Yangtze River, where a site survey has identified the Jinping site for development. The Yalong Hydropower Base covers the major tributary to the Jinsha River where the Ertan project is planned for construction, utilizing the consulting engineer services of a major U.S. engineering firm.

On the upper reach of the Yellow River, the Longyang Hydropower Base includes the now-completed Liujiaxia station and the Longyangxia and Lijiaxia stations. In the middle reach of the Yellow River, the MWREP has recently concluded an approximately USD 3 million contract with another major U.S. engineering firm for technical services for the Xialandi multipurpose water resources and hydropower project.

The Dadu River Hydropower Base in Sichuan Province, a tributary of the Yangtze River, has not had much work accomplished yet although two projects, the 700 mW Gongzui station and the 600 mW Tongjiezi station, are planned and preliminary site investigations for ten other projects have been completed. In the Wujiang Hydropower Base in Guizhou and Sichuan, another main tributary to the Yangtze River, several major projects are planned or underway, such as the Wujiangdu station which will have the largest capacity and a height of 165 meters.

In Southwest China, the Hongshui River Hydropower Base is getting great attention and has involved U.S. participation in the "ten dam plan" for the Hongshui River and its main tributaries, such as the Nanpan River. Under Annex 1 to the Hydropower Protocol, the U.S. Army Corps of Engineers dispatched a delegation to China to work with their Chinese counterparts to provide advice on the ten dam plan.[28] This successful experience led to the U.S. Trade and Development Program funding of a feasibility study for the Tianshengqiao project, which was conducted by a major U.S. engineering firm and led to the sale to MWREP of tunnel boring machinery and technical services from the U.S. The Tianshengqiao project is the first project at the upstream end of the Nanpan River, which flows into the Hongshui River, and will consist of a high rockfill dam at Dawan upstream from a concrete dam under construction at Basuo. The Basuo dam is being constructed primarily for power generation and the Dawan dam is planned for both power and river regulation, with a storage capacity of 40 billion cubic meters. The Dawan dam will be the highest concrete-faced rockfill dam in the world at a height of 185 meters, and preliminary design work is

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[28] "A Review of Multiple Purpose Development Planning, Hongshui River Basin, People's Republic of China", U.S. Army Corps of Engineers North Pacific Division, April 1982.

now underway. Since the next project planned downstream from Tianshengqiao will be a higher Longtan dam, an additional intermediary dam at Pingba has been deleted as an alternative addition to the ten dam plan. Further downstream on the Hongshui River, the Dahua dam is almost complete and a ship elevator is being added. The Yantan dam preliminary design has been completed and site preparation is underway. The most downstream dam in the ten dam plan is the proposed Datengxia project which is still in question due to inundation problems and may be lower in height than originally planned or may be cancelled.

The Lancang Hydropower Base in Yunnan Province comprises the Lancang (upstream Mekong) River system and the Huangni River in Yunnan, the site of the Lubuge project now under construction partially financed by the World Bank.

The Xiangxi Hydropower Base includes projects on the Xiang, Zi, Yuan and Li Rivers. The largest project is the Wuchangxi station on the Yuan River.

The East China Hydropower Base covers Zhejiang and Fujian Provinces. The total number of projects completed, planned and surveyed is about 80. The Shuikou project in Fujian Province has been studied by a major U.S. engineering firm and will be primarily financed by the World Bank. The tender documents now have been completed.

The Northeast China Hydropower Base is centered around the newly commissioned Baishan station in Jilin Province. There are also other smaller hydropower bases that are being developed.

V. Foreign Participation in Hydropower Projects

Substantial foreign government credits have been made available to China for its hydropower construction program. The World Bank Group has also studied several planned projects and in February 1984, agreed to provide a US $145.4 million loan for foreign equipment and steel for the Lubuge Hydropower Station in Yunnan Province. Canada has recently made available to MWREP about $16 million for project planning in China through the Canadian International Development Agency. The Kuwait Fund for Arab Economic Development has provided an estimated US $30 million in low-interest loans to Fujian Province for construction materials for the 300 mW Shaxikou hydropower station and navigation project on the upper Min River to be completed in 1988 and to be linked to the East China hydropower base. Other countries, such as Austria, Norway, France and Japan have also made grants and low interest funds available to MWREP to assist their nation's firms to obtain work on MWREP hydropower projects.

China has been investing heavily in its own power projects in recent years. For example, in 1981 China invested approximately 4 billion yuan[29] in power projects, which was almost ten percent of the total national investment for capital construction projects in that year.[30] Of that amount, 1.34 billion yuan was invested in hy-

[29] See footnote 8, *supra*. The 1981 US$:Yuan exchange rate was 1:2.3.
[30] *Id.*

dropower projects, 1.45 billion yuan spent for thermal power projects, and 1.21 billion yuan for power supply work.

The U.S. Government has made an effort to assist the U.S. private sector to gain an entree into hydropower project work in China but has not maximized the very effective role that could have been played up to this time due to the lack of a clear and direct mandate for full federal agency participation and confusion between commercial and political objectives. Although several informal exchanges and government-to-government delegation visits had been accomplished prior to 1979, it was not until the 1979 Agreement Between the United States and the People's Republic of China on Cooperation in Science and Technology (S&T Agreement) that U.S.-PRC cooperation became formalized.[31] The 1979 S&T Agreement provided for the establishment of a U.S.-PRC Joint Commission. The U.S. Co-Chairman has been the Science Advisor to the President, who directs the Office of Science and Technology Policy (OSTP), Executive Office of the President, and the PRC Co-Chairman has been the Minister in charge of the PRC State Science and Technology Commission. The 1979 S&T Agreement provided the authorization for then Vice President Mondale to execute the 1980 Protocol on Cooperation in Hydropower and Water Resource Management, which was one of over 22 Protocols in force during 1984. Under the Hydropower Protocol, two successive work schedules were negotiated as Annex 1 and Annex 2 to the Protocol. Annex 1 involved the MWREP and Ministry of Communications on the Chinese side and the major U.S. agencies involved in hydropower and water resources on the U.S. side.[32]

Toward the end of the implementation of Annex 1, U.S. interest in the commercial potential for U.S. participation in China's hydropower development program led the U.S. private sector to lobby for a shift of the U.S. federal agency coordinator role from the Department of Energy to the Department of Commerce. Annex 2 was then negotiated under the coordination of the Department of Commerce, which sought to assist the U.S. private sector into a more active role in the primarily government-to-government activities scheduled for Annex 2.

The commercial potential of U.S. private sector participation in the activities of Annex 1 and Annex 2 was deemed to be significant and would provide exposure and experience to U.S. firms in a direct working relationship with their Chinese engineering counterparts. This was the primary justification for acquiring funding for activities under Annex 1 and Annex 2 from the U.S. Trade and Development Program.[33]

Since the participating federal agencies did not have funds available or authorized to fulfill the bilateral commitments of the Annexes, they were fortunate to be able to rely on the U.S. Trade and

[31] T.I.A.S. 9179, 30 U.S.T. 36 (1979).

[32] The U.S. participating agencies were the Department of Energy, U.S. Army Corps of Engineers, Bureau of Reclamation, Tennessee Valley Authority and the Bonneville Power Administration.

[33] The Foreign Assistance Act of 1961, as amended, (the Act) prohibits the provision of assistance to China under Sections 620(b) and (f). In 1979, China was determined to be a "friendly country" for purposes of eligibility for inclusion in federal agency reimbursable programs authorized by Section 607 and 661 of the Act, such as the U.S. Trade and Development Program grant programs pursuant to Section 607a of the Act.

Development Program for partial funding. Although much effort had been made by many of the U.S. technical agencies involved to seek authority and funding to meet commitments through their own channels, little was done by their oversight entities to assist them to meet the basic commitments under the Annexes.

Nevertheless, as a result of the close working relationships and fine rapport developed by the U.S. technical agencies' engineers participating in Protocol activities with their PRC counterparts, the MWREP was willing to pursue direct cooperative relationships with several U.S. agencies. After the November, 1983 visit to the U.S. by Minister Qian, on February 10, 1984, MWREP proposed a sister-laboratory relationship between MWREP's Nanjing Hydraulic Research Institute and the U.S. Army Corps of Engineers Waterways Experiment Station, as well as joint committees to monitor the technical progress on the planning, design and execution of the Longtan Hydropower Project and the Yangtze River Estuary regulation and navigation project. On February 23, 1984, MWREP also proposed a "sister relationship" between the Yangtze River Valley Planning Office and the U.S. Bureau of Reclamation's Engineering and Research Center, as well as joint committees on the Three Gorge and Ertan Hydropower Projects.

On August 3, 1984, the Bureau of Reclamation executed two agreements to provide for technical cooperation with MWREP on the Three Gorge Project.[34] The Three Gorge Hydropower Station is a multipurpose project for electric power, flood control and navigation. The project at Sandouping in Hubei Province will be comprised of the world's largest concrete gravity dam spanning the Yangtze River at a length of 1,924 m and at a height of 165 m, two power houses with a total installed capacity of 13,000 mW and a two-route four-stage navigation lock.[35]

The Bureau of Reclamation agreed to provide consulting services to the China National Technical Import Corporation on the technical and economic issues concerning design, construction and operation, and requires the Bureau of Reclamation to dispatch engineers to China to provide consulting services and to supply necessary and relevant technical documentation and data. The purpose of the technical cooperation is to obtain the best quality design and construction at the lowest cost and to shorten construction time.

Although the U.S. participation will be to perform consulting and advisory services, the advantage to the U.S. is to include the U.S. private sector in the early stages of the project. Of course, the responsibility for the design, construction and operation of the project and all final decisions are to be made by the Chinese side. The technical design and work-site preparation is scheduled to

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[34] Agreement Between the Changjiang Valley Planning Office of the Ministry of Water Resources and Electric Power, People's Republic of China and the Bureau of Reclamation of the U.S. Department of the Interior on the Technical Cooperation for the Three Gorge Project, and, Agreement on the Technical Consulting Services for the Three Gorge Project on the Changjiang River Between China National Technical Import Corporation and the Bureau of Reclamation of the U.S. Department of the Interior.

[35] See "Three Gorge Dam bids streaming into BuRec", *Engineering News Record*, New York, January 3, 1985, p. 12, and "Yangtze engineers aim high", *Engineering News Record*, July 26, 1984, p. 26.

commence in 1985 with construction to begin in 1986. The project schedule seeks to commission the first unit in 1994 and complete the entire project in 1999.

VI. Conclusion

It is clear that commercial opportunities are significant for foreign participation in China's ambitious hydropower development program, as evidenced by the clamor of foreign firms and the huge credit facilities made available to China for hydropower project planning, design and implementation. It is also clear that China has an extremely capable and experienced engineering and construction force. The energy demands of China's modernization program require a massive hydropower construction program which is now underway, for which tremendous capital and advanced technology is required. Friendly foreign countries from the West can indeed make a great contribution to this effort, particularly in terms of hard currency credits, advanced technology and construction and operational management, but China will at all times be in control of its own projects and decision making. The commercial organizations which will reap the rewards of participation in China's hydropower development program will be from those friendly foreign countries whose governments affirmatively act to assist China to reach its ambitious modernization goals. The U.S. government should enunciate a clear policy of support for China's efforts and authorize and fund federal agency programs in close coordination with MWREP. The U.S. government must provide the leadership and coordination for a joint U.S. public and private sector effort to formulate innovative solutions to the massive foreign exchange and financing needs of China's hydropower development program if U.S. firms are to participate in any significant manner in hydropower work in China.

VI. MILITARY

OVERVIEW: CHINA'S DEFENSE MODERNIZATION*

By Paul H. B. Godwin**

CONTENTS

PRINCIPAL FINDINGS

China's defense modernization objectives are twofold. In the short-term Beijing seeks to improve the combat effectiveness of its current forces through the adoption of combined arms operations as the basis for its battlefield strategy and by improving the technical and professional skills of the officer corps. The armed forces' weapons and equipment will be incrementally improved, but with only limited and selective importation of foreign weapons and equipment. The long-term goal is to build a scientific and defense industrial base capable of developing and producing weapons and equipment based upon advanced military technology. These two objectives are being sought as the nuclear weapons program continues to develop and deploy strategic systems capable of providing a more effective nuclear deterrent.

The choice of a slow and incremental approach to defense modernization was required for a number of reasons. First, Beijing places primary importance on developing the civil sector of the economy. Thus defense modernization was placed last in the investment policies established for the "Four Modernizations"—agriculture, industry, science and technology, and national defense. In addition, even if it were seen as desirable and financially possible, a massive introduction of foreign military technology could easily

* The views and opinions expressed in this essay are those of the author and are not to be construed as those of the United States Air Force, the Air University, or any other department or agency of the United States Government.

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overwhelm both the defense industrial base and the armed forces, both of which are suffering from twenty-five years of technological stagnation. To the extent that foreign military technologies are being imported, their selection is based as much on the long-term goal of developing a self-sustaining infrastructure of military R & D and production facilities as it is the more short-term objective of improving current capabilities.

The relationship of the United States to this process presents both opportunites and risks. Increasing China's capabilities to defend itself against the USSR is clearly in America's interests. However, there is no assurance that American technology will not, someday, be used against US interests in the Asia-Pacific region. Nonetheless, because China is not seeking a rapid and massive technological modernization of its armed forces, the sale of American military technology, weaponry and equipment on the limited scale sought by Beijing will not result in a major increase in China's military capabilities. Thus the issue of American military technology transfers to China will be more politically sensitive than it is militarily critical.

Introduction

The Chinese defense establishment is now in its seventh year of an extensive defense moderization program, but even as the policies associated with this program settle into reasonably defined paterns it must be recalled that China has been through this experience before. Many of the policies now underway are, in fact, a reinstatement of policies that were first put into effect in the 1950s, when the Chinese armed forces were undergoing a comprehensive program of modernization with the support and tutelage of the USSR. In the mid- and late-1950s, however, Mao Zedong criticized many aspects of that program, and in 1959–1960 the USSR terminated its assistance to China's fledgling nuclear weapons program and its support for the conventional arms industries when it cut off essentially all technical and economic assistance to Beijing. Thus, Mao's own views on the proper path for China's defense modernization along with Soviet attempts to coerce China into following Moscow's policy preferences combined to deal the Chinese defense establishment a blow from which it is only now recovering.

Historical Overview

Even as the Soviet-supported defense modernization programs were expanding, Mao's views were coming into conflict with those held by his military high command.[1] As early as 1953, members of the civil party leadership began to object to the attitude held by some members of the military elite that modern warfare had made the technological and material factors of warfare more important than the human and political factors. Because of this changing emphasis, the military high command insisted that a modern army required an officer corps trained primarily in the specialized skills

[1] Ellis Joffe analyses this conflict in his *Party and Army: Professionalism and Political Control in the Chinese Officer Corps, 1949-1964* (Harvard University Press, Harvard East Asian Monographs, 1967).

required to command and staff an increasingly complex combined arms force. The development of these skills required both careful recruitment and continuous development of officers through a systematic program of training and professional military education (PME). This emphasis on a professional officer corps was reinforced in July 1955, when the National People's Congress passed a Military Service Law that introduced a rank structure modeled on the Soviet armed forces and transformed the Chinese People's Liberation Army (PLA) from an all-volunteer force into a conscript army. With the introduction of conscripts serving for a prescribed number of years, the officer corps became the heart of the new PLA. It would be responsible not only for training a specified number of conscripts each year, but also for developing doctrine and strategy and the forces that were to be the substance of China's new army.

The creation and expansion of specialized schools designed to develop the skills of a professional officer corps served to reinforce the perception of the officers that they were the driving force of the new PLA. What Mao and other members of the civil party elite objected to, however, was not only the growing sense of military professionalism in the officer corps, but also the increasing influence of Soviet concepts of doctrine and strategy.

This growing conflict with the military high command and its perception of the future PLA was made even more critical by the cost of defense modernization. In a major address to the Politburo in April 1956, Mao stated that military expenditures had become a major drain on the state budget and had distorted China's investment priorities. He concluded that rather than continuing to invest excessively in the defense industries, the most expeditious way for China to modernize its armed forces was to create a strong civil industrial base and graft a self-sustaining defense capability onto the civil sector. Here Mao was opposing those who sought to continue the rapid expansion of China's defense industries that would, in his view, continue to be expensive and result in excessive dependence upon the Soviet Union. Mao's position was that if China were to become a major military power it had to be capable of sustaining its own defense establishment without external support. To achieve this goal it was necessary to give priority to a broadly based program of economic development combined with a commitment to increase China's indigenous scientific and technological capabilities.

Political campaigns attacking the new professionalism had begun in 1955, and in 1958–1959 they reached the point where there was a major clash between Mao and the military high command. This confrontation came at a time when the economic policies of Mao's Great Leap Forward were creating the infrastructure of an economic disaster and his rift with Moscow was becoming even more intense. In 1959, the USSR abruptly cancelled its support for China's fledgling nuclear weapons program, and in September Mao brought the rising tide of military professionalism to an end by dismissing his defense minister and chief of staff. The Soviet Union, seeking to force China into accepting its dominance, terminated essentially all technical and economic assistance in the summer of 1960. This act ended Soviet support for China's defense industries, throwing them into chaos.

Without Soviet assistance it was simply not possible for China to continue the broad program of defense development it had pursued since the mid-1950s. In addition, the demands of the civil sector of the economy, now that the USSR was refusing to render assistance, made the opportunity costs of investment in defense even greater than they had been in the past. Faced with shrinking resources, defense R&D was focussed on the nuclear weapons program while the conventional forces entered a long period of technological stagnation.

By 1965, recovery from the economic consequences of both the termination of Soviet assistance and the effects of the Great Leap Forward had been largely achieved. Funds were increasingly available for conventional armaments, but the fall of that year saw the opening stages of what was to become Mao's "Great Proletarian Cultural Revolution." This campaign was to have its own economic consequences, but its political costs to the PLA were perhaps even greater.

As the cultural revolution progressed, the PLA became enmeshed in the internecine conflict that spread from Beijing to the provinces. Ultimately, the cultural revolution itself blended into an intra-party struggle over succession to an obviously ailing Mao Zedong. The fall of 1971 saw China's defense minister, Lin Biao, die in a plane crash as he sought to escape after an alleged attempt to assassinate Mao. Practically all of the senior members of the military high command were implicated and arrested along with a large number of other officers. Years of political involvement had left the PLA in disarray and the attempted coup was the nadir of its involvement in politics. Yet there were other problems soon to be brought to light.

In the summer of 1975, meetings of the Party's Military Commission (MC) headed by Deng Xiaopong, concluded that the Chinese armed forces were incapable of effectively performing the military tasks required for the defense of China. The officer corps was overaged and under-trained; the staff and administrative structures of the PLA were bloated; and the technological base of the armed forces' weapons and equipment was dangerously behind that of other major military powers.

Nonetheless, decisions made at these meetings could not be transformed into policies designed to renovate the PLA, for the intra-party struggle to succeed Mao yet continued, resulting in the purge of Deng Xiaoping, and basic issues of defense and security policy continued to divide the party. Even after the death of Mao in September 1976 and the arrest of the radical wing of the Politburo less than one month later, internal disputes over security policy precluded any systematic approaches to the problems faced by the defense establishment. A central issue in these disputes was whether or not the military threat posed by the USSR required a massive reallocation of funds to defense modernization programs. 1977 saw Deng restored, but the debate continued and it was not until 1978 that the necessary compromises were made that led to an agreement on the proper balance of investment between the defense and civil sectors of the economy. These compromises established the gradual and incremental approach to defense modernization that remains in effect today. In a decision remarkably similar to that announced by Mao Zedong in 1956, it was agreed that the defense industrial base and military R&D capabilities would be improved and expanded only in balance with the overall development of China's economy and its scientific and technological base. The civil sectors would receive priority in investment, and defense requirments would not be permitted to distort the priorities required for the comprehensive development of China's economy.

Just two months after these decisions were made, China conducted a punitive expedition into Vietnam. The military operations conducted inside Vietnam during February and March of 1979 served to demonstrate that military technology was not the only source of weakness in the Chinese armed forces. The sweeping condemnation made by the Military Commission some five years earlier was confirmed. Combat with Vietnamese forces demonstrated that command skills, logistics, communications, and basic military operations utilizing combined arms on the battlefield were capabilities clearly lacking in the Chinese armed forces. To correct these weaknesses as well as rebuild the technological base of the defense establishment, Beijing has reinstituted many of the programs introduced in the 1950s. To this date, and in spite of some resistance both inside and outside the defense establishment, there is no sign that sufficient opposition exists to replicate the reversal that came in the late 1950s.

ISSUES IN DEFENSE MODERNIZATION

Relegating defense modernization to fourth place in the investment priorities established for the Four Modernizations has not rendered the defense establishment poverty stricken. China's estimated military expenditures are exceeded only by those of the United States and the USSR, and its defense industrial base is one of the world's largest, producing both nuclear-armed ballistic missiles with ranges in excess of 7,000 miles and the extensive variety of conventional armaments associated with major military powers. China's conventional arms lack the technological sophistication of those produced by the leading industrial powers, but they have been produced in large quantities while acquiring a reputation for being both rugged and effective. Indeed, quite recently China has publicly entered the international arms market selling tanks, artillery, armored personnel carriers, small arms, etc., through NORINCO (China North Industries Corporation) headquartered in Beijing. China's continuing development, production and deployment of space satellites, including one in geosynchronous orbit, ballistic missiles, nuclear-powered ballistic missile submarines (SSBN), and solid-fueled submarine-launched ballistic missiles (SLBM) indicate that China intends to sustain military programs usually associated only with leading military powers.

What the Chinese defense industrial base lacks are the scientific and technological underpinnings required to generate arms and military equipment utilizing advanced military technology, especially in conventional arms, C^3I (command, control, communications and intelligence) equipment, electronic warfare, precision guided munitions (PGM), and other areas where technology has made significant contributions over the past two decades. Compounding the weak technological and scientific base of the defense industries is the fact that the armed forces themselves lack both the technically trained personnel to maintain and support large inventories of advanced military technologies, and staff and command personnel experienced in planning and conducting military operations utilizing advanced weaponry and equipment. In short, twenty years of military technology have passed by the Chinese industrial base and armed forces, and they are now involved in grappling with the multifaceted problems created by these years of relative stagnation. But, as the Chinese themselves have stated with great frequency over the past seven years, solving this problem requires far more than simply updating military technology. It requires major changes in their military doctrine, strategy, operations, officer recruitment and professional military education, and in the organization of their defense establishment.

Defense Modernization Policies

Although nothing resembling a long-range defense modernization program has ever been publicly announced, when systematic approaches to defense modernization were begun in 1978–1979, it soon became evident that a major overhaul of the entire defense establishment was underway. Commentaries by senior Chinese defense officials and analyses of defense related issues in China's press and specialized journals all indicated that the "modernization of national defense" was to embrace an holistic approach to the problems faced by the defense establishment. These discussions and commentaries indicated that there are two basic foci for the emerging policies: first, that the combat effectiveness of the current forces had to be improved. Secondly, that the goal of improving current effectiveness, especially the issue of importing foreign weaponry and equipment, was not to detract from the primary objective of developing a defense infrastructure capable of building and sustaining modern military forces without external assistance. Thus there were both short and long-term goals implied in the modernization policies developed after 1978.

In a very real sense, the Chinese had very little choice but to develop such a strategy. Financial constraints provide only limited budgets; an extremely limited pool of scientifically and technically trained personnel does not permit a wide-ranging development program; the defense industrial base does not have the production technology required for the serial production of advanced weaponry; and the armed forces do not have the experience required for the proper supply, maintenance and employment of advanced-technology weapons and equipment. Thus, even if it were possible, the defense establishment would have been overwhelmed by any rapid introduction of advanced technology. No "quick fix" was plausible, even if it were seen as desirable.

Beyond these technology related issues were questions about the military doctrine, strategy, and operations of the armed forces. These had to be modified and adjusted in preparation for the introduction of more advanced weaponry and equipment and to make effective use of the current force structure. These modifications would require changes in organization of the armed forces and the manner in which the officer corps was recruited and trained. Such sweeping transformations would require a review of the role played by the armed forces in the society at large.

A major aspect of these changes has been the leadership's decision to build a smaller more professionally trained army. The active services are undergoing a force reduction of 1 million personnel and are being supplemented by a reserve system of both officers and enlisted personnel, thereby reducing the cost of a large standing army. In part, this is being achieved by separating from the ground forces those units concerned primarily with internal security and placing them in the newly formed Chinese People's Armed Police Force (PAPF). The basic choices have been made, but achieving the overall objectives of defense modernization will be difficult.

FUNDING DEFENSE MODERNIZATION [2]

With the exception of 1979, when expenditures were increased to pay for the cost of invading Vietnam, China's estimated defense spending measured in constant 1981 US dollars has not increased appreciably since 1972. Given the dramatic increase in the value of China's gross national product (GNP) over the same period, the actual burden of defense on the economy has been reduced. The state budget has also increased, but the relative share of the budget allocated to defense has been decreasing. Thus current spending is estimated to absorb some 6–8 percent of the GNP, whereas a decade ago it approximated some 11.5 percent.[3] Clearly, defense modernization has not been sought at the expense of other sectors of the economy. Similarly, decisions requiring the defense industries to produce goods for civil consumption and to enter into the international arms market also serve to reduce China's defense burden.

However, although the overall pattern of defense expenditures has been stable and designed to minimize the cost of defense modernization, there have been changes in allocations within the budget that may reflect changing defense priorities. Most noticeable has been increased funding for China's strategic offensive forces—its ICBMs, IRBMs, and SLBMs. This increased funding almost certainly reflected the increasing costs associated with larger and more sophisticated missile systems. Naval procurement, although decreasing in the post-1979 period, is also estimated to have increased in recent years to pay for the production of new series of nuclear-powered ballistic missile submarines. RDT&E (research, development, testing, and evaluation) costs associated with development of longer range missiles and the submarine-launched systems are assumed to have absorbed the greater part of development funding since 1974.

In other areas of weapons procurement, the picture since 1979 is one of steady decline. Ground force weapons and equipment procurement dropped after 1971, and saw their only sharp increase in

[2] A more detailed analysis of this issue is to be found in Ed Parris, "Chinese Defense Expenditures, 1976–1983," this volume.

[3] The US Arms Control and Disarmament Agency (ACDA), *World Military Expenditures and Arms Transfers, 1972–1982* (Washington, D.C.: ACDA Publication 117, 1984), p.2.

1979 as a consequence of the war with Vietnam. Naval construction decreased steadily during 1970–1976, but increased in 1976–1979 because of the procurement of destroyers and frigates in the place of smaller coastal defense craft, and then went into a period of decline. As noted earlier, the construction of SSBNs will increase naval funding, but these expenditures should be more properly associated with the strategic missile forces. Aircraft are very expensive to produce, and they have formed the most variable component of China's procurement patterns. It is now believed that as China's latest fighter—the F-8—enters early serial production its high initial cost will cause an increase in the air force component of the procurement budget.

Even given the difficulties involved in precisely determining the patterns of China's weapons development and procurement, it does appear that the strategic weapons have received priority in recent years. In other areas, especially land armaments and aircraft, it is unclear how many have been built for export and how many for deployment by the Chinese forces. The only constant emphasis appears to be on strategic nuclear forces.

Similar problems occur when attempting to determine which, if any, service arm is receiving priority in the importation of foreign technology. There has been an indication of a preference for the ground forces with the modernization of China's T-59 tank through the addition of a smoothbore main gun, a laser-ranging gunsight, etc. This, along with series production of the Soviet-designed Sagger anti-tank wire-guided missile and recent photographs of what appears to be a new anti-tank missiles amounted on jeeps in the October 1984 National Day parade, demonstrates concern with improving the anti-armor capability of the ground forces. At the same time, however, the F–8 is going into early series production—essentially a much modified version of the Soviet MiG–21 produced in China as the F–7. Rumors abound that the Chinese are actively seeking a modern air-to-air missile for this aircraft in order to make it a more effective high altitude interceptor. The cancellation of the British Sea Dart air defense system tended to dampen rumors that the navy was about to receive foreign technology, but since Secretary Lehman's visit last August there have been reports that China is interested in American gas turbine engines, the Phalanx air defense system, and antisubmarine warfare equipment.[4] None of these reports has been confirmed. The simple fact is that China has not thus far imported major quantities of foreign weapons systems or equipment for its armed forces, thus no pattern of preferences can be established.

What is probably more to the point is the frequently asserted position taken by China's senior defense officials that foreign technology cannot be the basis of China's defense modernization. Foreign technologies will be imported when they are essential for China's defense industries and armed forces, but such technology is too expensive to be imported on a large scale. What we have been observing is a major attempt by China to upgrade the capabilities of current weapon systems at a minimal cost. Thus, assuming that the

[4] See, for example, "U.S. Announces Tentative Accord on Arms Sales to China," The Wall Street Journal, January 14, 1985, p. 20.

pattern of the past decade continues, military technology imports will be highly selective and extremely limited. The primary objective will be to improve China's capability to develop and build its own advanced technology systems.

REBUILDING THE OFFICER CORPS

Recognizing that the technological modernizaton of the armed forces will occur only slowly, special emphasis has been placed on improving the professional skills of the officer corps. Xiao Ke, the doyen of PLA's professional military education (PME) system has defined this process as the essential "capital construction of our army." [5] New officers are now selected primarily from among college graduates and the 100 or so technical academies and schools specifically created to train a new generation of officers. These PLA-run schools recruit around 15,000 candidates a year from among China's high school graduates and train them to be "command cadres" and technical officers. Those few candidates selected from the enlisted ranks will have to attend "command schools" prior to their commissioning and will receive college degrees upon graduation. Within the officer corps as a whole, professional and technical skills will be improved by requiring attendance at PME schools prior to promotion. In the future, officers will not be able to attend advanced schools and academies without completing PME requirements at the lower schools.

These changes have not been brought about without resistance, especially from among the older generation of officers who won their commands in the 1930s and 1940s. It is this generation of officers too old to function effectively on active duty, especially those unwilling or unable to adjust to the rigors of professional education now demanded of the officer corps, who are being encouraged to retire. Many are reported to be retiring, but there is also some evidence of resistance in spite of generous retirement programs. Progress has been made, but it is more important for China's defense modernization goals that the institutional attitude toward military professionalism has changed dramatically from the views that dominated the armed forces after the late 1950s.

THE ARMY, THE SOCIETY, AND THE ECONOMY [6]

Changes have also occurred in the manner in which the armed forces interact with the society and the economy. The traditional role of the communist forces in the economy and the society was multifunctional, with its origins going back to the early days of the civil war and the Sino-Japanese war. In areas occupied by the communist forces, they built schools, factories, and hospitals and helped the peasants raise crops. The army also took upon itself the responsibility of raising much of its own food. What emerged was a military ethic designed to create good relations with the local population and to reduce the economic burden of the Red Army on the

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[5] Beijing, Xinhua Domestic Service, 22 February 1983, citing a *Jiefangjun Bao* (Liberation Army Daily) article by Xiao Ke dated 22 February 1983, in Foreign Broadcast Information Service, *Daily Report-China* (henceforth, FBIS-CHI) No. 037, 23 February 1983, p. K-31.

[6] A more detailed analysis of this issue can be found in June Teufel Dreyer, "The Role of the Military in the Chinese Economy," this volume.

peasantry. Within the armed forces, procedures were developed to ensure that senior cadres did not develop attitudes of superiority, and to correct these attitudes when they did occur. Central to this military ethic was the principle that communist forces were a "people's" army and not a "warlord" army.

After the Communists came to power, additional facets were added to their military ethic, including the goal of providing the population with a model of good citizenship; of imparting skills to recruits that would be useful when they returned to civil life; and of committing the armed forces to the economic reconstruction of China both through specific projects and by contributing free labor. In fact, the actual implementation of all the facets of the "people's" army ethic waxed and waned in the years following the defeat of Chiang Kai-shek in 1949, but they remained a major component of Mao's concept of a revolutionary people's army.

With the death of Mao in 1976 and the renewed emphasis on defense modernization that followed, the traditional ethic continued but was transformed. By requiring the defense industries to contribute to the civil sector of the economy, the defense establishment was continuing past practice but its purpose was transformed to one of reducing the burden of the defense industrial base on the society as a whole. Equally important, because the defense sector of the economy was often more technologically advanced than the civil sector, it permitted internal technology transfers to occur through the use of military plants for civil purposes—especially in such fields as electronics, optics, nuclear power, and other high technology areas. It should also be noted that as more advanced technologies are introduced into the civil sector of the economy, internal technology transfers can flow more easily into the defense industries. This same pattern could occur in R&D programs, for military research and development is no longer as insulated from civil R&D as it once was.

The practice of contributing work days directly to the civil economy also continues. The numbers involved are large, with one account reporting that over the years 1949–1979, the armed forces contributed a total of 460 million work days to the civil economy—an average of 15.3 million days a year. However, when this number is divided among the estimated number of military personnel in the armed forces during any given year, it averages between 4.4 and 6.6 days per soldier. This is clearly not a major drain on the armed forces' available training time. It is difficult to determine what the value of this contribution is to the economy, but its symbolic value remains of importance to the traditional ethic of the PLA. Today there is constant reporting of army-men planting trees, assisting the peasants at harvest time and contributing to disaster relief.

The armed forces place continuing importance on the role they play in preparing young soldiers for their return to civilian life. These skills have ranged from basic literacy training and elementary level education to the higher skill levels associated with engine maintenance and the support of electronic equipment. This approach to training, it will be noticed, is not unique. The United States' military establishment uses precisely the same concepts when it advertises that young men and women can join the army and learn a skill that will provide a good job in civilian life.

Of important symbolic value is the practice of senior officers "returning to the ranks" for a period of days to conduct menial tasks. High ranking military leaders are often reported sweeping streets, washing windows, unloading boxcars, etc., in an effort to symbolize the total integration of the armed forces. The purpose behind these performances is to demonstrate that although the duties and responsibilities of PLA members vary greatly, they are all part of the same army dedicated to "serving the people." Originally conceived as a technique for correcting tendencies toward arrogance and to induce a sense of humility, such practices have now become almost purely symbolic.

As the policies of modernization and professionalism came into effect over the past seven years, there has been a definite attempt to retain much of the traditional military ethic of the Chinese armed forces. Retaining an ethic that had its origins in the 1930s has not been difficult because much of its substance had become symbolic and the symbolism is easy to retain. Of far greater importance has been the gradual blending of the defense industries into the civil industrial base and the reduction of the insulation between defense and civil R&D. In the long term this will almost certainly be beneficial, not only because of the economies involved but also because it will facilitate internal technology transfers within China's industrial base.

There are potential problems, most significant of which is the question of whether or not a given plant could shift swiftly and easily from civil to military production to fulfill wartime needs. Nonetheless, because the defense industries have sufficient capacity to enter into the international arms trade, there must be some slack that can be immediately directed to fulfilling the needs of the Chinese armed forces should the need arise.

There is also the widely reported problem of incidents of corruption within military plants producing civilian goods. It is difficut to determine how important this problem is, or what effect it is having upon the defense industries. It could well be that such publicity is designed as a warning that misuse and abuse of these plants will result in severe punishment. Because corruption among civil officials also received wide publicity, the problem appears to be one of keeping corrupt practices to a manageable level rather than a particular problem with military enterprises.

Doctrine, Strategy and Technology

For much of the past decade Chinese strategists have grappled publicly with the problem of adjusting their concepts of military doctrine and strategy to the demands of modern military technology. Yet, although many observers view this issue as one where China has had to respond to the more advanced technologies of potential aggressors, Beijing has also found it necessary to respond to its own advances in military technology. The development and deployment of nuclear-tipped ballistic missiles brought China into the logic of nuclear deterrence, and as the armed forces deployed increasing numbers of combat aircraft, armored fighting vehicles

(AFV), artillery pieces, and more capable naval forces, the complex battlefield requirements of combined arms operations became of greater concern. The response of Chinese strategists has been to move away from reliance on protraction and attrition as the keys to the defense of China as they move closer to concepts of forward defense and nuclear deterrence in their analysis of the demands of a "future war against aggression."

Thus, although the Chinese armed forces are clearly decades behind other major military powers in terms of the technology that forms the basis of most of the weapon systems and military equipment they deploy, their concepts of doctrine, strategy, and military operations are beginning to reflect both the technology they have and that they plan to incorporate into their order of battle over the next two decades.

"People's war under modern conditions" became the rubric for modifications in Mao's concepts of doctrine and strategy that were seen as essential if China was to make a successful transition to strategies that would make the most effective use of its armed forces. Strategic nuclear weapons were seen as the shield behind which China could slowly improve the capabilities of its conventional forces. The objective behind improving the capabilities of these forces and restructuring them to make them more capable of fighting combined arms warfare is stop or disrupt a Soviet invasion before it can penetrate too deeply into China. By seeking the capability to effectively implement such a strategy, the Chinese leadership is explicitly rejecting the classical concepts of people's war developed by Mao Zedong in the 1930s. As the defense minister observed in 1983: "The principle of war is to achieve the greatest victory at the smallest expense. To achieve this, we should depend not only on political factors but also on the correct strategy and tactics of the war's commanders, the sophisticated nature of our military equipment, the quality of our personnel who use the equipment, etcetera." [7]

No matter how slowly it occurs, the current military modernization program is designed to give the Chinese armed forces the capability to face an adversary on something approaching equal terms.

Such a capability is decades away, and over the next 15–20 years, assuming the USSR and the United States maintain the level of technological innovation they have sustained for the past 20 years, the Chinese cannot attain the level of military technology achieved by the superpowers. What does seem to be the case is that the time of gross imbalance is coming to an end. Improvements made in their T–59 tank and Chinese interest in procuring and producing precision guided munitions for anti-armor and air-to-air combat and for the defense of their naval forces demonstrate's Beijing's goal of improving the battlefield performance of their current weapon platforms. The PLA's military exercises over the past few years emphasizing combined arms warfare have been specifically designed to improve the armed forces' capabilities to fight effectively in the early stages of a war with the Soviet Union. However, the ability to conduct a forward defense against Soviet forces cannot be

[7] Zhang Aiping, "Several Questions Concerning the Modernization of National Defense," *Hongqi* (Red Flag), No. 5, March 1983, in FBIS-CHI, No. 053, 17 March 1983, p. K–2.

achieved without considerable improvement in Chinese weaponry and equipment as well as improved battlefield tactics. Chinese concern over the technology of contemporary warfare can be seen in the simulated use of tactical battlefield nuclear weapons as part of their training scenarios. Maneuvers have been conducted in which Chinese forces have had to respond to the use of tactical nuclear weapons to break open their prepared defenses. On another occasion, Chinese forces have simulated the use of low yield weapons to break up a concentration of enemy forces.[8]

The importance of these exercises is not to be found in what they may tell us about actual Chinese military capabilities, but in what they say about the way the Chinese military leadership now thinks about military strategy and the kinds of military operations and weapon systems required to support such a strategy.

By the mid-1980s it has become evident that what was being debated inside China in the mid to late-1970s has now largely been resolved. China's doctrine and strategy for a "future war against aggression" has evolved to the point that people's war as it was conceived in the 1930s will be used only as a last resort. The intention is to develop a nuclear and conventional capability that will permit China to defeat an invader without reverting to the brutal requirements of a war of attrition in which China pays the costs of protraction. In the event of a nuclear war, China's search for a survivable second strike capability threatens the potential adversary with detonations on its own homeland, thus China will not pay the entire cost of nuclear conflict.

IMPLICATIONS FOR THE UNITED STATES [9]

The implications of China's military modernization programs for the United States are mixed, for they present both opportunities and risks. The modernization of China's armed forces and its defense industrial base assists the United States in maintaining a stable balance of military forces along the Sino-Soviet border. Thus growing Chinese military capabilities help check the expansion of Soviet military power and influence in Asia. At the same time, however, these same capabilities may, in the future, be used to threaten American friends and allies in the Asia-Pacific region. It is also the case that China's most advanced ICBMs, though currently few in number, are now capable of reaching the continental United States with thermonuclear warheads. It is also suggested by some that China's nuclear weapons program has introduced proliferation problems into the region by prompting India to develop its own program and by covert assistance to Pakistan's alleged nuclear weapons program—a charge denied by Beijing.

The ambiguous implications of China's defense modernization efforts, especially its strategic weapons, has led to a level of disagreement over the most judicious response available to the United

[8] Reports on these exercises are to be found in Beijing, Xinhua, 20 July 1982, in FBIS–CHI, No. 141, 22 July 1982, pp. K-2/4; *Ningxia Ribao* (Ningxia Daily), 27 June 1982, in FBIS–CHI, No. 129, 6 July 1982, pp. K-19/20; and "China Tests New Military Strategy," the New York Times, 14 July 1982, p. 3.

[9] A more detailed analysis of these issues is to be found in Robert G. Sutter, "Chinese Nuclear Weapons and American Interests—Conflicting Policy Choices," this volume.

States. There is obviously little support for direct American assistance to Beijing's nuclear weapons program. At the same time, there is general agreement that Washington's ability to impede the program through technology embargoes is extremely limited. Many do, however, favor a freer approach to the transfer of so called "dual-use" technologies that, although designed primarily for civil applications, do have potential military applications in both conventional and nuclear weapons programs.

The primary advantage perceived in a more liberal approach to the transfer of dual-use technology is the belief that it would foster a greater sense of cooperation and trust between China and the United States. This could lead to greater cooperation by Beijing in issues of international arms control and in limiting the proliferation of nuclear weapons. A more liberal approach to such transfers could also assist in closing what many see as a dangerously widening gap between Soviet and Chinese weaponry, especially in the realm of nuclear arms. The overall effect of such liberalization is seen as contributing to Beijing's confidence that its own defense is assured, therefore the Chinese leadership would concentrate even more on its problems of domestic economic development and would be less inclined to use military force in support of its foreign policy objectives.

Yet another strongly held view is that any move toward a more liberal trend in US military technology transfers should be linked specifically to Chinese behavior in such areas as arms control, nuclear non-proliferation, and American concerns over the future of Taiwan.

Finally there are those who directly oppose any liberalization of American technology transfers to China that would directly or indirectly assist Chinese defense modernization programs, especially those related to strategic weapons. The concerns of those who hold this position are threefold: that any appearance of US military assistance to China would unnecessarily aggrevate US-Soviet relations, thereby jeopardizing American interests in the limitation of strategic arms and other areas where the United States seeks to ease the tensions between itself and the USSR; secondly, that such assistance disturbs friends and allies of the United States in Asia who entertain some doubts about China's long-term interests and objectives in the region; thirdly, that any sign of US support for China's nuclear weapons program would undercut American opposition to the proliferation of nuclear arms.

It must also be noted that Beijing's own position on the limitation of strategic arms and nuclear proliferation has been modified over the past few years. China states that it does not transfer nuclear weapons technology or materials to anyone, specifically denying connection with the programs believed to be underway in Pakistan and South Africa. Beijing has recently joined the International Atomic Energy Agency (IAEA) and now regularly participates in the United Nations' nuclear disarmament forums. However, it publicly argues that the overwhelming advantage in nuclear weapons held by the United States and the USSR makes it impossible for China to stop its own programs. It therefore demands major cuts in the arsenals of the superpowers before it will contemplate a reduction in its own weapons. With this underlying argument China now supports arms control negotiations between the US and the USSR in both strategic weapons and intermediate nuclear forces (INF).

Harsh though Chinese rhetoric might be when it condemns the nuclear weapons programs of the US and the USSR, it is a significant change from the recent past when Beijing charged that Soviet-American strategic arms negotiations were designed purely to ensure superpower monopoly of such weapons. In the same vein, China used to condemn the nonproliferation treaty (NPT) on the grounds that the spread of nuclear weapons would serve to undermine the superpower monopoly of strategic arms. Even now, however, Beijing refuses to sign the NPT and has refused to accept "full scope" safeguards for its nuclear exports and has not agreed to the Nuclear Supplies Guidelines.

Even with the change in China's stance on strategic arms negotiations between the US and the USSR, and its changing attitude toward issues of nuclear proliferation, US assistance to China's nuclear weapons program is seen as unwise. The more difficult issues revolve around the transfer of technology applicable to conventional arms. There can be no long-term assurance that the capabilites developed from these technologies will not be used against American interests. Nonetheless, restricting sales of military and dual-use technologies that are widely available would serve only to aggravate the already existing tension between the United States and China that is directly related to the extensively reported logjams created by bureaucratic impediments to efficient technology transfer. There is a very delicate policy issue involved here, for on the one hand China expects to be treated as a "friendly but non-allied country" when export controls are applied to technology transfers, while on the other there is the question of to what extent the United States should directly or indirectly assist Chinese military modernization. Choices made under these conditions specifically relate to what the United States wishes to establish and maintain as its relationship to China, and what risks it is willing to accept in creating such a relationship. However, because Beijing plans only slow and incremental improvements in its conventional forces, there is no suggestion that the United States should be involved in a dramatic military technology transfer. It is perhaps in this fact that there is a release from the dilemma. The United States is not being put in a position where the technology or weapon systems it transfers will make a major change in the capabilities of the Chinese armed forces, thus the choices Washington faces may be politically sensitive but they are not militarily critical.

CHINESE DEFENSE EXPENDITURES, 1967-83

By Ed Parris*

CONTENTS

SUMMARY

Although the Chinese now publish information on their annual level of spending for defense, they do not elaborate on which national security programs and activities are funded. Analytical constructs used in this study suggest that recent spending levels announced by the Chinese understate the funding of national security programs by at least one-half.

The trend of estimated Chinese spending shows a rapid rise between 1967 and 1971, followed by a sharp decline in 1972. Except for an increase in 1979 due to costs associated with the border war with Vietnam, annual Chinese defense spending has been relatively constant since 1975.

Defense has nonetheless absorbed a fairly substantial portion of Chinese economic resources. Although it is very difficult to assess accurately the current share of the gross national product (GNP) devoted to defense, the figure probably now falls within the range of 6–8 percent.

Defense spending, however, is taking a much smaller share of China's GNP now than a decade earlier. Military modernization has been subordinated to a massive effort to develop China's econo-

* Defense Intelligence Agency.

my, and the resource decisions to constrain defense spending probably were initially implemented in the 1971-72 time period.

Over the long term, it will be difficult for China's leadership to make important decisions concerning defense expenditures without regard to the development of the overall economy. Because defense competes directly for those very limited resources that are vital for developing the economy, the opportunity costs for expanding defense capabilities will continue to be very high.

Nevertheless, the availability of Western technology is allowing the Chinese armed forces to procure some relatively modern weapon systems at affordable costs. Even with constant levels of spending, the Chinese can continue to modernize while expanding their military capabilities. Although spending for the strategic offense forces amounted to less than 5 percent of total defense spending in 1983, annual spending levels have been steadily rising since 1978. This sustained rise in spending for strategic offense, triggered by an emphasis on larger and more sophisticated missile systems, implies that the Chinese are striving to increase rapidly their measure of strategic security as the national economy undergoes its massive development program.

Thus, the current trend of Chinese military modernization entails an emphasis on the development of more sophisticated strategic offense weapon systems incorporating advanced technology, combined with a program of comprehensive military force restructuring and increased professionalism. However, in terms of the broad scale of military modernization, time will be required to assimilate new technology into existing production processes, to develop associated supply and maintenance organizational structures, and to train military personnel in the effective use of the new equipment.

1. Introduction

In 1979, the Chinese revealed information about their state budget for the first time in 20 years. In that year, data were also provided for the state budgets of 1978 and 1977. The Chinese have continued to publish figures for their annual state spending levels since the 1979 announcement.

The Chinese have not explained which activities were covered by the figures reported for national defense, but these figures clearly represent only a portion of total defense spending. Defense activities include an array of functional categories including construction, procurement, pay and allowances, operations and maintenance (O&M), and military research, development, testing, and evaluation (RDT&E). The Chinese approach to publishing defense expenditures appears to be analogous to the single-figure defense entry in the state budget of the Soviet Union, which is known to reflect only a portion of actual defense spending.

This report presents estimates of Chinese defense spending over the 1967-83 time period. Due to uncertainties as to how the Chinese define defense spending, the definition used in this report is based upon that used to describe US national security programs. Because all conceptual approaches entail some compromise, an important effect of the selection of this approach is that costs for con-

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structucting and maintaining military production facilities are not included in the estimates.

The estimates of Chinese defense spending to be presented are based on a building-block methodology that incorporates an extensive data base with a sophisticated cost analysis model.[1] A detailed list of the activities and physical components of the Chinese military—including data on order of battle, manpower, equipment production, military construction, and the operating practices of the military forces—is compiled for each year. These force components and activities are then converted into monetary estimates.

Because this analysis focuses on the flow of real resources as well as the implications of the defense burden, expenditures are valued in Chinese yuan terms, rather than in US dollars. Characteristics of the price data used by the cost analysis model dictate that calculations be handled in constant 1974 yuan. Constant prices allow the estimates to reflect real changes in defense activities, not the effects induced by China's recent inflation. The yuan estimate facilitates understanding of the economic and resource considerations that underlie Chinese defense planning, and also helps to reveal priorities within the overall defense budget.

It should be understood that the estimates of defense spending presented in this report differ markedly from those reported by the Chinese in their annual state budgets. For example, the 17.7 billion yuan budgeted for defense in 1983—about 13.7 percent of the state budget—is less than half the amount that was indicated to have been spent by the model (see Table 1).

TABLE 1.—CHINESE MILITARY SPENDING, 1977–83

[Billions of yuan] [1]

Year	Announced spending	Estimated spending
1977	14.9	38.5
1978	16.8	39.6
1979	22.3	46.2
1980	19.4	40.7
1981	16.8	39.8
1982	17.6	40.0
1983	17.7	40.0

[1] Announced spending is in current yuan terms whereas estimated spending is in constant 1974 yuan terms. At the end of August 1984, the yuan was officially valued at 1 yuan=$0.42 US. Inflation in China will cause the announced spending in recent years to be somewhat overstated in terms of real purchasing power. All estimates in this report are in constant 1974 yuan terms.

Building block analytical constructs suggest that the components of the Chinese defense effort—in a budgetary framework corresponding to that used by the US Department of Defense—total about 40 billion yuan for 1983, about 30 percent of the state budget.

The cost estimates in this analytic model may have margins of error that are substantial in some categories. Spending trends

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[1] For previous related studies, see Sydney Jammes, "The Chinese Defense Burden, 1965–74," in Joint Economic Committee, 94th U.S. Congress, "China, A Reassessment of the Economy" (Washington: Government Printing Office, 1975), pp. 459–466; Ronald G. Mitchell and Edward P. Parris, "Chinese Defense Spending, 1965–78," in Joint Economic Committee, 96th U.S. Congress, "Allocation of Resources in the Soviet Union and China—1979" Part 5. (Washington: Government Printing Office, 1980), pp. 66–72; and Ronald G. Mitchell, "Chinese Defense Spending in Transition," in Joint Economic Committee, 97th U.S. Congress, "China Under the Four Modernizations" Part 1. (Washington: Government Printing Office, 1982), pp. 605–610.

probably have more validity than estimates of absolute spending levels. Also, estimates of weapons procurement expenditures—that account for over 45 percent of estimated total spending—are probably more valid than estimates of facility construction, personnel costs, or O&M. Because of the many uncertainties about Chinese RDT&E efforts, these estimates—that account for about 15 percent of total estimated spending—are probably least valid.

Serious distortions may be associated with the methodological approach inherent in the cost analysis model. This model, for example, utilizes experience curves that have been obtained from studies of US industry for various types of production processes, such as for aircraft and missile fabrication, and the construction of electronic equipment. These experience curves probably are not completely valid in the China context, and their cumulative effect probably will be to understate somewhat the true costs of Chinese production.

2. Background

China maintains the world's largest military force, and its army has pervaded almost every aspect of Chinese society. When the Communists took power in October 1949, the country had been thoroughly ravaged by war, first by the Japanese and then by the bitter civil strife that followed. Most of the industrial base had to be reconstructed, and much of this occurred with assistance from the Soviet Union during the mid-to-late 1950s. Progress in the development of this industrial base came to a standstill in 1960 when the Soviet Union abruptly withdrew its assistance.

Since 1961, China has fallen behind in its industrial reconstruction goals, and its industries have been forced to rely on technology that is generally appreciably behind that of the developed countries. In addition, China's energy, transportation, and communications infrastructure remains heavily overburdened.

After the death of Mao Zedong in 1976, China's leadership intensified the debate over the proper path for transforming the world's most populous developing country into a modern, industrialized state. The "Four Modernizations" policy (industry, agriculture, science and technology, and national defense) that evolved aims at achieving developed-nation economic status by the year 2000. One of the unique aspects of this modernization plan is Beijing's unprecedented willingness to use large-scale imports of selected technologies in the development effort.

Although the development of a modern defense establishment remains a fundamental objective of the Chinese leadership, defense modernization has been assigned the lowest priority among the Four Modernizations. The quality and sophistication of China's military production has lagged considerably because of the lack of industrial technology. Many types of weapons in China's military inventory are copies or modifications of Soviet designs of the 1950s.

The People's Liberation Army (PLA)—the name assigned to China's military forces—has traditionally emphasized large, conventionally equipped ground forces utilizing a wide range of simple, time-tested weapons. The orientation of these forces has been primarily defensive. China's navy has been equipped to fulfill a coastal defense role, the ground forces possess only a limited projection capability, and the air force consists largely of obsolescent air defense aircraft.

The Chinese have developed and deployed some strategic medium-range ballistic missiles (MRBMs), intermediate-range ballistic missiles (IRBMs), and intercontinental ballistic missiles (ICBMs), and have recently announced the test firing of a submarine-launched ballistic missile (SLBM). The difficult and costly acquisition of these strategic offense systems attests to China's long-term ambitions to become a major world power.

3. Expenditure Trends and Historical Perspective

a. Overview of Expenditures

Defined to correspond to US budgetary accounts and measured in 1974 prices, estimated Chinese spending for defense increased from about 24 billion yuan in 1967 to almost 41 billion yuan in 1971. Spending then fell to its lowest point in the decade in 1973—to a level of 35 billion yuan—but increased substantially in 1975. Spending remained at the 1975 level—almost 39 billion yuan—until the period of the border war with Vietnam, in the spring of 1979, when spending reached an all-time high of 46 billion yuan. Spending fell sharply in 1980 and 1981, and leveled out at about 40 billion yuan in 1983 (see Figure 1).

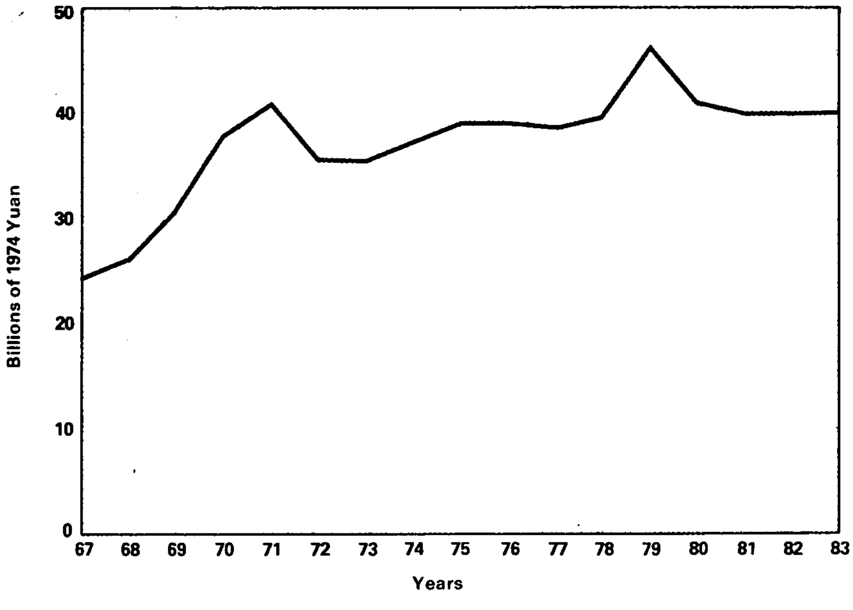


Figure 1. Estimated Chinese Military Expenditures.

b. Historical Perspective

Arms production was severely curtailed in the early 1960s as the effects of the Great Leap Forward—initiated in 1958—compounded the decline associated with the withdrawal of Soviet economic and military assistance. By the mid-1960s, as the Chinese perceived direct external threats by the US involvement in Vietnam, the output of nearly all types of weapons had recovered. However, in 1966 Mao Zedong launched the Great Proletarian Cultural Revolution. Despite the efforts by the leadership to insulate defense industries from the social turmoil, the estimated value of military procurement fell by over 10 percent in 1967 due to lagging defense production.

As the Cultural Revolution was unfolding, Beijing perceived that it was faced by two powerful adversaries. The Chinese were disturbed by intrusions of US aircraft and ships into what they considered to be their territorial areas, while tension was building on the borders with the Soviet Union to the north. The adverse effects of the Cultural Revolution on military production were better controlled in 1968, and spending for defense began to increase rapidly as Beijing responded to heightened tensions with the Soviet Union. The PLA became heavily involved in domestic politics as order was restored, with a large number of troops assigned to economic and political activities. Defense Minister Lin Biao benefited from the rapid emergence of the military in Chinese affairs as his position within the leadership was strengthened.

In early 1969, Chinese forces clashed with Soviet troops along the Ussuri River. Reacting to the bloody fighting in the north, defense spending rose by almost 35 percent between 1969 and 1971. Spending for ground force procurement increased by over 40 percent during this period, and aircraft procurement more than doubled.

Very important military-economic issues probably were debated by the Chinese in 1971. One major concern focused on the heavy involvement of the PLA in internal affairs at a time when the defense against the Soviet Union appeared to be inadequate. The Vietnam War had turned into a stalemate, and the risk of direct conflict between the United States and China had largely subsided. Premier Zhou Enlai reportedly had been advocating a rapprochement with the United States over Lin Biao's objection. At about that time, the United States signaled its interest in easing tensions with China by ending travel restrictions and secretly sending the Secretary of State to Beijing for a conference with Zhou. In September 1971, Lin Biao and several of his supporters died allegedly after an unsuccessful effort to oust Chairman Mao Zedong. The momentum of military mobilization carried defense spending in 1971 to a high point, at over 40 billion yuan.

The decline in defense spending in the 1972–73 time period coincided with rapidly warming relations with the United States. President Nixon visited China in February 1972 and issued the Shanghai Communique as US involvement in the Vietnam War was coming to an end. Rapprochement with the United States enabled Beijing to focus on the Soviet Union as its principal threat. This newly emerging relationship with the United States simplified China's immediate national security problem, and offered promise for a source of technology for long-term defense modernization. It is estimated that defense spending declined by almost 15 percent in 1972 as procurement was cut by 20 percent. Total defense spending continued to slide in 1973. During the 1971–73 period, spending for ground force procurement fell by over 30 percent, while spending for new aircraft dropped by two-thirds.

A low point for Chinese defense spending occurred in 1973 as military influence within the leadership plummeted after the Lin Biao affair. The number of PLA personnel represented on the Chinese Communist Party Central Committee was substantially reduced at the Tenth National Congress in late 1973. Following this congress, most of the military region commanders were rotated, causing a substantial loss of political influence within this group. However, the military received a boost in 1974 when Deng Xiaoping advocated increased military modernization, and supported enhanced training for the forces.

In January 1975, Zhou Enlai unveiled the Four Modernizations policy, which was to be accomplished by the turn of the century. Although not the highest of the modernizations, national defense was explicitly included as one of the four principal priorities. The movement toward higher defense spending continued in mid-1975 when Deng Xiaoping delivered a speech to the Military Commission in which he outlined Central Directive 18–1975—apparently Deng's blueprint for China's future military policy. This directive reportedly called for a modernization of China's military forces, with an emphasis on improved weapons and professionalism. It appears that Deng was somewhat successful in his efforts to reinvigorate China's military forces because estimated defense spending increased during the 1973–75 time period by about 10 percent. Procurement rose by almost 15 percent, due largely to renewed acquisitions of advanced military aircraft.

More turmoil and internal indecision appeared in 1976 after Zhou Enlai died, and the programs of Deng Xiaoping were set aside as he was again purged from the leadership. Later that year, Mao died, and shortly thereafter the influential Gang of Four was also purged. Defense spending remained at the 1975 level as national economic priorities were again debated by China's leadership.

With Hua Guofeng as China's leader in early 1977, deliberations on the defense budget centered on the dilemma posed by the need to develop the economy while simultaneously building the military capability to counter the threat posed by the Soviet Union. The leadership probably was satisfied that war was not imminent and that higher levels of defense spending would divert resources from important civilian development projects. The decision was apparently made to avoid increases in defense spending, thus continuing the subordination of military modernization to the development of the overall economy.

Chairman Hua Guofeng stated in early 1978 that economic growth had to be the overriding goal of China's leadership. A reduction in the pace of military modernization would permit higher rates of investment and growth for China's economy. This was vitally important because China was still suffering from the effects of the Cultural Revolution. Schools and universities had been closed during the "lost decade," severely damaging China's technological base. At the Third Plenum of the Chinese Communist Party's Central Committee in December 1978, Deng Xiaoping and his followers regained their influence on economic decisionmaking, promoting more imaginative approaches to economic development.

In an effort to gauge the degree of obsolescence of China's military inventory and to assess the costs of modernization, numerous military delegations were sent to Western nations in 1978 to learn about foreign weapon systems that were available for purchase. Actual purchases were minimal, however, because the Chinese desired primarily to inspect available technology levels, while conserving the foreign exchange that was required for the acquisition of industrial technology.

Estimated defense spending was constant during the 1975–78 time period, but procurement declined somewhat—possibly reflecting a reluctance to continue acquisition of obsolescent military items at comparable rates as in the past.

In 1979, estimated defense spending soared to its highest level—to over 46 billion yuan—as the Chinese engaged Vietnam in a sudden and intense border war. Total defense spending increased by over 15 percent above the 1978 level, with procurement jumping by over 20 percent. The Chinese announced a 5.5 billion yuan increase in defense spending in 1979 because of costs associated with the brief war.

At the Third Session of the Fifth National People's Congress in September 1980, it was announced that the defense budget for 1980 would be cut by 14 percent. Further cuts were announced at a subsequent meeting—in February 1981—of the National People's Congress Standing Committee. It is estimated that China's defense spending dropped sharply in 1980, continued to fall in 1981, and was essentially constant in 1982 and 1983. During the 1979–83 time period, estimated annual spending fell by almost 15 percent.

4. Spending for the Forces

To facilitate analysis, estimated spending for China's military forces is divided into the following six functional categories: strategic offense, strategic defense, ground forces, naval forces, tactical air forces, and national command and support activities. Although these categories reflect US budgeting practices within the Department of Defense and do not follow the organization of China's PLA, the spending trends associated with these categories provide useful insights concerning Chinese defense priorities.

a. Strategic Offense

China's strategic offense forces include the intercontinental attack forces—CSS-3 and CSS-4 ICBMs, the SLBM program, and military support earth satellites—and the peripheral attack forces—the CSS-2 IRBM, and the CSS-1 MRBM, with associated support.[2] It is believed that China has not developed a strategic bomber force whose mission is similar to that of the Strategic Air Command of the US Air Force.

Estimated spending for the strategic offense forces averaged less than 5 percent of total defense expenditures over the 1967–83 time period, but this proportion has been steadily increasing since 1979. Spending rose sharply through 1971, then dipped as the Chinese

[2] The differentiations noted here between "intercontinental" and "peripheral" are for purposes of analysis, and are not intended to imply actual limitations to targeting flexibility or role.

began a transition to larger, more sophisticated missile systems. Spending for strategic offense increased through 1976, hit a plateau, then began a rapid climb from 1979 through 1983 (see Figure 2).

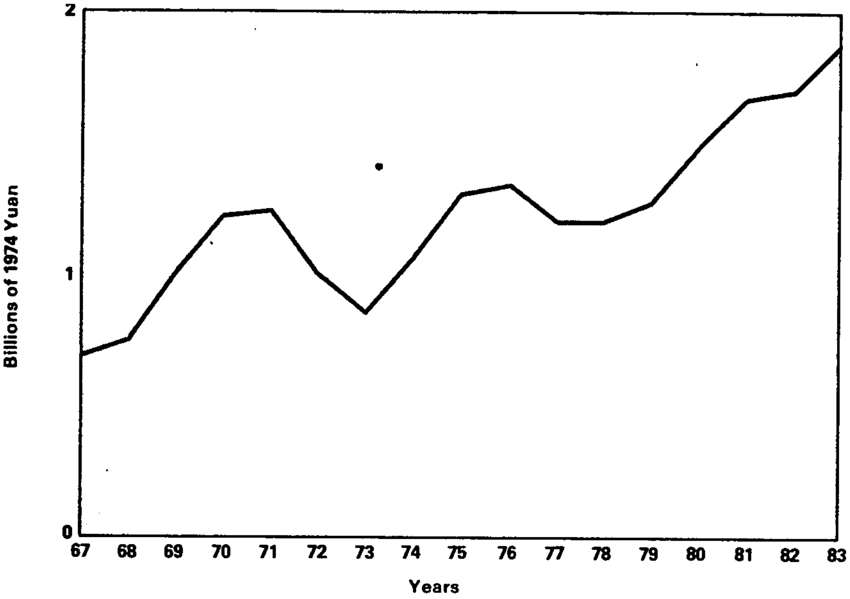


Figure 2. Estimated Spending for Strategic Offense.

b. Strategic Defense

China's strategic defense forces include air defense aircraft—F-5 (MiG-17/Fresco), F-6 (MiG-19/Farmer), F-7 (MiG-21/Fishbed), and the F-8 (Finback), a new Chinese-developed interceptor now being deployed with the forces—anti-aircraft artillery (AAA), surface-to-air missiles (SAMs), and the radars and communication facilities that support the strategic air defense system.

Spending for strategic defense grew rapidly between 1967 and 1971 as the Chinese invested heavily in F-6 aircraft, AAA units, and CSA-1 SAMs. Spending dropped sharply in 1972 as aircraft procurement was drastically curtailed, but climbed steadily from 1973 through 1976 as procurement of air defense aircraft was resumed. High spending in 1976 was associated with the installation of more advanced early warning equipment, and the dip in spending in 1978 and rise in 1980 were associated with variations in air defense aircraft procurement and the acquisition of air defense radars. Estimated expenditures for strategic defense forces averaged about 15 percent of total defense spending during the 1967-83 period (see Figure 3).

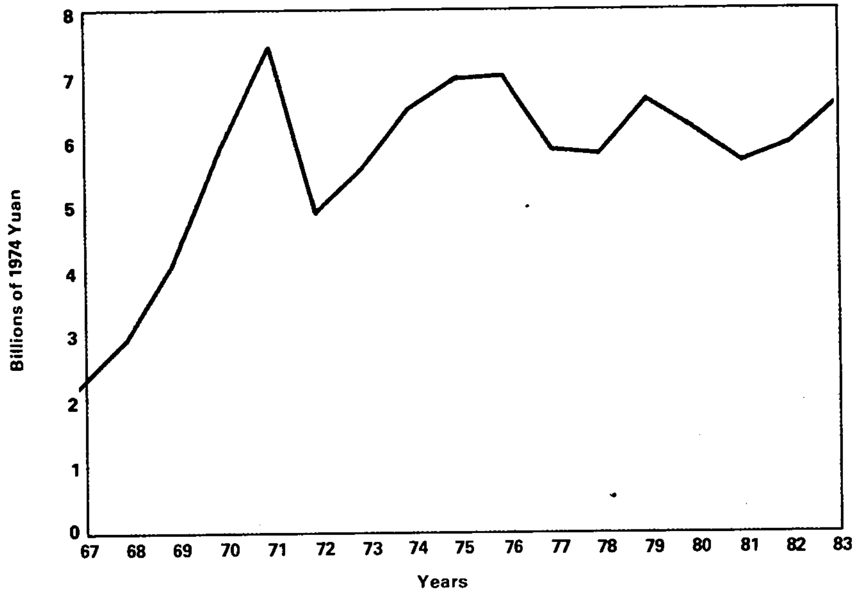


Figure 3. Estimated Spending for Strategic Defense.

c. Ground Forces

With a population of over one billion, China is able to conscript a huge army—by far the largest in the world. Because of modest wages and an emphasis on simple weaponry, the costs of maintaining this force are comparatively low. Estimated spending for the ground forces has shown a gradual increase since 1967, with a rapid rise immediately preceding the border war with Vietnam in early 1979. About one-fourth of total defense spending has been allocated to the ground forces over the 1967–83 time period, and that proportion appears to have been generally constant over those years (see Figure 4).

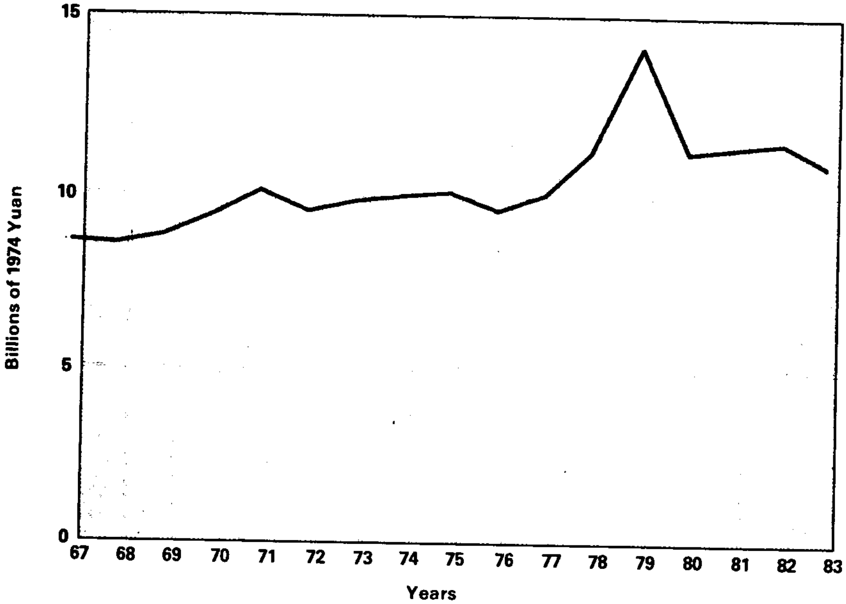


Figure 4. Estimated Spending for Ground Forces.

d. Naval Forces

Estimated spending for naval programs, including the naval air force, showed a generally steady increase during the 1967–79 time period, but has rapidly declined since 1979 as Chinese shipyards have concentrated on military sales and nonmilitary construction. Up to about 1976, the defensive role of China's navy was reflected by an emphasis on procurement of minor surface combatants and submarines. Since that time, there has been a greater emphasis on the construction of major surface combatants—destroyers and frigates. Spending for naval forces increased by somewhat more than 20 percent during the 1976–79 time period as construction of frigates doubled naval procurement costs. During the 1967–83 period, about 15 percent of defense spending was allocated to the naval forces (see Figure 5).

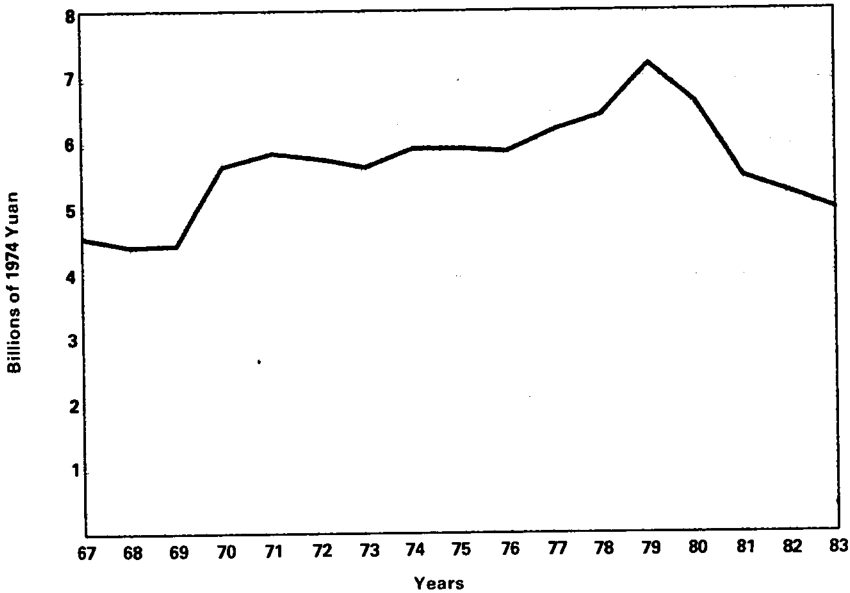


Figure 5. Estimated Spending for Naval Forces.

e. Tactical Air Forces

Spending for tactical air forces rose very steeply between 1967 and 1970 reflecting the early production of B-5 (Il-28/Beagle), A-5 (Fantan), and B-6 (Tu-16/Badger) bombers. The estimated share of total defense spending rose from less than 5 percent to over 10 percent during this time period. Estimated spending fell in 1972 and 1973, and despite a rise in 1975, the trend has been downward since that time. All of China's tactical bombing aircraft are technologically obsolescent. For example, China first acquired models of its mainstays of the tactical air force—the Il-28 and the Tu-16—from the Soviet Union in the 1950s. It is estimated that slightly more than 5 percent of total defense spending during the 1967–83 time period was allocated to the tactical air forces, with the proportion declining since 1979 (see Figure 6).

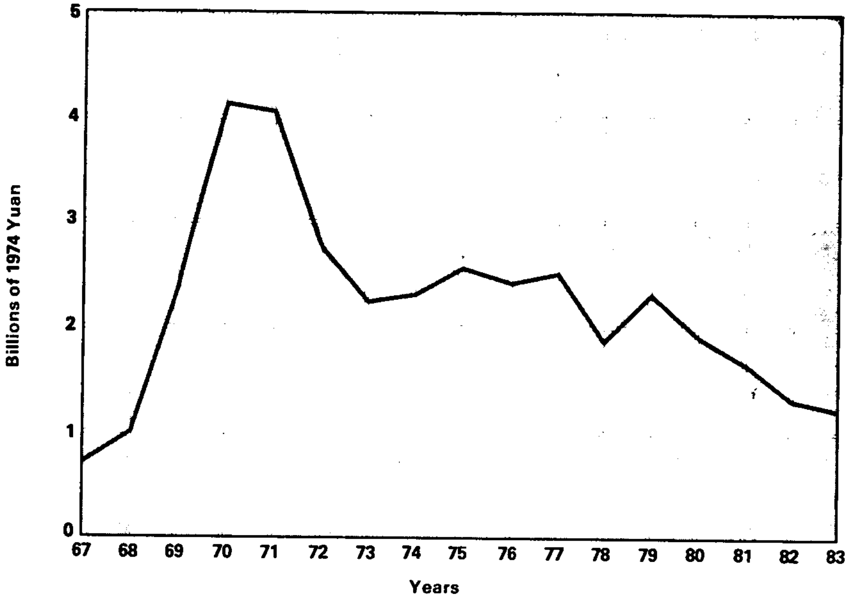


Figure 6. Estimated Spending for Tactical Air Forces.

f. National Command and Support Activities

Another 30–35 percent of total expenditures is accounted for by activities that are not included in the five categories discussed above. These other activities include national airlift forces, the administration and training of China's enormous militia, the retirement and demobilization apparatus, RDT&E, generalized training, and other miscellaneous command and support activities of the military forces. Estimated spending for national command and support increased by over 60 percent between 1967 and 1971 as China was rapidly building its military force structure. Spending declined in 1972 and 1973, but has been generally increasing since that time as the structure has become more elaborate (see Figure 7).

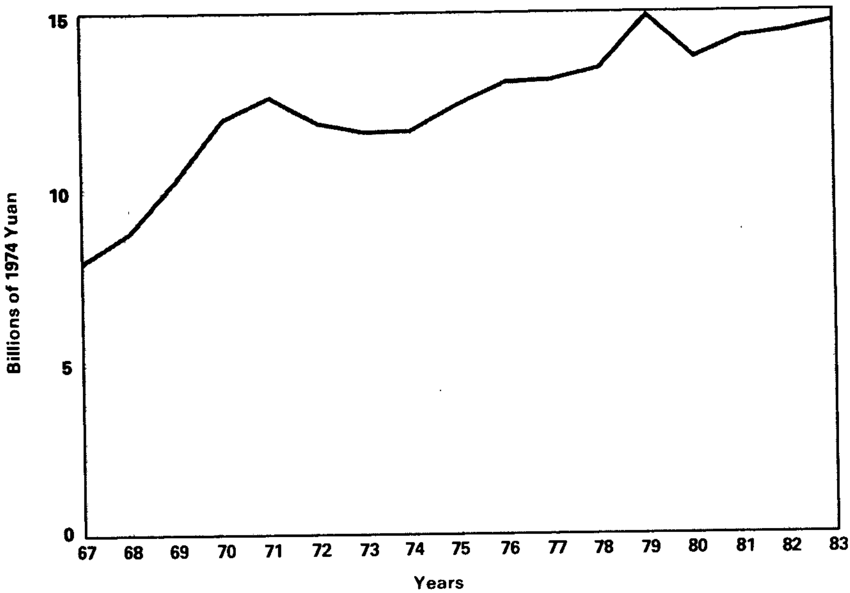


Figure 7. Estimated Spending for National Command and Support Activities.

5. Spending by Resource Category

The building-block elements that comprise the yuan estimates of Chinese defense costs are grouped, for analytical convenience, into three principal resource categories: investment, RDT&E, and operating. Investment expenditures include military procurement and the construction of military structures, and reflect the flow of new and replacement equipment and facilities into the forces. Expenditures for RDT&E provide some indication of plans for future force modernization and sizing; and operating expenditures are the costs associated with the day-to-day functioning of the military forces. Defined to correspond to US Department of Defense resource accounts, it is estimated that almost 50 percent of total defense expenditures during the 1967–83 time period was allocated for investment. Over 15 percent was spent for RDT&E, and operating costs absorbed about 35 percent of the total (see Figure 8).

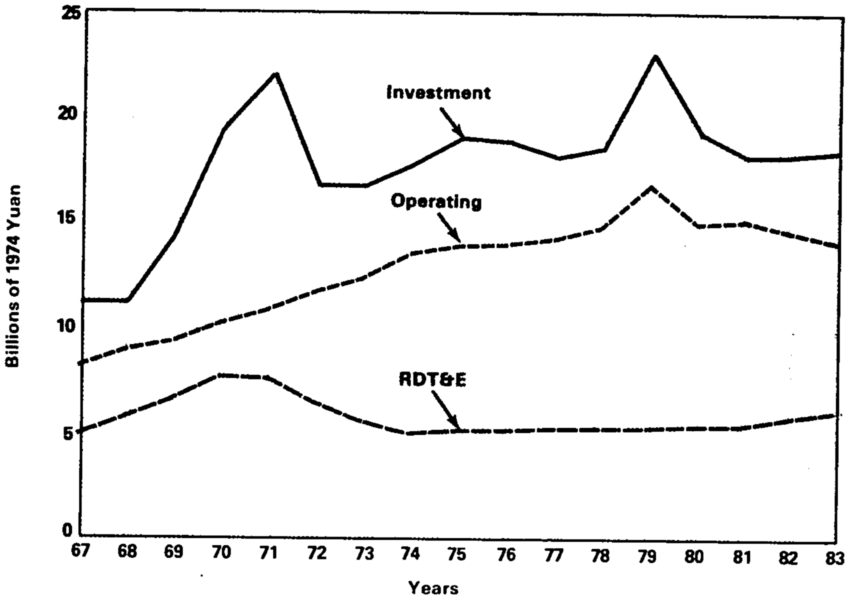


Figure 8. Estimated Defense Spending by Resource Category.

a. Investment

Defense investment consists of both the procurement of weapons and equipment and the construction of military facilities. It is estimated that over 90 percent of investment spending has been for weapons procurement, with the bulk of this going for aircraft, land arms, ships, missiles, and electronic equipment (see Figure 9).

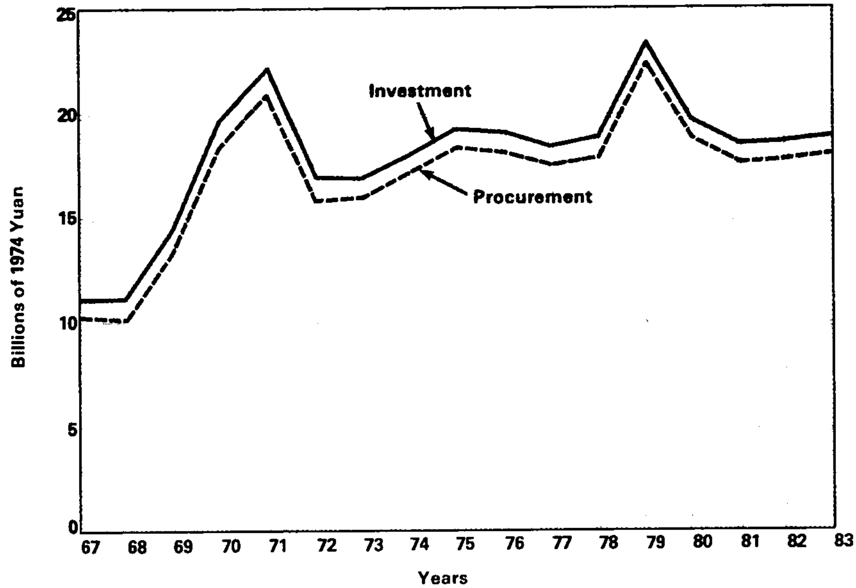


Figure 9. Estimated Spending for Investment.

Procurement is the resource category that largely determines the trend of total Chinese defense expenditures. In addition to its magnitude—over 45 percent of total outlays—spending for procurement of equipment is the most variable element of defense spending and the one most susceptible to policy change. The military procurement category includes spending for land arms, ships and boats, aircraft, missiles, electronic equipment, ammunition, nuclear weapons, general purpose vehicles, organizational equipment, and miscellaneous supplies and equipage. Almost 25 percent of China's spending for procurement during the 1967–83 time period has been for aircraft. Over 15 percent has gone for ground force weaponry, and about 10 percent has been allocated each for naval and for missile systems.

Estimated spending for procurement doubled between 1968 and 1971 as China rapidly bolstered its defenses. The priority during this period was on air defense aircraft, which accounted for about 30 percent of total procurement. Ground force weapons accounted for almost 20 percent of procurement, and spending for naval and missile weaponry, and ammunition each accounted for 10 percent of the total.

Led by a decline in aircraft production, procurement fell sharply in 1972. Purchases of land arms and missiles also declined, but acquisitions of naval vessels—where longer lead times for production were required—appeared to remain at about the same level. Although not all of the reasons for the drastic cutback in military procurement in 1972 are known, the primary economic factors probably were associated with new national priorities favoring industrial development at the expense of continued high investment in the military sector. Increased acquisition of aircraft in 1975 caused procurement spending to climb somewhat, and purchases of ground force equipment and ammunition contributed to the high level of procurement in 1979.

Aircraft procurement has been both the most expensive and the most variable of all the PLA procurement programs. The largest portion of these expenditures has been for the acquisition of about 3,000 F-6 aircraft for China's strategic defense forces. Large numbers of these aircraft have also been produced for export. Other expenditures for aircraft have been for B-6 and B-5 bombers, A-5 fighter-bombers, F-7 fighters, and several types of military transports and helicopters. The Chinese have reported that their new high-altitude interceptor—the F-8—has now reached operational status. Costs for the production of this aircraft are substantial as early models move down the assembly line.

The Chinese also produce a wide array of tactical and strategic missiles. The highest cost missile programs in terms of overall procurement spending have been for the CSS-1 MRBM, CSS-2 IRBM, the CSS-N-1 tactical cruise missile, and the CSA-1 SAM. Spending for missile procurement grew by about 15 percent between 1967 and 1971 as the Chinese invested heavily in CSA-1 SAM deployment. After a moderate decline between 1972 and 1974, spending for missiles rose in the mid-1970s as procurement of larger offensive missiles increased. The trend toward increased spending for larger missiles—the CSS-3 and CSS-4 ICBMs—appears to be continuing, as spending for the obsolescent CSA-1 SAM and CSS-N-1 cruise missiles tapers off.

Procurement of land arms for the PLA ground forces increased by about 85 percent between 1967 and 1971 as the Chinese attempted to respond to the Soviet threat on the northern border. This procurement declined after 1971, however, and was generally constant between 1975 and 1978. There was a sharp increase in 1979, however, as the Chinese reacted to the hostilities with Vietnam. In response to cutbacks in the acquisition of obsolescent equipment, land arms procurement fell sharply in 1980, and declined again in 1981.

China's navy has generally been supported by a vigorous construction program. Procurement of naval vessels grew from 1967 through 1970 due to large acquisitions of minor surface craft, along with construction of submarines. Annual procurement spending decreased gradually until 1976, and then began a steady increase driven by procurement of guided-missile destroyers and frigates. After a peak in 1979, procurement spending for the navy began to decline.

Of the various procurement programs associated with the navy, it is estimated that the Chinese have spent the most on Romeo Class submarines. Because of the high technology involved, costs associated with construction and modification of nuclear submarines have contributed significantly to the level of recent naval procurement spending.

Estimated investment spending for the construction of military facilities such as barracks, airfields, naval bases, and missile sites has generally been constant during the 1967-83 time period, and has accounted for somewhat less than 10 percent of total investment costs. Although some recent construction associated with more modern weapon programs has been very costly, the slow pace of much of this construction has allowed budgeted costs to be spread over a multi-year period.

b. RDT&E

RDT&E has claimed about 15 percent of total defense spending during the 1967-83 time period. These expenditures increased by almost 60 percent between 1967 and 1970, but began to decline in 1971, remaining essentially constant from 1974 through 1983. It appears that the majority of RDT&E funds have been directed toward the development of strategic missiles and space programs. However, progress on many of these programs has sometimes been intermittent as technological problems—many tied to Beijing's strong penchant for self-reliance—have been encountered.

Because of overall slow progress, some projects begun in the late 1960s which were initially heavily funded have only recently begun to appear with the forces. This apparent difficulty in translating weapons concepts into production probably is directly associated with the underdeveloped condition of China's technological base—especially the scarcity of trained scientific personnel. Although the weapon systems currently under development show a substantial technological improvement over those in production, many are only comparable to the state of the art of U.S. and Soviet military production in the 1960s.

c. Operating Expenditures

Estimated operating expenditures—spending associated with the operations and maintenance of equipment and facilities, as well as spending related to personnel—increased steadily during the 1967-83 time period. Outlays for the purchase and installation of spare parts—comprising about two-thirds of operating expenditures during the 1967-83 period—almost doubled, while personnel costs—pay and allowances, food, and personal equipment—increased by about half during the time period. The higher rate of growth in spending for O&M reflects the increasing size, diversity, and complexity of Chinese weapon holdings combined with the advancing age of the inventories.

6. Defense and the Economy

Defense has absorbed a substantial portion of China's economic resources during the 1967-83 period. Although there are very substantial methodological problems involved in assessing the share of gross national product (GNP) devoted to defense spending in 1983, tentative estimates indicate that the figure has fallen to the range of 6-8 percent. Despite a respectable rate of economic growth, China continues to be among the poorest countries in the world, with a per capita income valued at less than $500. However, China's burden of defense spending—though decreasing—still appears to be high when compared to most other developing nations of the world. The implication of a high defense burden coupled with a low per capita income is that any increases in burden can impose inordinately high opportunity costs for the economy.

The priority of defense spending within the national budgetary process has apparently fallen considerably since the rapid military buildup in the 1967–71 time period. Although the 1979 peak in defense spending exceeded the 1971 peak by almost 15 percent, China's estimated GNP in 1979 was about 60 percent above the 1971 level. An index of defense procurement spending shows a decrease of almost 15 percent in the 1983 level when compared with 1971, while a similar index of general industrial production, based on the gross value of industrial output (GVIO), reflects an increase of over 170 percent since that time. A comparison of these respective trends shows that defense procurement growth generally conformed to the growth of industrial production from 1967 through 1971. Since 1971, however, industrial production has continued its sharp upward trend, while defense procurement has shown a decline (see Figure 10).

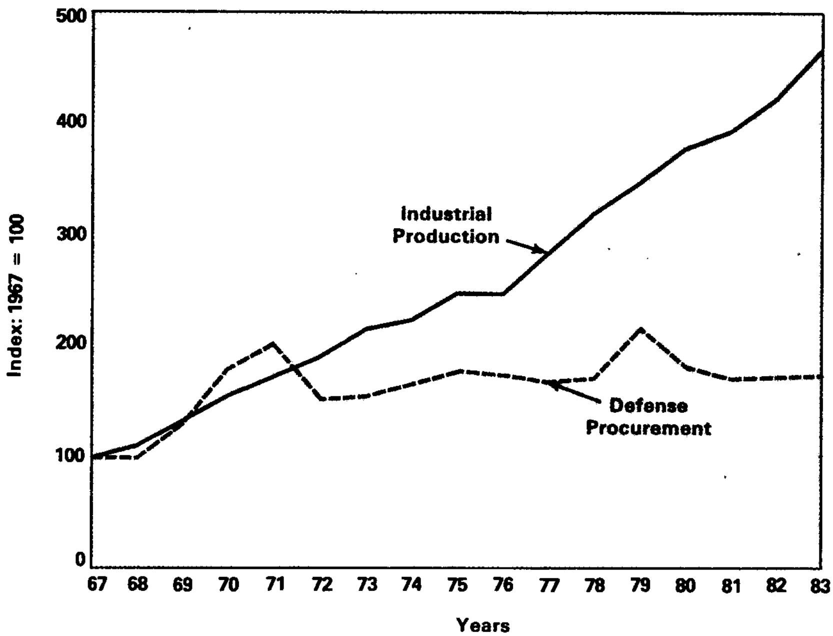


Figure 10. Indexes of Defense Procurement and Industrial Production. *

*Because of methodological differences in the preparation of data for military procurement and industrial production, this chart should be considered as a general representation of trends, and not as an exact comparison.

A comparison of these indexes reveals Beijing's subordination of military modernization to development of the overall economy, and suggests that the critical decisions to curtail military growth were initially implemented in the 1971–72 time period.

7. Implications

Based on analysis of estimated defense expenditures, China's leadership appears to be committed to developing the overall economy before undertaking an extensive upgrading of defense capabilities. With the exception of spending associated with the border war with Vietnam in 1979, estimated levels of defense expenditures have not increased appreciably since 1972. Therefore, as China's GNP has been steadily climbing at an impressive rate and the state budget has expanded proportionately, the relative share of the budget allocated to defense each year has generally been declining.

This constraint on defense spending appears to have been imposed over a period of several distinct political regimes in Beijing. Continuation of this trend, however, is by no means assured because of both domestic and international uncertainties. With the architect of the present national modernization plan—Deng Xiaoping—now in his 80s, it remains to be seen how long his regime will be able to continue subordinating military modernization to long-term economic goals with the same degree of effectiveness. Likewise, in the international realm, a serious deterioration in relations with China's recent antagonists, such as the Soviet Union or Vietnam could lead—as in 1979—to sharply increased allocations to the military.

Over the long term, however, it will be difficult for any leadership representing a nation as underdeveloped as China to set levels of defense expenditures without regard to the vitality of the overall economy. Defense competes directly for the very resources that are vital for developing the economy. The opportunity costs for expanding defense capabilities are high, particularly for an economy that is obligated to sustain a huge population—growing at a rate of about 15 million a year—while maintaining progress in economic development.

The current wide availability of Western technology is allowing the Chinese to procure more modern weapon systems at affordable costs. A paced acquisition of defense technology providing limited amounts of new hardware could allow more time for China's military forces to choose and thoroughly assimilate their modernization programs.

It appears that technology absorption is tied directly to the deficiencies of China's technical manpower. Virtually a decade of training was lost as a result of the Cultural Revolution because of a downgrading of research and development, and an excessive emphasis on self-reliance. Time will be required to assimilate new technology into existing production processes, to develop associated maintenance and logistic organizational structures, and to train military personnel in the use of new equipment.

A policy of constant annual allocations for defense need not be inconsistent with selective military modernization. The Chinese appear to be modifying priorities within their defense budget in order to provide a higher degree of national security within the constraints of an on-going fixed level of spending. Although spending for the strategic offense forces amounted to less than 5 percent of total defense expenditures in 1983, annual spending levels for strategic offense have been steadily rising since 1978. This sustained rise in spending, triggered by an emphasis on larger and more sophisticated missile systems, implies that the Chinese are striving to increase rapidly their measure of strategic security as the national economy undergoes its massive development program.

CHINESE NUCLEAR WEAPONS AND AMERICAN INTERESTS—CONFLICTING POLICY CHOICES

By Robert G. Sutter*

CONTENTS

I. Principal Findings

As a result of strenuous efforts over the past 30 years, China has managed to develop a modest nuclear force consisting mainly of over 100 medium and intermediate range nuclear missiles but also including a few intercontinental ballistic missiles, aging bombers, and a submarine-launched ballistic missile that has undergone successful testing. Aided initially by the Soviet Union, China has developed its nuclear forces largely on its own. Chinese leaders have given the nuclear weapons program a consistently high priority and have generally managed to insulate it from the negative effects of the tumultuous political changes in China.

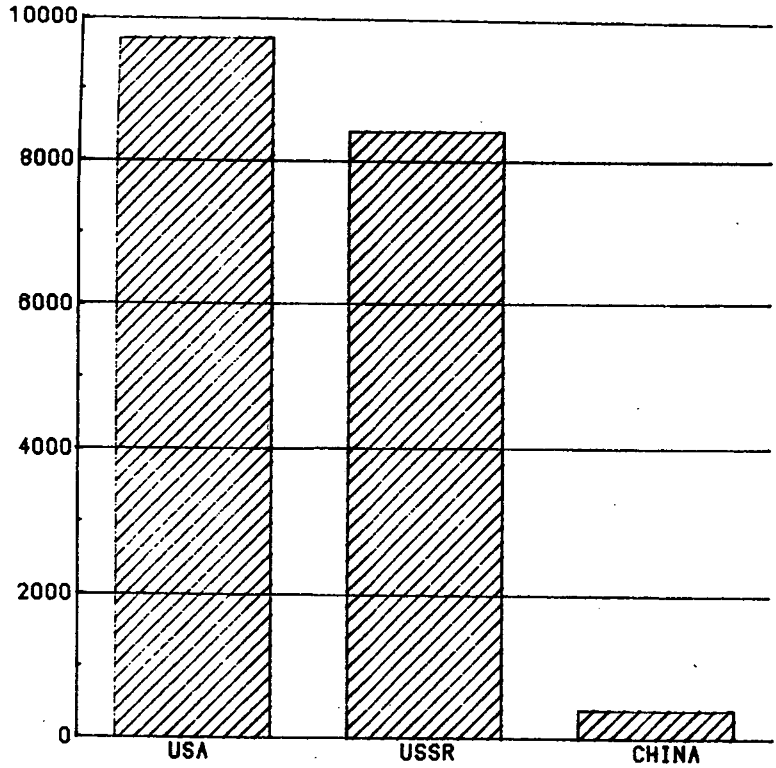
China is expected to continue to devote a considerable portion of its limited military resources to improve the quality—if not necessarily increasing the quantity—of its nuclear weapons, especially nuclear-weapons delivery systems. These weapons are seen as providing a key bulwark in Chinese defense at a time when Beijing

*Specialist in Asian Affairs, Foreign Affairs and National Defense Division. This article is based on a review of available unclassified literature and other data, as well as a series of interviews and consultations conducted with 15 U.S. Government and non-Government specialists knowledgable about Chinese nuclear weapons and their significance for U.S. policy. In order to encourage these individuals to be as frank as possible in offering their assessments, the author agreed that their remarks would not be for specific attribution. The author would like to express his thanks to those individuals who can be identified. They include A. Doak Barnett, Banning Garrett, Bonnie Glaser, Gerrit Gong, and Robert Worden. He would also like to note his appreciation to several colleagues at the Congressional Research Service, particularly John Collins, Warren Donnelly, Louis Finch, Stuart Goldman, Larry Niksch, Stanley Sloan, Al Tinajero, and James Wootten.

still faces serious external military dangers but wishes to focus resources more on economic rather than military modernization.

China's arsenal of 225–300 nuclear weapons represents only a small fraction of the strategic nuclear forces of the United States and the Soviet Union (See chart), but it has given China some ability to deter Soviet aggression, to retaliate against a possible Soviet nuclear or conventional attack, and to enhance China's political influence in Asian and world affairs. China's initial development of nuclear weapons in the 1960s had a notably unsettling effect on the Asian balance of forces. Despite the subsequent twists and turns in Chinese policy, however, Beijing has not engaged in "nuclear blackmail"—using nuclear weapons to threaten and intimidate non-nuclear neighbors—and Asian states have reacted calmly to recent Chinese weapons developments.

STRATEGIC FORCES, NUCLEAR WEAPONS*



*Source: U.S. Soviet Military Balance: Statistical Trends CRS Report No. 83-153 S. August, 1983. p.13.

The implications of Chinese nuclear forces for American interests are mixed. On the one hand, a continuation of Beijing's gradual development of nuclear arms helps U.S. interests in maintaining a stable balance of forces along the Sino-Soviet frontier and helps check the perceived expansion of Soviet power and influence. But China's nuclear weapons also pose possible risks for U.S. interests. Thus, a few Chinese missiles are now capable of hitting the continental United States with thermonuclear warheads; China might use its enhanced power to coerce its neighbors (e.g., Taiwan, Korea) to follow policies favorable to Beijing; China's possession of nuclear weapons has helped prompt India to develop a nuclear weapons capability; and Beijing reportedly has supplied nuclear weapons technology to Pakistan and certain nuclear materials to states engaged in furtive nuclear activities—charges which it denies.

There is little support in the United States for direct U.S. assistance to China's nuclear weapons program, and American ability to impede the further development of Chinese nuclear weapons—say through a U.S.-backed international embargo on the transfer of militarily useful technology to China—is also seen as small.

While U.S. policy thus is seen as likely to have only a small impact on the development of Chinese nuclear weapons, many Americans nonetheless favor a more liberal U.S. policy on the transfer to China of so-called dual-use technology—civilian technology with potential military use—in order to influence Chinese policy, including Chinese nuclear weapons policy, in directions favorable to the United States. A U.S. liberalization regarding the sale of dual-use technology—perhaps in conjunction with other forthcoming U.S. actions regarding Taiwan and other issues—is seen as having the following positive results:

—Such transfers could foster a relationship of cooperation and trust between the United States and China that would help assure that Chinese nuclear weapons would not be used against U.S. interests, and that Chinese nuclear exports would be carefully controlled. Over time, they could help establish an atmosphere more conducive to China's playing a constructive rather than resistive role regarding international arms control and nuclear nonproliferation issues.

—They could enhance China's interest in domestic economic development, thereby increasing Beijing's stake in maintaining a peaceful environment in Asia and in avoiding recourse to military means to achieve foreign policy goals.

—They could assist China indirectly to close what some Americans see as a dangerously widening gap between the military capabilities—including nuclear weapons capability—of China and the Soviet Union.

Other Americans also favor a more liberal American policy on technology transfer to China but they judge that it should be carefully linked to Chinese behavior involving American interests in Taiwan, arms control, nonproliferation and other questions.

Meanwhile, another group of Americans opposes any liberalization of American technology transfers that might indirectly enhance Chinese military power, expecially Chinese nuclear weapons. Some are concerned that the appearance of the United States indirectly assisting the strenghtening of such Chinese forces would so alienate the Soviet Union that it could jeopardize important U.S. interests in reaching arms control agreements and other arrangements with the USSR. It could also upset our friends and allies in Asia and perhaps undercut the American position on nuclear nonproliferation questions if the U.S. appeared in some way to be abetting China's nuclear weapons ambitions.

II. Chinese Nuclear Forces

Chinese development of a strategic nuclear weapons program dates back at least to the mid 1950s.[1] With extensive aid from the Soviet Union until 1959, as well as support from indigenous talent including repatriated Chinese scientists trained earlier in the United States, China was able to establish a sound basis for future nuclear weapons development.

The withdrawal of all Soviet technical assistance in 1960 was a serious blow. Nevertheless, in the early 1960s, the Lanzhou gaseous diffusion separation plant began operation assuring China's uranium enrichment capacity. Shortly thereafter, completion of two plutonium production reactors near Baotou, Inner Mongolia, allowed for weapons grade production. China also had adequate uranium supplies for this production of nuclear weapons materials.

With these assets and continued financial and policy support from the central government, Beijing's nuclear weapons program continued to progress at a steady pace. In 1964, China detonated its first nuclear fission device, and in 1967 it successfully tested a fusion (thermonuclear/hydrogen) bomb. In 1966, China announced that it had fired its first nuclear capable ballistic missile. From the mid 1960s to the present, testing and development of nuclear weapons and delivery systems have continued apace. There has been an average of one or two major tests a year, although no nuclear test was recorded from 1980 to mid 1984. U.S. Government data show that more than half of Chinese military research and development costs from 1965 to 1979 were in the nuclear weapons programs.[2]

Progress came despite shifts in Chinese policy and political instability including:

(a) the breakdown of political order during the Red Guard movement in the 1960s;

(b) the leadership purges during the Red Guard movement, following the fall of Defense Minister Lin Biao in 1971, and after the death of Mao Zedong in 1976;

(c) the shift in Chinese foreign and defense policy from emphasizing the U.S. threat to viewing the United States as a potentially useful counterweight to the Soviet threat to China. More recent information suggests China continues to devote a considerable portion of its limited military resources to improve the quality—if not necessarily increasing the quantity—of its nuclear weapons, especially nuclear weapons delivery systems. These weapons are seen providing an important bulwark in Chinese defense against external military threat at a time when Beijing appears determined to give economic mod-

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[1] For background on Chinese nuclear forces see The Military Balance 1983-1984. Defense Intelligence Agency, Handbook on the Chinese Armed Forces. Jencks, Harlan. From Muskets to Missiles. Boulder, Colorado Westview Press, 1983. Johnston, Iain. Chinese Nuclear Force Modernization and Its Implications For Arms Control. Manuscript, 1983. Banning Garrett and Bonnie Glaser, Soviet and Chinese Strategic Perceptions in Peacetime and Wartime. Manuscript, 1982. Banning, Garrett and Bonnie Glaser. War and Peace: The Views From Moscow and Beijing. Berkeley, University of California Press, 1984.

[2] See, Central Intelligence Agency. Chinese Defense Spending, 1965-79. See also, U.S. Congress. Joint Economic Committee. China and the Four Modernizations. Washington, U.S. Govt. Print. Off., 1982. p. 597-610.

ernization higher priority than military modernization for sometime to come.[3]

CURRENT FORCE LEVELS

Estimates of the size and organization of Chinese nuclear forces vary, but available data and interviews with American specialists point to a Chinese arsenal having 225-300 nuclear weapons, including atomic weapons ranging from 20-40 kilotons in yield, and thermonuclear weapons ranging from 1 to 5 megatons in yield. Delivery vehicles include land-based missiles and conventional bombers. A submarine-based ballistic missile has been successfully tested and will likely soon be deployed in China's first nuclear powered ballistic submarine. The Chinese are reported to be continuing to increase their already significant stockpile of nuclear weapons material.

Bombers.—Some of China's 90 TU-16 medium-range bombers, and perhaps some of its tactical aircraft, could be used to deliver nuclear weapons. However, these obsolescent aircraft would have great difficulty in penetrating sophisticated air defenses. At least some observers speculate that it is improbable that China's air force has a strategic nuclear delivery mission against either the Soviet Union or U.S. forces in Asia.[4]

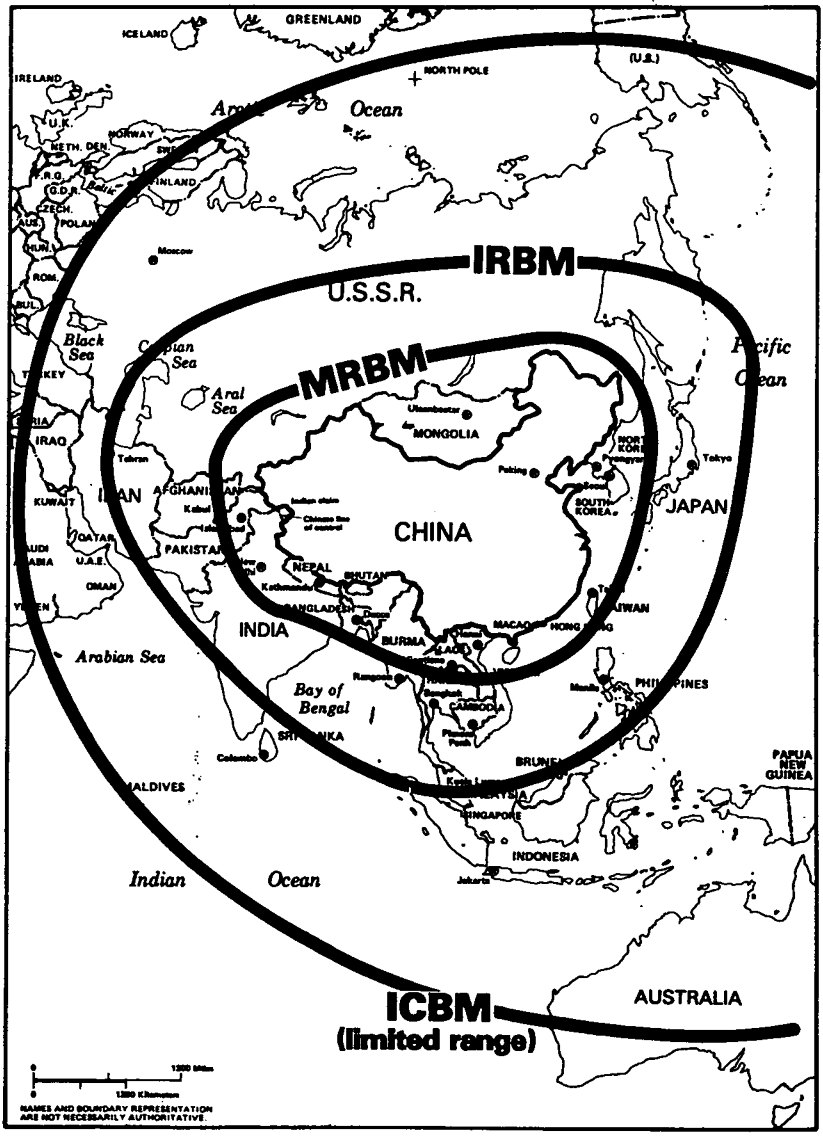
BALLISTIC MISSILES

The Chinese have focused instead on developing and improving their missile delivery systems. This effort has resulted in several distinct land-based surface-to-surface systems, and the start of a sea-based system. (See maps)

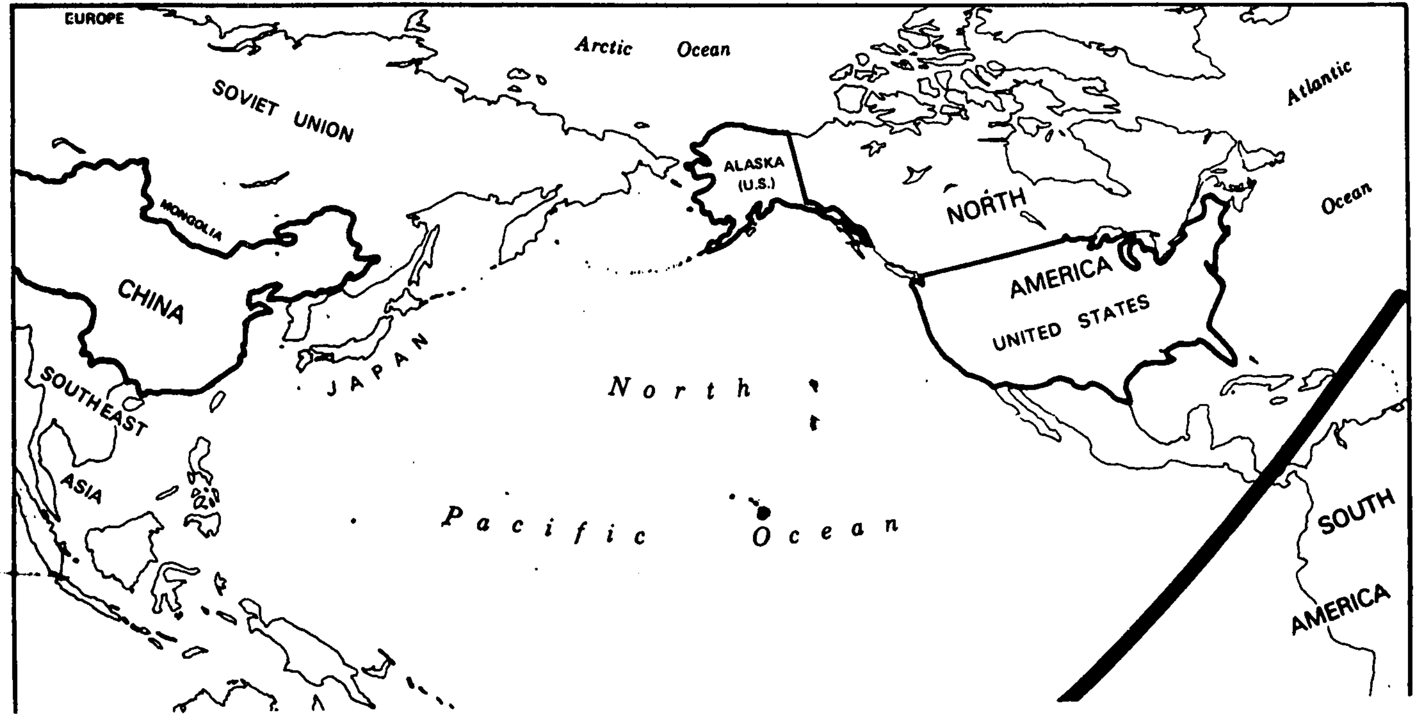
[3] See footnote 1. See also U.S. Congress. Joint Economic Committee. Allocation of Resources in the Soviet Union and China—1983, Washington, USGPO 1984.

[4] See for example, Jencks, From Muskets to Missiles, p. 158.

Estimated Range MRBM, IRBM, ICBM (limited range)



Estimated Range ICBM (extended range)



Medium Range Ballistic Missiles (MRBMs).—China's MRBM forces consist of a small number (perhaps 50) of liquid-fueled, single-staged, road-transportable missiles similar to earlier Soviet rockets. A 600-mile range missile, which has been operational since 1966, is believed to carry a warhead with a yield of 20 kilotons. It is capable of striking some key military and industrial targets in the Soviet Far East as well as targets in Korea and Taiwan.

Intermediate Range Ballistic Missiles (IRBMs).—China's IRBMs, operational since 1972, are also small in number (estimates range from 50 to 80). They are powered by a Chinese-designed, single-stage, liquid system, have a range of 1,500 miles, and carry a thermonuclear warhead having yield estimated at 1–3 million tons by the International Institute for Strategic Studies. Deployment of this system provides the People's Republic with a capacity to hit relatively large population and industrial centers in central and eastern USSR, as well as similarly close targets elsewhere in East and South Asia.

Intercontinental Ballistic Missiles (ICBMs).—In the early 1970s, China began testing a limited range intercontinental ballistic missile with a range of 5,000–7,000 kilometers (3,000–4,300 miles). A few of these have been reported deployed. Employing a multistage, liquid-fueled rocket, each missile carries a warhead estimated to have a 3 megaton yield, and can threaten targets in European Russia and all of Asia.

China's largest multistage ICBM was tested, with a substantial amount of publicity, with two firings in May 1980 from central China to the vicinity of the Fiji islands, about 12,000 kilometers (7,450 miles) away. This is the only Chinese missile system capable of reaching targets throughout the United States. It is thought to use liquid fuel and to carry a warhead of 4–5 megatons in yield. The London based International Institute for Strategic Studies says China now has four of these missiles ready for use.[5]

Chinese land-based ballistic missile forces are thought to be targeted almost exclusively on Soviet territory. Available data indicates that at least the bulk of the Chinese missiles are deployed in the north and north western parts of China and Tibet where Beijing's limited range MRBMs and IRBMs could reach Soviet targets.[6]

Beginning in the latter 1960s, Chinese missiles were deployed at a gradual rate—according to one specialist this was done to avoid frightening the USSR and thereby provoking a Soviet "preventive strike."[7] The MRBMs and IRBMs are widely dispersed, often deployed in silos and man-made caves in mountainous terrain, and are so carefully camouflaged that satellite reconnaissance reportedly failed to disclose their presence until several years after they were initially deployed. (There may be doubt in the minds of Soviet and American planners that all Chinese missile sites have been discovered or that all sites found are armed.)

Meanwhile, pictures and news stories released by Beijing in 1979 indicate that some Chinese missiles are mobile by road and rail. As a result, an adversary might not be certain that it could locate and

[5] The Military Balance, 1983–1984, p. 84.
[6] See Jencks, From Muskets to Missiles, for background on deployment of Chinese missiles.
[7] Ibid.

preemptively destroy all Chinese nuclear weapons sites during a conflict with Chinese forces. On the other hand, it is widely held that Chinese reaction times are likely to be slow. Because of the time involved in preparing these missiles for firing, Chinese forces today are seen as incapable of launching much of an immediate retaliatory attack upon receiving warning of a surprise attack, say from the USSR. They could have difficulty in responding quickly even after Soviet missiles hit Chinese targets, although some Chinese missiles could survive and strike back. Optimal preparation and dispersal of Chinese missile forces would appear to require a period of at least several days warning, such as would occur in the event of a rise in acute tensions with the USSR.

Submarine-Launched Ballistic Missiles (SLBMs).—China's successful launch of a SLBM in 1982 no doubt has further complicated the strategic plans of likely adversaries and enhanced Chinese nuclear deterrence. In 1964, China successfully assembled a single diesel-electric-powered GOLF-class submarine from parts supplied earlier by the USSR. It has three missile launching tubes, is believed to be used as a testing platform, and presumably was the submarine that fired China's first SLBM in October 1982.[8]

China has also deployed a nuclear-powered submarine with 12 ballistic missile tubes. This sub—along with possibly others later in the same class—would serve as a sea-based leg in a future Chinese nuclear force.

It is estimated that China's SLBM uses a solid fueled rocket and has a range in excess of 650 miles. The technology used in this missile—especially the use of a solid fuel rocket—could be applicable to land-based missiles which would likely improve the mobility and reaction times of China's land-based forces.[9]

Atomic Demolition Munitions (ADMs).—Some specialists assume that Chinese nuclear forces include an unspecified number of ADMs. These devices are thought to be ready for use in northern parts of China where they would be employed to destroy mountain passes, divert rivers and otherwise impede the progress of an advancing enemy force.

PROSPECTS

It is widely held that because of its limited financial and technical resources, China will probably continue with the painstaking, incremental approach that has marked its strategic nuclear weapons program over the past three decades.[10] Thus, China will presumably strive to keep pace with Soviet advances to some degree by improving the quality of its land- and sea-based missile forces, but would be unlikely to expand greatly the number of missiles or bombers to deliver nuclear weapons. Chinese leaders are expected

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[8] See David Miller, China's SLBM in Perspective. Proceedings, March 1983, for background on Chinese developments in this area.

[9] The advent of an operational Chinese SLBM will increase the perceived danger that Chinese nuclear forces might somehow provide the catalyst for a U.S.-Soviet nuclear exchange. There is some doubt, for example, as to whether or not the Soviet Union could identify accurately an incoming Chinese missile, particularly an SLBM. If Moscow thought it were an American missile, it might retaliate, leading to U.S.-Soviet nuclear conflict.

[10] For background, for example, see U.S. Senate. Committee on Foreign Relations. The Implications of U.S.-China Military Cooperation. Washington, U.S. Govt. Print. Off., 1982.

to replace gradually some of the older liquid-fueled rockets with more mobile, accurate and easily handled solid fuel weapons. China continues to devote a large portion of its scarce, highly trained manpower and its government funds to nuclear weapons development and production.

Beijing may also have an interest in developing multiple reentry vehicles (MRV) for its larger missiles. In 1982, one Chinese missile successfully launched three separate space research satellites, thereby suggesting a Chinese MRV capability. China is also thought to be interested in modernizing other capacities related to its nuclear forces such as early warning radar, intelligence and reconnaissance satellites, more secure command and control equipment, better computers and other instrumentation useful in production and operation of nuclear weapons.

There is some tentative evidence that China may be interested in developing battlefield nuclear weapons. Most notably, Chinese forces reportedly simulated nuclear warfare in a battlefield situation during a large military exercise in Ningxia province in north central China in June 1982.[11] Experts disagree as to whether this exercise was designed to strengthen Chinese defenses against an enemy using tactical nuclear weapons, or to simulate Chinese use of nuclear weapons in a tactical way against an invading enemy, or some other possibility.

Some American specialists see China as particularly vulnerable to a large scale Soviet conventional attack backed by Soviet tactical nuclear weapons. They claim that, without tactical nuclear weapons of their own, the Chinese would have to limit their nuclear response to strikes against targets in the USSR—an action that could lead to an all-out Soviet nuclear devastation of China. Nevertheless, some other Americans doubt that this apparent weakness would prompt China to develop truly tactical nuclear weapons. They stress the weakness of China's command and control apparatus and problems associated with maintaining central control over battlefield use of such weapons to judge that Beijing could be wary of using them. There is also the question of China's industrial capacity to make an arsenal of tactical nuclear weapons and their delivery systems. Of course, the Chinese might try to use in a tactical way its existing MRBMs and bombers—which are under central command and control.

CHINA'S OBJECTIVES

Few analysts see any substantial change in the goals of Chinese nuclear forces for the foreseeable future. Briefly put, these objectives have been, and are likely to remain:

To help deter Soviet aggression and intimidation.—This objective has been at least partly achieved since the Chinese have deployed a number of nuclear missiles capable of hitting Soviet targets. Because of Chinese use of mobility, concealment and camouflage, and with a new Chinese SLBM capability coming into play, the Soviets

[11] Cited in Johnston, Chinese Nuclear Force Modernization and Its Implications for Arms Control, p. 12.

probably judge that they cannot destroy the entire Chinese missile force even with a surprise attack.

To secure a strategic retaliatory capability.—This objective—which underpins the first—says that China seeks a reliable and serviceable strategic retaliatory capability that could be effective against Soviet targets, should deterrence fail. This objective appears to have been at least partly achieved. The effectiveness of China's strategic retaliation remains constrained by Beijing's limited force size, and by the fact that some Chinese missiles might be destroyed by a Soviet preemptive strike due to the slow reaction time of Chinese missiles and China's limited resources for obtaining adequate information on possible Soviet attack. Some Chinese missiles could survive a Soviet attack and strike back.

To demonstrate China's international importance.—China has also sought to develop nuclear weapons in order to enhance its influence in Asian and world affairs. It went far toward demonstrating its global strategic importance in 1980 when it became only the third world power to test successfully a truly intercontinental land-based ballistic missile.

III. Implications for U.S. Interests

The incremental further development and production of nuclear weapons by China anticipated over the next several years may help to maintain a stable balance of forces in Sino-Soviet relations and assist American interests against the Soviet Union. However, it could also increase the capability of Chinese nuclear forces to threaten directly the continental United States as well as its bases and friends in the Asia-Pacific region. China's development of these weapons also could have negative impact on American interests in stopping the proliferation of nuclear weapons and maintaining stability in Asia and elsewhere.

At present, China is seen to play a generally positive role in the international balance of power in Asian and world affairs. Backed in part by its modest nuclear deterrent, China is able to offset steadily growing Soviet forces along the Sino-Soviet frontier, to exert pressure—without excessive fear of Soviet nuclear retaliation—on Moscow's Vietnamese ally as it attempts to dominate Indochina, and to work against suspected Soviet ambitions in Southwest Asia. Beijing's defense capabilities, along with its more cooperative relationship with the United States, Japan and West European countries, also serve to raise Soviet concerns about potential Russian security problems in Asia, in the event of an East-West conflict elsewhere.[12]

By keeping pace at least in a limited way with the growth of Soviet forces in Asia, it can be argued that China helps to "stabilize" Sino-Soviet relations.[13] In particular, a continued credible Chinese nuclear deterrent has reduced the chance that Moscow might be successful in pressuring China to adopt a pro-Soviet for-

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[12] For background on this view, see U.S. Senate Committee on Foreign Relations. The Implications of U.S.-China Military Cooperation. op. cit.

[13] In contrast, it can also be argued with equal validity that the escalating Sino-Soviet nuclear arms race means that if a conflict were to break out, it would be more devastating for Asia and American interests there.

eign policy—a development that could renew instability and conflict throughout Asia, adversely affecting American interests and those of our allies and friends.

The most obvious disadvantage of the Chinese strategic nuclear weapons program for U.S. interests is that China will become increasingly capable of targeting the continental United States. Circumstances that would give rise to such a possibility are widely seen to be remote, but they could involve a possible renewed U.S.-Chinese confrontation over Taiwan or Korea. If the United States in the future might attempt, as it did in the 1950s, to use nuclear brinkmanship in order to get Beijing to back down, China this time could counter with nuclear threats of its own, not only against U.S. forces in Asia [14] but also against the continental United States.[15]

Another possible disadvantage for the United States is posed by the fact that China could use its nuclear capability to engage in coercive diplomacy in Asia, forcing countries there to follow policies compatible with Chinese interests. However, so long as China continues, as in the past, to be preoccupied with either Soviet or American power in Asia, its ability to engage in such a policy appears quite limited. At present, it may be only those Asian capitals most suspicious of Chinese intentions (e.g., Taipei, Hanoi, New Delhi, Jakarta and Seoul) who worry that China might practice nuclear diplomacy. The acquisition of nuclear weapons has given China greater prestige and political influence in the region, with the main impact felt in the 1960s when China began testing and deploying nuclear weapons. Subsequent developments have not had a major effect on Asian stability.

Perhaps the most serious perceived negative result for the United States of China's nuclear weapons program relates to proliferation of nuclear arms. By developing nuclear weapons, China is widely seen to have caused India to move toward a nuclear weapons capability with its nuclear test in 1974. This, in turn, is said to have prompted Pakistan's reported attempts to develop a nuclear bomb—an effort that some say has received direct technical support from China. Moreover, the reported interest of Taiwan, South Korea and possibly other Asian states in nuclear weapons is said to be related in part to the fact that China, their neigbhor and potential adversary, has such weapons.

Meanwhile, China in the past reportedly has been careless in supplying some nuclear materials useful in making weapons to states with suspicious nuclear activities. Reports of past Chinese shipments to South Africa are a notable case in point.[16] These

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[14] The impact of a few Chinese nuclear strikes against U.S. bases in East Asia—or Soviet transport and military centers in the Far East—could very seriously hamper either superpower's ability to conduct large scale military operations in the region. Such an attack, of course, would risk an all-out nuclear counterstrike from either superpower, but China might reduce the risk by threatening to strike back against cities in the USSR and United States.

[15] Most specialists consulted for this study assumed that the United States had contingency plans to counter possible nuclear threat from China by targeting some portion of U.S. missiles and other forces against Chinese nuclear installations. At the same time, they also assumed that Chinese planners took account of contingencies whereby Chinese nuclear forces would be directed against American targets in Asia and North America.

[16] On China's proliferation actions, see U.S. Nuclear Cooperation With The People's Republic of China, CRS Issue Brief IB83149 (Periodically updated).

charges have been aired in Congress as it awaits the Administration's submission of an agreement for civil nuclear cooperation between the two countries which was initialled during President Reagan's trip to China in 1984.

IV. China and Nuclear Arms Control

China's stance on nuclear weapons remains governed primarily by Chinese military weakness vis-a-vis the superpowers. Beijing is loathe to limit its own nuclear weapons development at a time when the United States and Soviet Union enjoy such an overwhelming advantage. Nevertheless, China has recently sought to soften its reputation as an opponent of international safeguards for civil nuclear power, and of U.S.-Soviet arms accords. The Chinese want to enhance their international respectability, smooth the way for the purchase of nuclear technology, and encourage limits on the U.S.-Soviet nuclear arms race that jepardizes Chinese security. Thus, while China still opposes the non-proliferation treaty, Beijing has recently jointed the International Atomic Energy Agency (IAEA), publicly disavowed nuclear proliferation, participated in international disarmament forums and counseled U.S.-Soviet arms restraint. Beijing was not reported conducting a nuclear test from 1980 to mid-1984.

China has followed closely the East-West Intermediate Nuclear Force (INF) discussions in Geneva. It indicated support for the Reagan Administration position of putting global limits on intermediate forces so as to prevent the redeployment of Soviet SS-20 missiles from the European to the Asian theater. There already are over 100 SS-20s in Soviet Asia, many in a position to attack China.[17]

If the United States were to modify its strategic arms stance in such a way that the Soviet Union would be freer to deploy SS-20s and other such forces to Asia rather than in Europe, some U.S. observers note, it could have serious negative repercussions for U.S.-China relations and stability in Asia. In particular, Beijing might see it as a sign of a Europe-centered U.S. foreign policy designed to seek an accommodation with the U.S.S.R. over Europe, while giving Moscow a freer hand to use Soviet military power to influence developments in Asia. In response, Beijing might judge that it would have more to gain by seeking its own accommodation with Moscow in Asia, rather than persist, with only weak U.S. backing, in resisting Soviet expansion there.

In the past, China has had little good to say about U.S.-Soviet arms control negotiations, claiming that each power used them to shackle the other while pursuing its own nuclear weapons development. Nevertheless, Chinese leaders now appear to be more aware that such East-West negotiations are not purely negative from China's point of view. In particular, Beijing shows concern that the arms race is entering a new stage of nuclear deployments that will leave China still further behind the U.S. and the U.S.S.R., result in

[17] For background on Beijing's position on INF and START issues, see Iain Johnston. Chinese Nuclear Force Modernization and Its Implications for Arms Control.

greater bipolarity in world politics, and reduce China's ability to steer an "independent" foreign policy.

China's nonproliferation policy in the past has been reflected in strong, rhetorical support for the principle that an increase in the number of states having nuclear weapons would undermine the nuclear "monopoly" of the superpowers. China also bitterly denounced the nuclear nonproliferation treaty and still opposes it. China also has not agreed to require "full scope" safeguards for its nuclear exports and has not agreed to the Nuclear Supplies Guidelines. And, as noted earlier, there have been reports, denied by China, that it has given nuclear weapons assistance to Pakistan, and supplied nuclear material to South Africa.

In practice, however, China on the whole has been reluctant to foster the proliferation of nuclear weapons states. Its negative reaction to India's nuclear test in 1974 also underlined the ambiguity in China' stance on non-proliferation. The Indian capability was seen to jeopardize Chinese interests on the subcontinent and to subject countries there to what Beijing called New Delhi's ambition to be a "sub-superpower." For obvious reasons, Beijing is also opposed to Taiwan's acquisition of nuclear weapons, and probably would view with grave reservations the developing of nuclear weapons by either North or South Korea.

U.S. Interests.—It appears to be in the long term interest of the United States that China become a more active and constructive member of international arms control efforts, although U.S. specialists do not anticipate soon a major change in China's often negative position on these issues. At present, American specialists seem to favor China's participation in arms control regimes to limit the spread of nuclear weapons, curbing tests of such weapons in the atmosphere, and improving international understanding of the consequences of nuclear war.

At the same time, they tend to oppose China's participation in such East-West talks as INF and START because it would add to the complexity of those talks and reduce the chances of a settlement. China thus far has expressed no interst in joining these talks. In particular, Soviet officials from time to time have pointed to the danger they face from Chinese forces to argue for their "need" for a larger arsenal than the United States. While some American specialists have acknowledged that Soviet officials may be sincere in seeing China as a threat and in feeling a need for compensation, they have judged that the overall Soviet and American arsenals are so overwhelmingly large that the China factor is of relatively very minor importance and should not be raised in these East-West talks. Several American observers said that the Soviets raise the China issue largely in order to seek advantage over the United States or to warn the United States against seeking too close a relationship with China.[18]

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[18] Of course, this does not mean these Americans oppose Chinese participation over the longer term, which many see as increasingly important since China is continuing to develop its nuclear weapons capability, and thereby impacts ever more strongly on both the United States and Soviet Union.

V. Options for U.S. Policy

American commentators have suggested widely differing options for U.S. policy regarding Chinese nuclear weapons. At one extreme are those who favor direct U.S. assistance to the development of Chinese strategic weapons.[19] This could involve such steps as helping China to develop better solid fueled rocket motors for its intermediate range missiles, assisting China to develop a capacity to penetrate the ABM shield surrounding Moscow, or training Chinese nuclear weapons scientists at U.S. Government nuclear installations. This approach would presumably lead to an increase in Chinese military capability against the Soviet Union, and could serve to check and complicate suspected Soviet efforts at international expansion.

At the other extreme are those who are deeply suspicious of China's ambitions in Asian and world affairs. They fear that China, backed by its massive size, large armed forces, and nuclear weapons, will eventually push both the Soviet Union and United States out of Asia in order to dominate the region. They judge that the United States should do whatever possible to strengthen international restrictions on the transfer of information and equipment potentially useful in the development of Chinese arms, especially nuclear weapons.

As in most debates, the majority of knowledgeable observers occupy positions somewhere between these extremes. In general, they tend to agree on the following points:

(1) China's further development of nuclear weapons, both warheads and vehicles, poses both potential risks and advantages for American interests.

(2) Aside from a major U.S. effort to assist China's nuclear weapons program, which is thought to be counterproductive for American interests under foreseeable circumstances, American ability to influence the speed and direction of China's nuclear weapons effort appears quite small. China has managed to develop its nuclear weapons for 20 years without U.S. support, and presumably could continue to do so.

(3) U.S. efforts to block the transfer to China of dual-use technology and information that may be indirectly helpful to the development of China's nuclear weapons program may well be both futile and counterproductive for American interest in fostering a better relationship with China and stability in Asia. On the other hand, any substantial liberalization of such U.S. technology transfers to China might give rise to a perception that the U.S. was attempting to support indirectly China's nuclear weapons program—a perception that could seriously damage U.S. interests in relation to friends in the Asia-Pacific region, the Soviet Union, arms control and nuclear nonproliferation.

Suggested options for U.S. policy depend on how one views China's strategic position in the U.S.-Soviet-Chinese triangular relationship and on how much weight one gives to the potential risks

[19] None of those interviewed favored this stance. But some said they had had private conversations with proponents with this view.

for U.S. interests caused by further Chinese nuclear weapons development. Thus, if it is judged that the gap between Soviet and Chinese military capabilities has grown dangerously large, then the United States could try to do something to help shore up the Sino-Soviet balance. Otherwise, an unbalanced Sino-Soviet military relationship might have dire consequences for American interests.

As a remedy, some suggest U.S. efforts to liberalize American transfer of dual-use technology to China, including such technology as sophisticated computers possibly useful in nuclear weapons development, and instrumentation and other electronic equipment potentially useful in both the early warning and targeting missions of Chinese nuclear forces.[20]

If some observers are more sanguine about China's military power vis-a-vis the Soviet Union, they can still urge a forthcoming U.S. approach to dual-use technology transfer and cooperation with China, even some technology with direct or indirect application to China's nuclear weapons program, in the interest of establishing a dialogue between the United States and People's Republic. In this way, the United States could have better communication with Chinese leaders and gain more assurance that Chinese forces will not be used in ways inimical to American interests. One could go further to suggest that the United States also could be more forthcoming on other U.S.-China issues, notably U.S. arms sales to Taiwan, in order to increase mutual trust between Washington and Beijing that would improve the chances for the United States that Chinese policy in general, and Chinese nuclear weapons in particular, will not be used in a way contrary to American interests.

If a policymaker wishes to stress the long-term goal of limiting Chinese nuclear weapons, and those by other states, it can be argued that the United States could use the goodwill built in part by the more forthcoming U.S. policy on technology transfer to the Chinese. This could be used to "educate" Beijing leaders as to the dangers of nuclear conflict and the merits of arms control, and to encourage China to join in arms control measures and to curb its nuclear weapons development. Such efforts could include closer consultations with China over the implications of East-West talks on INF and START—thereby reducing China's longstanding suspicions regarding such superpower arms control efforts. China also could be urged to avoid practices that might foster the international proliferation of nuclear weapons.

However, many Americans put little stock in such intangible concepts as goodwill or mutual trust. They would argue that the United States should be more forthcoming in technology transfer in order to foster Chinese interest in overall economic modernization, increase China's own stake in developing a peaceful environment in Asia, and reduce the likelihood that China would resort to military means, especially the use of nuclear weapons, to achieve foreign policy aims.

[20] Other areas of suggested cooperation include the transfer of U.S. technical information to allow the Chinese more easily to conduct their atomic tests underground, not in the atmosphere as in the past, and equipment that would improve Chinese command and control over nuclear forces. These are suggested not so much to increase Chinese power vis-a-vis the Soviet Union, but to reduce fallout from Chinese nuclear tests and to reduce the chances of a possible accidental firing of a Chinese nuclear weapon.

Other observers urge the United States to be more forthcoming on technology transfer to China, perhaps even including some with application to Chinese nuclear weapons, but only on condition that the United States would receive some tangible "quid pro quo" in return. Thus, for example, if the United States agreed to Chinese requests to liberalize substantially computer exports to China—even computers with potential applications to Chinese nuclear forces—it should demand some compensating Chinese action in return. As one specialist put it, if the Chinese expect to be treated as a "friendly country" as far as U.S. technology export policy is concerned, they should behave like a friendly country as far as U.S. interests are concerned. This trade-off could involve a more moderate Chinese policy toward U.S. arms sales to Taiwan, a willingness to sign the nonproliferation treaty, or a more constructive Chinese policy, from a U.S. perspective, in Korea.

Finally, it should be noted that many Americans emphasize what they see as serious negative consequences for the United States if it were to become associated in any way with the development of Chinese military power, especially nuclear weapons, and thus oppose the liberalization of U.S. "dual-use" technology to China that might indirectly be of possible use to China in developing such weapons. These observers often favor a forthcoming U.S. stance toward China on other issues, and they frequently do not oppose the transfer of U.S. technology to China for strictly economic use. But they stress several major risks for the U.S. in liberalizing other technology that indirectly might help Chinese weapons development. Thus, such transfers could easily give the impression that the United States was abetting Chinese military modernization, including Chinese nuclear forces. This in turn might jeopardize Soviet interest in arms control and other negotiations with the United States; and might alarm other Asian states about perceived American support for a nuclear powered China dominating Asian politics, and could undercut U.S. efforts to persuade other states not to develop nuclear weapons of their own. These observers judge, on balance, that whatever positive benefits would accrue in U.S.-China relations from a more liberal technology transfer policy to China would be more than offset by these negative considerations.

THE ROLE OF THE MILITARY IN THE CHINESE ECONOMY

By June Teufel Dreyer*

CONTENTS

SUMMARY

The PLA's involvement in the Chinese economy has served a number of purposes, including the making of specific contributions to economic development, the improvement of civil-military relations, the rectification of erroneous attitudes within the PLA, and the inculcation of certain technical skills and political attitudes to large numbers of people. Although a heavy military role in production has been associated with the dominance of leftist-generalist influence in the PRC's leadership, the PLA's role in civilian economic activities has actually increased since the decline of leftist-generalist influence. A new role has been added since defense industry-associated factories are now utilizing more than 20% of their total capacities to manufacture products for civilian goods. The PLA's role in production probably does not seriously affect its military effectiveness, although there are certain caveats to this general conclusion. In any case, for reasons which appear to be as much symbolic as economic, the present leadership seems committed to a continuation of the PLA's role in the Chinese economy.

THE ROLE OF THE MILITARY IN THE CHINESE ECONOMY

I. THE PLA'S TRADITIONAL ROLE

The People's Liberation Army (PLA) has been involved in the economy of Chinese society since the army was founded in 1927. The PLA's traditional involvement in the economy has served a number of purposes, including:

1. making specific contributions to the Chinese economy;
2. serving in a symbolic capacity; (a) to maintain and improve relations with local populations; (b) to provide the civilian population with a model to emulate;
3. providing a method for the rectification of erroneous attitudes within the PLA;

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4. serving as a conduit through which to impart certain skills in individual recruits, thereby raising the level of skills in the society as a whole.

While all four purposes were evident in the army's activities prior to the establishment of the People's Republic of China (PRC) in 1949, the military's specific contributions to the economy of the communist-held areas were of overriding importance. The army was founded when the Party was on the verge of extinction, and the Red Army, as it was then called, played a crucial role in the Party's resurgence.

Army units built schools, factories, and hopsitals, as well as helping civilians raise crops. To reduce the burden that supporting an army imposed on local people, the military was also expected to raise its own food, build its own barracks, and even knit its own socks. After the victory of the Chinese Communist Party (CCP) in 1949, the PLA became heavily involved in the reconstruction and extension of China's economic infrastructure, which had been badly damaged by two decades of war, and in the creation of socialist institutions. Soldiers built or rebuilt railroads, factories, schools, and government offices. They also reclaimed wasteland, dug irrigation channels and canals, and set up and staffed state farms.

The country's new leaders made plain that the military's involvement in the economy was not simply an expedient solution to the needs of post-war reconstruction, but was to be a permanent part of the PLA's mission. However, the degree of the army's involvement has not remained constant. According to Article 24 of the Common Program of the Chinese People's Political Consultative Conference, which functioned as the PRC's constitution until 1954, the country's armed forces were expected to "during peacetime, systematically take part in agricultural and industrial production . . . on the condition that military tasks are not affected." [1] Unfortunately, there was no objective method of deciding at what level of effort the army's participation in the economy began to adversely affect military preparedness, and the issue soon became an ideological football.

Leftist-generalists, including Mao Zedong, tended to favor a heavy military involvement in production, both because they valued the technical and organizational skills the army could contribute to economic development, and because they felt the military's participation in collective labor would mitigate a growing trend toward elitism within the PLA. Their views were opposed by professionalist-modernizers, including then-Defense minister Peng Dehuai, who argued that China's military performance in the Korean War had revealed serious deficiencies which could be solved only by improved weaponry and specialized training. Leftist-generalists reached the height of their influence during the Great Leap Forward [2] and, as can be seen from the following chart, so did the number of days that the PLA devoted to economic production.

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[1] *Common Program of the People's Republic of China*, Beijing, People's Publishing House, 1950.

[2] This debate is analyzed in Ellis Joffe's classic *Party and Army: Professionalism and Political Control In The Chinese Officer Corps, 1949-1964*. Cambridge, Mass., East Asian Research Center, Harvard University, 1967.

PLA "Uncompensated" Participation in Production Work in Number of Days [3]

Sources: [a] *Xinhua*, Dec. 25, 1956.

1956	[a] 4,050,000
1957	[b] 20,000,000
1958 (projected)	[b] 30,000,000
(completed)	[c] 59,000,000
1959	[d] 44,000,000
1960	[e] 46,000,000
1961	[f] 22,780,000
1962	—
1963	[g] 8,500,000
1964	[h*] 5,410,000

[b] *Xinhua*, Feb. 18, 1958.
[c] Xiao Hua, "Participation in national construction is a glorious task of the PLA," *Hong Qi*, Aug. 1, 1959.
[d] Fu Chong, "Achievements made by armed forces in support of socialist construction," *Renmin Ribao*, Apr. 6, 1960.
[e] "Chinese armymen active in production work," *Xinhua*, Jan. 7, 1961.
[f] *Xinhua*, Feb. 3, 1962.
[g] *Xinhua*, Jan. 30, 1964.
[h] Beijing Radio, Jan. 29, 1965.
[*] Agricultural production only.

As is also evident from the chart, the number of days the PLA devoted to economic construction fell rapidly after the Great Leap Forward. The aim of the days it did contribute fell under the heading of specific contributions to production, since the failure of the Great Leap Forward had reduced the economy to chaos and badly weakened the social structure as well. The PLA's work helped to restore normality in a milieu in which the need to maintain ideological orthodoxy paled before pragmatic needs like economic survival.

The next period of strong leftist-generalist influence was the Cultural Revolution. During it, the army, like the rest of Chinese society, was admonished to "serve the people," and was frequently portrayed as doing so. However, the main use of the military for production tasks seems to have occurred during a low point in leftist-generalist influence during the Cutlural Revolution, variously styled by radicals as the "February adverse current" or the "evil wind of March" in 1967. During this period, the PLA was sent out to restore order and ensure that spring planting took place. During this time, and even more noticeably during 1968, the army was also ordered into factories to ensure that production tasks were carried out. But, paradoxically, the role that the army assumed in production during the Cultural Revolution seemed to come at the expense of leftist-generalist influence rather than as a reflection of the strength of that influence.

As the passions of the Cultural Revolution subsided, the military continued to participate in production, though without fanfare or significant ideological fervor. Strained relations with the Soviet Union, including several armed clashes in 1969, mandated attention to military training. Although tensions with the Soviet Union eased in subsequent years, the army's role in production did not increase concomitantly. One possible explanation lies in the growing political power of the so-called Gang of Four during this period. Despite the fact that the Gang clearly represented the leftist-general-

[3] Chart adapted from John Gittings, *The Role of the Chinese Army*. New York, Oxford University Press, 1967, p. 182.

ist side of the ideological spectrum, they tended to distrust the military, and preferred to work through the militia instead.[4]

II. THE POST-MAO ERA

Mao Zedong's death in September 1976 was quickly followed by the arrest of the Gang of Four and the rise of Deng Xiaoping to power. An outspoken advocate of military professionalism and modernization, Deng owed his rehabilitation partly to elements of the PLA leadership who shared these views. Ironically, however, the military's involvement in the civilian economy has increased rather than decreased under Deng's leadership. Two factors would seem to explain this apparent paradox. First, most Chinese leaders realized that a strong military could not be grafted onto a weak economic base, and therefore that the modernization of significant sectors of the military would have to await the prior development of industry, science, and technology. Defense modernization has thus received lowest priority in Deng Xiaoping's modernization program, leaving parts of the military free to participate in economic activities.

A second factor in the PLA's increased participation in the economy was the leadership's feeling that the military could help to speed up the modernization of the other sectors. China's defense facilities have for many year struck outside observers as overly large in relation to their output.[5] In part this is the result of the tendency of the Soviet/Stalinist economic model, which the Party borrowed heavily from during the early years of the PRC, to invest heavily in defense production facilities. In addition, there was another, substantial, expansion in defense production facilities in the late 1960s and early 1970s, closely coinciding with the time when Defense Minister Lin Biao served as Mao Zedong's heir apparent. The increase in facilities at this time appears to have been related both to Lin's desire to favor his military colleagues with generous budgets, and to the outbreak of armed hostilities with the Soviet Union.

After Lin's death in 1971 and the abatement of hostilities with the USSR, military budgets began to decline, and these defense facilities were underutilized. China's 1979 border war with Vietnam led to a sharp 20% rise in defense expenditures, after which military budgets were cut back sharply again.[6]

A. Integration of Military and Civilian Industries

The leadership decided to solve this dilemma in a manner which brought the military into an even more prominent role in the Chinese economy: to employ idle or underutilized defense facilities in support of the civilian economy.[7] This was an attractive solution

[4] *Xinhua* (Beijing), Nov. 18. 1980 in the United States Department of Commerce *Foreign Broadcast Information Service*, Vol. I, China (hereafter, FBIS-CHI), Nov. 18, 1980, p. L/1; for an analysis of the relationships among army, militia and Gang of Four see June Teufel Dreyer "The Chinese Militia" *Armed Forces and Society*, Vol. 5, No.. 1 (Fall 1982). pp. 68-69.

[5] See, e.g. *Defense Week*, May 23, 1983, p. 21.

[6] See Dreyer, "China's Military Modernization, "*Orbis*, Winter 1984, pp. 1019-1020 for data on recent military budgets.

[7] See Defense Minister Zhang Aiping's explanation of this decision in *Zhongguo Xinwen She* (Beijing), Aug. 20, 1983, translated in FBIS-CHI, Aug. 22, 1983, pp. K/1-2.

for several reasons. First, since the technology and production processes of defense facilities were typically more advanced than those possessed by civilian industries and their personnel tended to be better trained, increases in both quantity and quality of products could be expected.

Second, utilization of defense production plants in support of the civilian economy would facilitate an increase in consumer goods, and hence in living standards. Third, by producing items for export, China could earn more foreign exchange, which would in turn enable it to purchase equipment and technology needed to speed up the PRC's modernization program, including the modernization of the military. Fourth, to the extent that military enterprises could successfully utilize idle facilities to produce and market civilian goods, the state's subsidy to them could be reduced. Some could even be expected to turn a profit, thus increasing the state's tax revenues. And fifth, through the process of internal technology transfer, further technological advances could be expected. Chinese leaders were aware that many significant civil-industrial advances in the developed world have originated as spin-offs of military research and manufacturing.

Although Chinese sources of the 1980s tend to date the beginning of this move to use military factories to produce civilian goods at 1976 or 1977, there is no mention of such a decision, or of any actions taken in pursuance of such a decision, in Chinese sources during these two years. This author believes that 1979 is a more likely date. One may speculate that Chinese sources cite the earlier years in order to emphasize, for propaganda purposes, the contrast between the stagnation of the economic scene under the Gang of Four and its dynamism since their fall from power.

In any case, the decision to convert defense facilities to civilian production was implemented quickly in 1979. In 1980, PLA-affiliated enterprises were reportedly manufacturing over 70 types of products for civilian use and export, with their output value 84% greater than the previous year's total.[8] By 1981, the number of products had risen to over 90 and output value to 1,180 billion *yuan.*[9] In 1982, over 200 products were reportedly being turned out, accounting for 20.7% of the total output value of national defense science, technology, and industrial departments, as compared to 10% in 1979.[10] Statistics for 1983 show a further rise, though sources differ on exactly how much. For example, *Xinhua* news agency reported on December 27, 1983 that the output value of civilian goods produced by defense industries was overfulfilled by 17.1%, up 24% from the previous year;[11] three weeks later, on January 20, it announced that the overfulfillment was 30.6%, up 22% over 1982.[12] Similarly, the number of products said to be manufactured varied between a low of three hundred in one source[13] and a high of five hundred in another.[14] The types of products

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[8] *Xinhua* (Beijing), Mar. 31, 1981, in FBIS–CHI, Apr. 2, 1981, pp. K/15–16.
[9] *Zhongguo Xinwen She* (Beijing), Feb. 12, 1982 in FBIS–CHI, Feb. 16, 1982, p. K/7.
[10] *Xinhua* (Beijing), Feb. 12, 1983 in FBIS–CHI, Feb. 16, 1983, p. K/3.
[11] *Xinhua* (Beijing), Dec. 27, 1983 in FBIS–CHI, Dec. 30, 1983, p. K/14.
[12] *Xinhua* (Beijing), Jan. 20, 1984 in FBIS–CHI, Jan. 24, 1983, p. K/16.
[13] *Zhongguo Xinwen She* (Beijing), Feb. 16, 1984 in FBIS–CHI, Feb. 17, 1984, p. K/29.
[14] Guiyang Radio, Nov. 1, 1983 in FBIS–CHI, Nov. 3, 1983, p. K/4.

manufactured included the entire range of technology, from socks and underwear through motorcycles, microwave ovens, and heavy machinery.

Although 80% of national defense industries were said to have converted part of their production lines to serve the needs of the civilian sector,[15] this modification of military production has not taken place uniformly throughout China. Most reports of large-scale integration of military and civilian production emanate from Jiangxi, Shaanxi, and Sichuan provinces. Two cities, Chongqing and Tianjin, seem to have been particularly active in this endeavor.[16] Whether they were targeted for experimental purposes or simply because they had a higher percentage of idle facilities than other areas is unclear. In several cases, the proportion of output allocated to the civilian sector exceeds 40%, and one Nanjing factory saw the proportion of its products shift from 70% military/ 30% civilian in 1979 to 20% military/ 80% civilian in 1982.[17]

There have been criticisms of both the decision to have military factories produce civilian goods at all, and of the specific ways in which that decision has been implemented. On the first point, some PLA leaders feel that the transfer of defense technology, even to other state-owned industries, is inadvisable because it compromises security.[18] There is also concern that concentration on the production of more profitable civilian lines may lead to neglect of the quality and quantity of military goods produced.[19] And some officers worry that it will prove difficult and time-consuming to switch production lines back to military purposes should external powers threaten the PRC. The official media have given repeated reassurances that this will not be allowed to happen, arguing that civilian and defense production are mutually reinforcing and pointing out, where appropriate, when a given factory has overfulfilled its quotas of both military and civilian goods.[20]

On the second point, the Chinese press has occasionally alluded to problems with the civilian-use products of military industries, criticizing factory managers for insufficient marketing research,[21] a lack of attention to quality control,[22] an "anything for money," [23] approach and caring more about the interests of their own units than those of the economy as a whole.[24] Local-level officials, on the other hand, complain about overly-rigid central government control, and argue that more autonomy would produce better results.[25]

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[15] *Xinhua* (Beijing), Mar. 22, 1984 in FBIS–CHI, Mar. 27, 1984, p. K/20.
[16] *Xinhua* (Beijing), Sept. 3, 1983 in FBIS–CHI, Sept. 7, 1983, pp. K/11-12.
[17] Nanjing Radio, Dec. 5, 1983, in FBIS–CHI, Dec. 8, 1982, p. K/8.
[18] Vigor Fung, "China Uses Idle Defense Plants to Produce Consumer Goods," The Asian Wall Street Journal (Hong Kong), Aug. 20, 1984, p. 12.
[19] Chengdu Radio, Apr. 20, 1983 in FBIS–CHI, Apr. 20, 1983, pp. Q/2-3.
[20] See e.g. *Xinhua* (Beijing), Jan. 20, 1984, in FBIS–CHI, Jan. 24, 1984, p. K/16.
[21] *Xinhua* (Beijing), Feb. 7, 1984 in FBIS–CHI, Feb. 8, 1984, p. K/14.
[22] Nanchang Radio, Apr. 3, 1982 in FBIS–CHI, Apr. 14, 1982, pp. 0/2-3; Xian Radio, Apr. 15, 1982 in FBIS–CHI, May 4, 1982, p. T/3.
[23] Fendou (Harbin), Feb. 10, 1983, p. 42 in US Department of Commerce, Joint Publications Research Service (hereafter JPRS), No. 83946, pp. 9-10. This particular instance of the materialist mentality allegedly led to explosions that killed 15 people and leveled a 300 square meter factory building.
[24] *Jingji Ribao* (Beijing), Aug. 8, 1983, pp. 1; 4 in FBIS–CHI, Aug. 12, 1983, p. K/2.
[25] Fung, p. 12.

However, at least one foreigner who purchases the products PLA factories make for export has been favorably impressed. A Rockwell International executive who has bought substantial quantities of goods from North China Industries Corporation (NORINCO), the trading arm of the Ministry of Ordnance Industry, describes the managers he has dealt with as intelligent and hard-working, and their factories as quite efficient and well managed by Chinese standards.[26]

The products seem to be good enough to have caused resentment among foreign competitors. One Beijing defense industry plant reportedly manufactured China's first five-color intaglio press for plastic films by "referring" to a machine imported from Japan, and a Shanghai military engineering factor began producing industrial steam irons, again after "referring" to a Japanese import.[27] The Beijing representative of Honda Motor Company has openly expressed dissatisfaction with Chinese plans to export motorcycles made in the PRC with Japanese technology, since they would compete with Honda-manufactured cycles sold elsewhere in Asia.[28] Apparently satisfied with preliminary results, the Chinese leadership has decided to press forward with the integration of civilian and defense industries.[29]

B. PLA Involvement in Other Areas of the Chinese Economy

In addition to its new role in civilian production, the military has been heavily involved in more traditional areas of the civilian economy, such as construction of hospitals, apartment houses, and irrigation works. In the past few years the PLA has, among other activities, built a subway line in Beijing, carried out an ambitious water diversion project in the Tianjin area,[30] completed a large-capacity coal mine in Shaanxi and a chemical fertilizer plant in Hubei, flown crop-dusting sorties in many different areas of China, and been at the forefront of a major nationwide afforestation campaign.

Through its network of over 2,000 PLA farms,[31] the military continues to be expected to strive for self-sufficiency in food production. Some army units are even able to supply food for local markets. In mid-1983, Chinese premier Zhao Ziyang endorsed PLA efforts to increase agriculture and sideline production by an average of 20% each year in order to "replenish state supply and improve the army's life."[32] And the paramilitary Production and Construction Corps of Xinjiang, its membership said to total over one million,[33] has been revived as part of Deng Xiaoping's plans to develop northwest China, one of the PRC's "last frontiers."[34]

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[26] Author's conversation, September 13, 1983, Washington, D.C.
[27] Robert Delfs, "Swords Into Bicycles," *Far Eastern Economic Review*, Aug. 25, 1983, p. 91.
[28] Fung, p. 12.
[29] See Zhang Aiping's speech of Sept. 3, 1983 on this theme, in FBIS-CHI, Sept. 7, 1983, pp. K/10-11.
[30] For an interesting eyewitness account of the military's work on this project, see Christopher Wren "Huge Water Project Aids China City," New York Times, Dec. 11, 1983, p. 3.
[31] *Xinhua* (Beijing), Mar. 5, 1983 in FBIS-CHI, Mar. 9, 1983, p. 11.
[32] Ibid.
[33] *Xinhua* (Beijing), Jan. 14, 1983 in JPRS-CHI 82842, p. 120.
[34] Urumqi Radio, Jan. 25, 1984 in FBIS-CHI, Jan. 26, 1984, p. T/4.

All of the above activities represent specific PLA contributions to the economy, the first of the four purposes noted in Section I above. The PLA has been involved in the other three areas as well. In terms of the symbolic function of its production work, the PLA has for several years been involved in building what are called "civilized villages": areas characterized by harmonious civil-military relations and in which PLA and civilians carry out joint projects which will benefit the community.[35] For the same reasons, the PLA has helped civilians to harvest crops, built day care centers, provided free medical care, and in sundry ways attempted to help people in the communities near which their units are stationed to overcome difficulties in their daily lives. The press has credited these activities with bringing about a marked improvement in civil-military relations.[36]

The publicity given to high-ranking military leaders loading boxcars, washing windows, sweeping trash and "working at lower levels"[37] seems aimed at correcting arrogance on the part of military personnel. Most reports mention that these activities are carried out under highly unpleasant circumstances, such as howling windstorms or freezing temperature. It is not, of course, possible to ascertain from these reports whether such duties genuinely succeed in inducing humility, or are tolerated as necessary rituals, or simply induce resentment on the part of those who must perform them.

As for the fourth traditional purpose of the military's production activities, raising skill levels in the society as a whole, there has been over the past several years an explicit campaign to provide recruits with what is called "dual-purpose training." It aims at producing individuals whose skills will be useful in both military and civilian labor forces.[38] In some cases, this has involved provision of technical training skills.[39] In others, even in relatively advanced areas such as the Shenyang Military Region, dual-purpose training has entailed providing soldiers with an elementary school education.[40]

III. IMPACT OF THE PLA'S PARTICIPATION IN THE ECONOMY

What effect the PLA's already substantial and, in some sectors, increasing participation in the civilian economy has on military preparedness has been the subject of considerable speculation, both abroad and within China. It is not difficult to accept the official argument that civilian goods are more needed by the economy at present than military items, and that the PLA's activities in this sphere are in fact a major contribution to economic development in the PRC. However, the real test will come if and when a decision is made to switch back to defense production. It is possible that the

[35] See *Renmin Ribao*, July 20, 1983, p. 1 for a fuller explanation of the purposes of these villages.
[36] Ibid.
[37] See, e.g., *Xinhua* (Beijing), May 29, 1981, in FBIS-CHI, June 2, 1981, pp. R/103, *Xinhua* (Beijing), Jan. 24, 1982 in FBIS-CHI, Jan. 27, 1982, p. R/3.
[38] See Zheng She, "Two-Way Training in China's Army," *China Reconstructs*, November 1983, pp. 28-30.
[39] *Xinhua* (Beijing), July 23, 1983 in FBIS-CHI, July 27, 1983, pp. K/18-19.
[40] Beijing Radio, Nov. 17, 1982 in FBIS-CHI, Nov. 23, 1982, p. K/13.

technical problems inherent in retooling will make the conversion period unacceptably long. Also, since the civilian market is more profitable, the problems of retooling may be compounded by worker and management resistance to going back to defense production, except in the face of the sort of massive invasion the PRC is unlikely to face.

Official sources have also sought to remove apprehension that the dual-purpose training program would have adverse effects of military preparedness. The only effect on military training, they argue, is positive "because (units make) use of their cultural knowledge and technical know-how gained in dual-purpose training to develop new weapons and equipment, solve difficult training problems, and study military science." [41] Dual-purpose training is said to help both the construction of a modern army and local-level economic construction.[42]

Military leaders and local civilians have not always been in agreement on where military duties end and the needs of family and community begin. For example, one press report described a prosperous elderly peasant who for several years had refused to allow his son to join the army. Finally succumbing to pressures of various sorts, he agreed—but only on condition that the young man be assigned to the motor pool, and with the understanding that after two years the son would return to contribute to the family income by driving a private transport vehicle. Clearly regarding such attitudes as typical rather than exceptional, the account criticized the sort of mentality that regarded the military as a cost-free training school.[43]

Even excluding the time spent by defense industry factories in manufacturing civilian goods, for which no figures have been made public, the time spent by the PLA in support of civilian-sector activities has been impressive:

Year	Estimated size of PLA	Total days (in millions)	Source
1979-80	4,750,000	50.38/52.38	Derived. Hong Qi Feb. 1, 1983, p. 7 says PLA gave 98 million days in past 4 years; Beijing Review Aug. 1, 1983, p. 15 gives a total of 100 million workdays since 1979; from each has been subtracted the total workdays from 1981 and 1982.
1981	4,750,000	21	Beijing Radio, Aug. 27, 1982, in FBIS-CHI Aug. 31, 1982, p. K/7.
1982	4,000,000	26.62	Xinhua Feb. 10, 1983 in FBIS-CHI Feb. 16 1983, p. K/2.
1983	4,000,000	22	Xinhua Jan. 18, 1984, in FBIS-CHI Jan. 19, 1984, p. K/15.

Claims that the Chinese military is becoming increasingly professionalized notwithstanding, the PLA's involvement in civilian construction activities in the Deng Xiaoping era has increased significantly. A mid-1973 source noted that the PLA had devoted 8.21 million workdays to local construction in the first half of that year,[44] and a 1979 account set the total at 460 million workdays during the previous 30 years,[45] or an average of 15.3 millions days per year.

[41] *Xinhua* (Beijing), July 23, 1983 in FBIS-CHI, July 27, 1983, p. K/19.
[42] *Banyue Tan* (Beijing), No. 14, July 25, 1983 in JPRS 84693, pp. 106-109.
[43] Lu Fei, "The Difficult Problems Confronting the PLA," Cheng Ming (Hong Kong), No. 71, Sept. 1983 in JPRS 85017, p. 86.
[44] *Beijing Review* (Beijing), Sept. 7, 1973, p. 54.
[45] *Xinhua* (Beijing), Sept. 28, 1979 in FBIS-CHI, Oct. 3, 1979, p. L/26.

Average figures can, of course, be misleading. The PLA's involvement was much higher during the time of the Great Leap Forward—a reported 59 million days in 1958 and 44 million in 1959.[46] And there have been variations in the size of the PLA. However, it seems clear that the commitment of the PLA to the civilian economy under Deng Xiaoping has increased, despite the latter's plans to modernize and professionalize the military. Figures in excess of 20 million days per year have been reported consistently, even as the size of the military has been dropping from an estimated 4.75 million at the end of the 1970s to a planned 3.75 million by the end of the 1980s.[47]

Although one might be tempted to conclude that such large-scale undertaking on behalf of the civilian economy would be bound to adversely affect the PLA's training program, such is not necessarily the case. Although the number of days involved sounds enormous, the size of the PLA is also large. Dividing total reported days by the estimated size of the PLA yields an average of between 4.4 and 6.6 days per person—hardly enough to be detrimental to troop training. Moreover, many of these activities are carried out by specialized units such as the PLA's Capital Construction Corps and, before their separation from the military in January 1984,[48] twelve divisions devoted to railway construction and maintenance.

Efforts have also been made to insulate main force units from the brunt of participation in mass campaigns such as the recent afforestation and sanitation drives. Apart from highly publicized appearances by leading military figures, which are apt to be token, it is generally the regional forces and surplus office personnel who are sent to do these tasks.[49] While it might be argued (and this author would agree) that the presence of such large numbers of extraneous personnel is in itself deleterious to the creation and maintenance of an efficient military apparatus, it should also be pointed out that most organizations in the PRC are overstaffed when judged by Western standards, and the PLA is no exception.[50] The alternative, in many cases, would be unemployment.

There are other caveats to this general conclusion that the PLA's involvement in the civilian economy does not substantially affect military preparedness. First, when one creates in a military organization both "hard" billets and "soft" billets—i.e., rigorous troop training under adverse conditions and service in remote border areas, versus factory jobs that produce skills which are saleable in the civilian economy, and liaison activities with urban populations—pressures will be created toward obtaining the soft billets and away from participating in the sort of training programs the PLA needs to improve its fighting capabilities. The story cited

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[46] See *Xinhua* (Beijing), Apr. 25, 1959 and *Renmin Ribao*, Apr. 6, 1960, in Joffe, p. 85.

[47] See the figures estimated annually in successive issues of *The Military Balance*, published yearly by the International Institute for Strategic Studies in London.

[48] *Xinhua* (Beijing), Dec. 13, 1983 in JPRS-CPS-84-002, pp. 46-47.

[49] Author's conversation with a former US military attache stationed in Beijing; Washington, D.C. Feb. 13, 1984.

[50] Efforts are being made to minimize the number of extraneous military and paramilitary personnel. The total size of the PLA is being reduced by one million, and the Production and Construction Corps has also announced plans to cut the number of cadres as opposed to persons directly engaged in production techniques. See Urumqi Radio, Mar. 26, 1984 in FBIS-CHI, Mar. 29, 1984, p. T/12. How successful these efforts will be and what effect they will have on the PLA's work on behalf of the civilian economy remain to be seen.

above of the peasant who refused to let his son join the military until he could be assured of a driver-training course is a case in point. In mid-1983, the official PLA newspaper *Jiefangjun Bao* reported discovering that a number of ineligible personnel had received illegal transfers from their units to such a course in Beijing.[51] And there are numerous reports of individuals who devise ingenious methods to avoid performing their military duties at the grassroots level in favor of less rigorous posts.[52] There are also tales of PLA cadres who arrange illegal transfers to favored cities like Shanghai and Beijing, leaving their duties elsewhere untended.[53]

Second, the military's involvement in economic activities gives the PLA increased opportunities for corruption. At the same time that the PLA was being publicly praised for spearheading a major mass campaign for afforestation throughout China, the PLA in Tibet was discovered to be felling large numbers of trees, manufacturing furniture from them, and selling it for personal profit.[54] Since denudement of ground cover has had extremely deleterious effects on the Tibetan economy and living standards in recent years, the case seemed particularly serious.

Cases of PLA corruption stemming from misuse of its economic functions are by no means confined to remote areas like Tibet. In mid-1982, Guangzhou province banned all PLA economic activities that were not specifially authorized, pointing out that certain practices have disrupted the socialist unified markets and sabotaged the state planned economy. They have also provided a hotbed for illegal and criminal activities such as smuggling and peddling contraband, engaging in bribery and corruption, and profiteering and swindling.[55]

And in Xian, construction that PLA personnel had represented as beneficial to the community was discovered to be illegal, for private benefit, and destructive to both the environment and the historic relics of that area.[56] While there is no direct cause-effect linkage between military corruption and reduced military effectiveness, the two tend to be closely correlated.

Judging from numerous official pronouncements on these subjects, Chinese leaders are aware of the problems caused by pressures to transfer from hard to soft billets, and of the consequences of PLA corruption stemming from the military's role in the civilian economy. They have vowed to root out these harmful practices. While it would be unrealistic to expect that any very complete end to such corruption can be accomplished, continued vigilance may at least keep the problems within manageable limits.

To the extent that this can be done, the PLA's activities on behalf of the civilian economy may be basically beneficial. Nonetheless, it is worth speculating on whether these activities might

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[51] Quoted by Beijing Radio, July 8, 1983, in FBIS-CHI. July 12, 1984, pp. K/17-18.
[52] See, e.g. Kunming Radio, Apr. 20, 1984 in FBIS-CHI, Apr. 25, 1984, p. Q/5.
[53] *Renmin Ribao*, Jan. 9, 1984, p. 1. This case involved nearly one hundred cadres who were supposed to be performing duties elsewhere.
[54] Lhasa Radio, Feb. 6, 1982 in FBIS-CHI, Feb. 8, 1982, p. Q/3; Lhasa Radio, Feb. 13, 1982 in FBIS-CHI, Feb. 13, 1982, pp. Q/1-2.
[55] See *Renmin Ribao*, June 5, 1983, p. 3.
[56] *Xinhua* (Beijing), Mar. 5, 1984 in FBIS-CHI, Mar. 14, 1984, pp. K/20-21.

not be performed more efficiently by civilians acting on their own behalves. However, in a country whose population is as large as China's, and in which developmental needs are great and the threat of external invasion small, the opportunity costs of maintaining a substantial military involvement in the civilian economy are probably not great. And in any case, repeated pronouncements by the highest leaders of the PRC indicate that the military will remain heavily involved in production work, partly because military production is regarded as important in maintaining close links with the civilian population, and partly because it is believed to be "a glorious tradition . . . and also an important part of building a modernized revolutionary army with Chinese characteristics." [57]

[57] *Guangming Ribao* (Beijing), Aug. 8, 1983, p. 3 in JPRS 84264, p. 46.

VII. SCIENCE AND TECHNOLOGY

OVERVIEW: SCIENCE AND TECHNOLOGY UNDER REFORM

By Richard P. Suttmeier*

CONTENTS

INTRODUCTION

On September 29, 1984, *The New York Times* carried an article with the headline, "Georgia Tech to Help China Build High-Technology Industries." The article, outlining the details of the agreement reached between Georgia Tech and the Chinese Association for Science and Technology (CAST), was not without interest. Left unstated, however, were the facts that such an agreement would have been inconceivable as recently as seven years ago, and that an agreement of this sort is symtomatic of what appear to be enormous changes in China's approach to the "modernization" of science and technology (S&T).

For a country plagued in the past by erratic official attitudes toward science and technology, to a remarkable extent, China's post-Mao leaders have stayed the course thus far in according to S&T a valued, central role in the nation's modernization drive. In spite of adjustments in policy in 1981 to give greater attention to applied research and technological development, and in spite of deep seated resistance to some aspects of policy from certain quarters, major changes in science and technology are beginning to take hold. Reflected in the *Times* article are the increasingly complex and deep ties China has been developing with the international technical community, and new approaches to industrial research. To these may be added new approaches to the organization and funding of science and to research in institutions of higher

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education (IHE's), new policies for technical manpower, and new attitudes toward intellectual property.

A new policy vision for S&T has emerged in China which is coupled to a program of reform intended to make the vision a reality. The vision, which Chinese policy makers have been struggling with since the early 1980's, reflects a desire for a more comprehensive and integrated approach to the institutional mechanisms for S&T development and priorities for S&T. In addition, it reflects a desire to anticipate the social and environmental impacts of S&T, including the relationship between S&T and basic changes in social institutions and values. The vision continues to evolve, aided by the emergence of groups of policy analysts, and students of the multiple facets of the social relations of science. These groups have launched a series of new journals which provide lively forums for the airing of views. Central to these discussions, and to the official thinking which they help shape, is the broad outlines of a "technology policy."

Inspiring the emerging conceptions of a "technology policy" are two basic considerations. The first is the belief that S&T must play a key role if the national goal of quadrupling of gross output value of the economy by the year 2000 is to be reached. To reach that goal, China's strategy of economic growth must change to one of "intensive" growth marked by productivity gains driven by technological innovation. Also inspiring the new technology policy is the image of a worldwide, "new technological revolution," in which rapidly emerging science-based industry is becoming the new basis for a nation's "wealth and power." This image has captured the imagination of policy makers and policy analysts alike, and has become a legitimizing symbol for many of the bolder policy initiatives and reforms seen in the last two years. Chinese leaders seem to believe that they cannot allow the "new industrial revolution" to pass China by, and this belief emboldens them to take on entrenched interests and previously sacrosanct ideological values which stand in the way of reform.

Out of this broad conception of the imperatives of technology policy come many of the more specific policy changes discussed below. China seeks to operationalize its technology objectives through a judicious mixing of technology imports from abroad and the achievements of an invigorated R&D system. Its new "open door" policy is to attract foreign investment, and with it, foreign technology. It has instituted a patent system to both serve the "open door" policy and stimulate domestic innovation. Finally, it has begun reforms in the R&D system designed to change the ways R&D is financed and managed, how R&D is to be related to production, and the ways technical manpower is recruited and rewarded. All of these changes come within a context of technological priorities stressing the importance of acquiring those technologies thought to be the keys to the "new industrial revolution," such as microelectronics, computers, biotechnology, and materials science.

China's program for change in S&T reached its highest official expression on March 13, 1985 when the Party Central Committee issued its "Decision on the Reform of the Science and Technology

Management System."[1] An appreciation of the significance of this document, however, requires attention to China's recent history of frustrations with the S&T system.

THE NEED FOR REFORM

As the Chinese have sought to realize their new policy vision for S&T, they have been forced to confront the problems of S&T development which have plagued them for years. Many of these problems are attributable to the radical policies of the Cultural Revolution decade (1966-1976). In the process of reversing these policies, however, the Chinese have developed a renewed awareness that many other problems are a function of the design of China's Soviet-inspired S&T institutions. Let us consider what the Chinese believe the problems to be.

In a speech to a national science and technology work conference held in late 1983, State Counselor Fang Yi (formerly President of the Chinese Academy of Sciences—CAS—and Minister in charge of the State Science and Technology Commission—SSTC) identified the two main problems which had been of concern to science policy officials since the late 1970's. According to Fang, these are the problems of overcoming the "disconnection between scientific research and production work," and of fully developing "the role of qualified people."[1a]

RESEARCH/PRODUCTION LINKAGES

The problem of "disconnection" has been addressed by a number of Chinese commentators in recent years. For instance, in contrasting the percentage of Chinese R&D achievements that actually are put into production with those of other countries, the Chinese gauge that their rate of utilization has been only about 10 percent. In contrast, they believe the record of the Soviet Union to be in the 30-50% range, while that of Western Europe to be 50-60%.[2]

This poor performance is all the more disappointing to the Chinese in light of the research capabilities which they possess. As one science policy official put it,

> China and Japan began their respective research on semiconductors at about the same time and China succeeded in the experimental production of a transistorized computer before Japan did, and China successfully developed a laser less than one year after the first laser came on the international scene. Today, China has substantial production in its semiconductor industry, computer industry and laser industry and tens of thousands of production workers in these industries, but we have fallen behind international standards in these areas.[3]

Increasingly, the Chinese came to believe that the failure to realize the potential which exists is institutional. For example, in the view of some analysts, there has been a serious failure in the national planning and coordinating mechanisms.

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[1] An English version can be found in *Beijing Review* #14 (April 8, 1985). 19-21.

[1a] XINHUA. December 17, 1983. In Foreign Broadcast Information Service. *Daily Report: China* (hereafter, FBIS). December 21, 1983. p. k13.

[2] Xia Yulong and Liu Ji. "The Battlefront of Science and Technology Must Also Purge Mistaken 'Leftist' Influence." *Kexuexue Yanjiu Lunwen Xuan* (hereafter *KYLX*). February, 1981.

[3] Luo Wei. "The Position and role of the Academy of Sciences in the Chinese Research System." *Ziran Bianzhengfa Tongxun*. 3 #3 (June 10, 1981). In Joint Publications Research Service (hereafter JPRS) 81620. p20.

. . . many research subjects were redundant. Money was spent without producing any results. According to some people's estimates, about 40% of or nation's scientific research subjects repeat the reseach results already available abroad, and repetition within the nation is even more serious. There are nearly 100 units engaged in the development of yittrium aluminum garnet laser crystals. There are nearly 300 units developing the rotor engine, there are over 20 units developing magnetic disks as peripheral equipment for computers. There are as many as 980 units studying monoploid cultivation.[4]

More generalized concerns about institutional failures were expressed by China's senior aerodynamicist, Qian Xuesen:

I believe there is no difficult scientific or technological question which can confound China's scientific or technical personnel. They can complete very well whatever task the Party and government hand them. But we do have one fear: there are too many obstacles in organization, management, administration, and other areas; sometimes they result in our not being able to move an inch and makes us useless. This is what is meant by having science and technology held back by non-scientific and technical questions." [5]

The Chinese face a fundamental analytical problem when considering the failures of research-production linkages: is the failure to be found on the research side, is it to be found on the production side, or on both sides? The Chinese have concluded that there are problems on both sides. While research units, if left to their own devices, seem to drift off into activities which often seem unrelated to production, there also seems to have been over the years, an indifference on the part of factory managers to the outputs of the R&D system. For many years, these problems were seen as a failure of communication, which could be solved by bringing the two sides into contact with one another. More recently, the definition of the problem has been broadened to include the question of whether incentives exist to form the linkage.

Both the incentive and communications problems (and indeed, many of the institutional problems in science) can be traced back to the decision to emulate the Soviet system for organizing research. Although the Chinese have made modifications in the Soviet model over the years, in its main forms, it has persisted as a major structural determinant on the conduct of both research and technological innovation. The main features of this model are its commitment to centralized, free standing research academies and institutes, its minor emphasis on research in universities, and its attachment to central planning and funding of research.

As with the economy generally, the Soviet model in science did serve a purpose when it was adopted in the 1950's. It provided the intrumentalities for rapid resource mobilization, and thus enabled the Chinese to move from a rather primitive base in science at the time of Liberation, to an impressive, and quantitatively extensive system by the early 1960's. It also enabled the Chinese to introduce a variety of, what were to China, new fields of inquiry, including atomic energy, electronics, lasers, etc.

However, the Soviet model has biased the Chinese system away from locating industrial research in production units, and from fostering research in conjunction with education in institutions of higher education (IHE's). It has also produced a system of financing

[4] Xia Yulong and Liu Ji. "The Battlerfront . . ."

[5] "Qian Xuesen Discusses Question of Intellectuals." *Jiefang Ribao.* December 8, 1982. In JPRS 83240 p. 212.

research which guarantees funding as a matter of right, through annual appropriations, regardless of the economic or intellectual merit of the work being performed. In a similar manner, it guaranteed resources to production units as well, thus removing incentives to undertake the risks of innovation.

Finally, the planning system, instead of providing opportunities for the "rational comprehensive" review of priorities, and alterations in them, led instead to the mindless incremental accretions over the years to fields identified as priorities in the 1950's. As a result, in the 1980's, China is faced with irrational oversupplies of manpower and facilities in some fields, (notably heavy industry and defense) and severe shortages in others. Thus, at least some of the reforms now under way can be thought of as efforts to break from the structural constraints imposed by the Soviet model.

UTILIZATION OF TECHNICAL MANPOWER

When Fang Yi called for strengthening the role of "qualified people" he was referring to a whole host of problems, including those of increasing the numbers of such people, seeing that they work at tasks befitting their training, involving them in national and local decision making forums, and improving the salaries, housing, and working conditions for scientists and engineers.

Arriving at reliable quantitative and qualitative assessments of China's technical manpower pool is a baffling business.[6] What is clear, however, is that while China claims to have some 6–7 million scientists, engineers and technicians, of whom 350–400,000 are employed in R&D, these numbers fail to reveal what is assuredly great qualitative variation in the training of technical personnel. Thus, only about 10% of the manpower pool can be classified as "senior" scientists or engineers, capable of providing intellectual leadership for China's research institutes and institutions of higher education.[7]

The aggregate manpower figures also do not convey the sense of technical manpower scarcity felt by many Chinese organizations. In one recent report on the electrical cable industry, for instance, it was noted that trained technical personnel represented only .74% of the total number of employees (in contrast to 6–7% in Japan), and that even in the industry's research institutes, the technically trained accounted for only 46% of the total staff.[8]

The problems of properly utilizing "qualified personnel" have been compounded since the Cultural Revolution by the rise of a host of what are often referred to as "feudal" practices associated with the dominant role in Chinese life of the work unit, or *danwei*. Leading cadres in Chinese work units often enjoy a great deal of local power because many of the basic needs of the individual in China—housing, health care, education—are supplied by the unit,

[6] See. Leo A. Orleans. *The Training and Utilization of Scientific and Engineering Manpower in the People's Republic of China.* U.S. House of Representatives, Committee on Science and Technology, Science and Technology in the People's Republic of China, Background Paper No. 5. October, 1983.

[7] *Ibid.* p. 47.

[8] Li Minquan. "A Discussion on Transforming Research Institutes of Various Trades into Technological Development Centers Through Readjustment and Improvement." *Keyan Guanli. (Scientific Research Management)* 1 (1984). In JPRS–CST–84–031. 171.

and the allocation of these are subject to the discretionary authority of the *danwei* leaders. Although new *policies* for upgrading the status and improving the utilization of technical intellectuals were announced in the late 1970's their *implementation* has often been frustrated at the *danwei* level by cadres imbued with the anti-intellectualism of the past. Technical personnel have been regarded by the leading cadres of the *danwei* as "unit property" (one manifestation of what is often called "unit ownership"). Policies to improve the lot and the utilization of technical personnel, therefore, have run up against a major structural condition calling for reform.

The abuses of the *danwei* system are evident in the following exerpt from a recent study of the personnel system:

> . . . when a person is assigned to a certain unit, he will almost certainly work there forever. The masses say, our personnel system is not a system of ownership by the whole people, but a system of ownership by the unit. . . . As a result, unneeded people cannot leave, needed people cannot be admitted. This method of consolidation hinders the leadership at each level to establish its own rational intellectual structure and also gives a green light to those mediocre leaders to bury and suppress talent.[9]

"Unit Ownership" is also blamed for the blind application of seniority principles, the use of "obedience" or subservience as criteria in personnel decisions, and the practice of considering family ties in personnel matters.

> . . . mechanically forcing children into the working units of their parents does not allow people to develop all their talent, and it also seriously effects the intellectual structure and calibre of every unit. . . . We must abolish the practice of assigning based only on family ties.[10]

The broad objectives for reform, as expressed by Fang Yi, thus grow out of a percieved dissatisfaction with the basic design of S&T institutions inherent in the Soviet model, and out of the corruption of those institutions by radical policies which reached their fullest expression during the Cultural Revolution. Let us consider below how the Chinese have operationalized the broad objectives for change into a reform program.

THE REFORM PROGRAM

Over the years, the Chinese research system has evolved into one described as having five "sectors." These are the academy sector, the IHE sector, the production ministry sector, the national defense sector, and the "local" sector composed of research units under provincial and sub-provincial units of government. The latter now includes 80% of the 4,300 research institutions of the country.[11]

The reform program has influenced each of these sectors. First, the CAS has undergone a number of changes both in terms of its relationship to the rest of the research system, and internally.[12]

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[9] "Open Up a New Situation for Talent." *KYLX*. April, 1980.

[10] *Ibid.*

[11] Zhang Xiaobin. "Organization Framework and Management System of China's Science and Technology." Unpublished paper presented at the China-Australia Conference on Science and Technology Policy. Beijing, November 1983.

[12] See, *The Chinese Academy of Sciences (A Brief Introduction)*. Beijing. Chinese Academy of Sciences, 1981; Lu Jiaxi. "Several Problems Concerning Current Scientific Research Management." *KYGL*. #3 (July 1982). In JPRS 83240 pl69; Xinhua January 30, 1983. In FBIS. February 9, 1983. p. k13; *Zhongguo Xinwen She*. February 6, 1983. In FBIS. February 9, 1983. pp. k 15–16; Xinhua. February 3, 1983. In FBIS. February 9, 1983. p. k15.

Second, research in IHE's is being encouraged as never before (although funding is still a problem). Third, major reorganizations and new funding schemes are being tried in industrial research. Fourth, efforts have been made to direct the considerable concentrations of material and human resources found in the defense R&D sector to the needs of the civilian economy. Finally, local governments have come to see science and technology as key ingredients in the development of their regions, and have taken steps to stimulate local S&T capabilities. This has resulted in vigorous science and technology based growth in small cities in certain parts of the country. (See the chapter by Rehn in this volume).

The evolution of this five sectored system and the decision to emulate the Soviet model of organizing research are closely related. Apart from the fact of China's close relationship with the Soviet Union in the 1950's, which argued for the emulation of Soviet institutions, the condition of science in the early 1950's required mechanisms for a centralized mobilization of resources. Thus, the idea of an academy-centered system made sense to the Chinese, both because of Soviet assistance, and because the Nationalists, in the face of scientific underdevelopment, also had opted to centralize research in the Academia Sinica.

From the beginning of the PRC, therefore, the CAS was designated as the lead organization in the development of Chinese science. However, over the course of the 1950's, the research system inevitably became more differentiated, as research activities spread to the production ministries, to the defense sector, to the IHE sector to a lesser extent, and by the end of the 1950's, as a result of vigorous decentralization measures, to the local governments. In this diffusion of capabilities, however, it was the CAS which was to be the creative center.

The relative success of this diffusion carried with it a set of problems which were never really solved. The two most notable were how to bring policy coherence to this increasingly differentiated system, and how to define the roles of the various research performers, particularly, that of the CAS. The first problem was approached by the establishment of the State Science and Technology Commission (SSTC) in 1958. Over the years, however, the SSTC seemingly has not had the bureaucratic muscle to exercise control over the entire R&D system. In large part, this was because it had no formal control over the greater share of the budgets of such key research performers as the CAS and institutes under the production ministries. In addition, although the SSTC did have, and continues to have responsibility for the preparation of research plans, effective integration of science and technology plans with economic plans evidently did not materialize.

ORGANIZATIONAL CHANGES

By the early 1980's, the Chinese concluded that the gap between research and economic plans was due in part to the organizational separation of the SSTC from the State Planning Commission. An important organizational reform in 1981 therefore was the creation of a new "planning bureau," staffed jointly by personnel from the two commissions. In addition to providing an organizational link to the two kinds of planning activities, the new bureau reportedly has the comprehensive budget authority which the SSTC never enjoyed.

The new joint planning bureau was associated with two other changes. The first was a redefinition of the role of the SSTC. This change made it less of an operating agency attempting to exercise control over the entire research system. Instead, it has been given operating responsibility over a more limited sphere of the R&D system, but its responsibilities for policy analysis, and "declarative policy" development has increased.

The second change was the creation in 1982 of a new supra-ministerial, supra-commission organ referred to as the "Science and Technology Leading Group" (STLG). This office is formally headed by Premier Zhao, but its day to day business has been conducted by officials at the vice-ministerial level of the SSTC and the Planning Commission. The STLG includes high level representation from the SSTC, the Planning Commission, the State Economic Commission, the Ministry of Education, the Ministry of Finance, the CAS, and representatives from the defense R&D sector. Its creation signifies high level commitment to science and technology, and for the first time since the 1950's, provides an authoritative forum for national policy coordination and interministerial dispute settlement.[13]

Thus, the science and technology policy structure has evolved into one where authoritative, comprehensive (i.e., cross-sectoral) policy is supposedly set at the highest level of government, where the technical tasks of planning are performed by the joint planning bureau attempting to coordinate economic and science and technology plans, and where the conceptual tasks for science and technology policy development are handled by the SSTC.

China's ability to handle these conceptual tasks has increased notably in recent years. Two developments in particular deserve attention. The first is the somewhat spontaneous appearance in the post-Mao period of groups of young technocrats engaging in studies of scientific development. These include studies of science and technology policy, research management, the history and philosophy of science and technology, science and technology manpower analyses, and studies of the psychological and sociological dimensions of creativity in science and technology.

These groups began publishing their own journals, which have become an important forum for science and technology, and more general economic reform thinking.[14] Gradually they have become more formally organized, and in 1982, they became parts of a new national "Association of Science of Science and Science and Technology Policy Studies" (ASSSTPS).

The second important development which has aided the development of science and technology policy thinking is the creation of the National Research Center for Science and Technology for Development (NRCSTD) within the SSTC. This center, which was inspired by China's dealings with the United Nations, does policy

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[13] Zhang Xiaobin. "Organization Framework . . ."

[14] A rich collection of articles from these journals is available in English in five special editions of JPRS, entitled *China Examines Science Policy*. The first of these is unnumbered, but is dated January, 1982. Subsequent editions bear the JPRS numbers 81620 (24 August, 1982), 83240 (12 April, 1983), 84524 (13 October, 1983), and JPRS-CST-84-011 (17 April, 1984).

analysis and is staffed by a number of the more cosmopolitan, younger officials of the SSTC. The SSTC is linked to the ASSSTPS informally; key officials in the Commission are members and officers of the latter.

Defining the role of the Academy of Sciences in a system that no longer required its stimulation to the degree that it once did, has been a particularly difficult problem since the late 1950's. The essence of the CAS problem is as follows. If the CAS is to be an applied research unit (which it has been, given that 90% of its budget has been for applied research), then isn't this an inappropriate mission given its organizational separation from production units? If it is to be a basic research organization, and given the fact that basic research should only be a small part of a developing nation's R&D effort, than shouldn't its influence (particularly its command of the highest calibre human resources) be reduced? In addition, doesn't it make more sense to concentrate basic research in IHE's, which China's western trained scientists have long recommended?

The primacy of a central academy of science, the "signature" of the Soviet approach to the organization of science, is clearly being rethought in today's reform minded China. Among the more controversial proposals for change is one that would lead to the divestiture of many of the CAS's nearly 120 research institutes (many employing well over 1,000 research personnel). Such a proposal would see the Academy recast as less a research performer, and more as a honorific and advisory organization, somewhat like the U.S. National Academy of Sciences. The fact that the CAS has grown to be a huge bureaucratic organization with close to 120 institutions and over 30,000 research personnel makes a divestiture program unlikely; its very size however, makes it understandable why such a proposal would be made.

The expanding role of research in IHE's is another sign of movement away from the Soviet model. This change, while seemingly independent of any CAS divestiture policy, would be reinforced by the latter. The western model of the research university, combining research and advanced training, is taking root. Its advocates are no longer only the senior scientists trained in the west at an earlier period, but also now include members of the younger generation who have studied abroad. Indicative of the regime's support for this change is the fact that 70% of the products of China's new graduate programs are being assigned to the higher education sector.[15]

A third area where a departure from the original Soviet model of the 1950's is evident is in the industrial ministry sector. Here, a variety of experimental reorganizations have occurred to alter the pattern of freestanding, centralized research institutes serving the needs of an entire industry. Among the changes being tried are the following. First, some institutes continue to be free-standing, but they are now expected to operate with revenues generated by the sale of their services instead of receiving annual appropriations from the national budget.[16] Others have lost their autonomous

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[15] *Renmin Ribao.* October 3, 1984. In JPRS-CPS-84-074. 34.

[16] This change, which has been underway for a few years was recently approved formally by the State Council in 1984. See, XINHUA. May 24, 1984. In FBIS. May 25, 1984. p. k20.

standing, and have been absorbed by the new large industrial corporations as "in house," enterprise research establishments. Research units have emerged in the collective sector of the economy, and there have also been reports of the establishment of privately owned research institutes.[17]

While many of the reforms in the industrial research sector show the influence of China's exposure to the west, the Chinese have also studied R&D reform experience in socialist countries. A variety of "research and production combines," have been formed which seem to be modeled after the Soviet reform experiments known as "NPO's" ("science-production organizations"). In the Chinese "combines," research institutes join forces with production units on a contractual basis for the provision of R&D, and a range of other technical services.

CHANGES IN RESEARCH FUNDING

Reforms in the funding of research, having the potential of being the most transformative of all the reform measures, also show a movement away from the Soviet model and the influence of China's exposure to the west. A central objective of the reform of research funding has been to solve the problem of what the Chinese call "eating out of the same big pot." This phrase, which is widely used in discussions of economic reforms as well, refers to the disincentive effects resulting from state support for research (and economic activities generally) under radical egalitarian principles.

In the realms of science and technology, two "pots" are at issue. The first is the national treasury from which support to research institutes was given as a matter of an annual appropriation. The appropriation was a function of the national research plan, but was not seemingly, a function of past performance. Leaders of an institute could count on the appropriation, and thus, in terms of their "cash-nexus," did not have an incentive to push for performance in the form research achievements.

The second "pot" was the budget of the institute as seen from the perspective of its members. As with production units, principles of egalitarianism had taken hold in the world of science as well. Thus performance at research, which can be expected to produce differential rewards, was not the basis for rewarding institute members.

These two problems have led to a reexamination of the underlying philosophy for funding research, and to two improtant policy innovations. The first is the widespread encouragement and adoption of contract research mechanisms, and in some instances, a linking of these to a type of "responsibility system." These changes are in keeping with the philosophy of using "economic" rather than "administrative means" in research management.

The second innovation in funding is the introduction of a special science fund, administered by the CAS, which is available to fund research on a project basis through competitive peer review.[18]

[17] XINHUA. April 8, 1984. In FBIS. April 9, 1984. p. k17.

[18] "Academy of Sciences Establishes Policy for Funding Assistance." *Guangming Ribao.* March 28, 1982. In JPRS 81620 pp. 93-97.

Under the science fund arrangement, individual researchers, whether part of the CAS system or not, can apply for research support for projects. Project proposals are submitted for competitive review by scientific peers. In this way, projects are not dependent solely on the planning mechanism, and on the internal politics of the institute. This innovation has been particularly welcomed by researchers in IHE's, where direct state funding for research has historically been modest. It is also being hailed as an aid to younger scientists and those in the more remote provinces, two groups who have apparently been disadvantaged by the block funding to institutes approach. The Chinese plan to expand on the experiences with the CAS fund and establish a "national science foundation."

The significance of changes in funding mechanisms can be appreciated by considering briefly what analyses of research funding in the Soviet Union have revealed about the operation of Soviet research institutes. In an examination of Soviet basic research, for instance, Thane Gustafson has argued that funding arrangements are a key determinant of professional life. In particular, the block funding of institutes through annual appropriations tends to make intra-institute decision making about research much more political than in the U.S. with its "project-peer" system. That is, the competition for research support among scientists is resolved less by the application of standards of scientific merit, than by the patterns of political coalition within the institute.[19]

The Chinese, until the recent reforms, were using what was in essence the Soviet system. Gustafson's conclusions, therefore, imply that reforms in funding may be particularly important. In addition, his observations point to the need to reconsider some of our interpretations that the organizational pathologies in the Chinese R&D system are uniquely a product of recent Chinese history.

Reform policies have not been universally supported, and resistance to them has come from both non-technical cadres, and from some scientists and engineers. Reactions to one of the more important of the reforms, the introduction of contract research, is illustrative. For some, the introduction of contract research clearly is a threat to their "iron rice bowls," and some opposition stems from such self-interested concerns. For others, however, the concerns are more for the potential problems contract research may cause for the national R&D effort.

In one early response to the contract research idea, written in 1982, two members of the Academy of Iron and Steel Research of the Ministry of Metallurgy, lament the consequences of the contract research system for institutes such as their own.[20] They begin by noting that since the contract research idea was introduced, their institute has come to experience shortages of research projects, funding, modern equipment, and "new blood."

Yet, there is more to their account than mere complaint. The authors develop the argument that the reforms in industrial research are actually imposing a cost on the industry itself. In this view, the

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[19] Thane Gustafson. "Why Doesn't Soviet Science Do Better?" In Linda L. Lubrano and Susan Gross Solomon (eds.). *The Social Context of Soviet Science.* Boulder, Colorado. Westview Press, 1980. pp. 35–43.

[20] Na Baokui and Jian Junzhao. "Preliminary Study of Reforming the System of Research Institutes of the Industrial Sector." *Keyan Guanli* 3 (July, 1982). In JPRS 83240 pp. 193–194.

reform is seen as denying the industry the kind of broad, long-term research on the technologies generic to its production which the Soviet-type free standing institutes such as their own, once provided.

These authors therefore propose another approach to reform which would have the effect of transforming institutes such as theirs, into common pool, "generic technology" centers (to use the phrase introduced in the Carter Administration) that would serve an entire industry. But unlike the Soviet model, these centers would be run like an industrial research consortium, and would be accountable to the major enterprises and companies in the industry, not to an industrial ministry.

THE PATENT SYSTEM

The introduction of contract research, which in many instances is linked to the introduction of the profit motive for research as well, makes the question of "who owns knowledge" inescapable. That is, the introduction of contract research is an instance of where a reform introduced for system performance goals, forces a reconsideration of ideological values. In this case, the value is one of the public ownership of knowledge under conditions of socialism. In taking this value seriously in the past, the Chinese adopted policies that were premised on the belief that research institutes should freely share the results of their research with production units. The assumption was that the costs of producing and disseminating new knowledge were captured in the appropriations received by research units, or in cases where contracts were used, would be reflected in the contract.

As we have seen, the Chinese have now seriously questioned these past practices. They have become skeptical that they produce effective, not to mention efficient, knowledge transfers. The producer of the knowledge lacked the incentives to market discoveries and inventions. From the point of view of the potential consumer of the products of research institutes, since knowledge was often perceived to be a free public good, there was no incentive to use it efficiently.

The current reforms have as one objective the fixing of a more understandable value for research through the reconception of technical knowledge as a commodity to be bought and sold in a market. This of course raises the question of whether the producer can deny knowledge to a potential consumer if the consumer is not prepared to pay the price which the producer feels the value of the knowledge commands. To make the market mechanism work, the producer should have the right of refusal, but to admit that right is in effect to admit that the producer has a claim to the ownership of the knowledge.

It is in this context that the recent adoption of China's patent code takes on significance. The patent law can be thought of as a reform which legitimizes the assignment of intellectual property rights to organizations and individuals.[21] Since the law was recent-

[21] An English version of the law can be found in *Beijing Review* #15 (April 9, 1984). pp. ii–viii.

ly passed, and only took effect on April 1, 1985, it is possible here only to discuss its background, and the expectations the Chinese have for it. (Serving the patent needs of international trade has taken priority over the needs of the domestic economy, and efforts to implement the law for the former objective have been accelerated. See the chapter by Lubman in this volume).

The decision to set up a patent system reportedly was made in 1978. The drafting of the law began in 1979, and a national patent office was established in 1980, with Huang Kunyi, a former SSTC official in the pre-Cultural Revolution period, as its director.[22] The law was clearly long in coming. The Chinese went to considerable lengths to investigate patent practices in the worldwide patent system. Consultations were held with patent offices in other countries, and with the World Intellectual Property Office in Paris.

It is also likely that the law was long in coming because it met with considerable resistance in China. Current discussions praising the introduction of the law frequently make reference to arguments against it. These include allegations that patent systems have "become a tool for multinational corporations to monopolize technology," [23] that a patent system is basically a capitalist institution,[24] and that it will hinder the diffusion of scientific and technological information, which in a socialist country, should be regarded as a free public good.[25]

For proponents of the patent system, there are a number of problems with China's S&T system which the patent system is expected to solve. According to Huang Kunyi, writing with another longtime science official, Wu Heng,

> In the past we emphasized merely that the achievements of science and technology were owned by the state and any unit could gratuitously apply them. This frustrated the initiative of many enterprises, scientific research institutes, and universities and colleges in creating scientific and technological achievements.[26]

Huang and Wu go on to assert that the patent system will help solve the serious problem of research duplication, will help generate additional revenues for research institutes, and will help overcome the problem of secrecy in research, long regarded as a "hard nut to crack" by the authors.[27]

For other proponents, by adopting a patent system and by joining the international patent regime, China will reap the following benefits:

(1) Ready access to the world's latest scientific and technological information. (2) An improved domestic information base for managing China's domestic R&D and technological innovation. (3) A basis for a much stronger system of incentives for research and innovation than the present system of state cash awards and citations for inventions and discoveries. (4) A firmer foundation for importing foreign technology, which should both encourage foreign firms to

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[22] XINHUA. March 14, 1984. In FBIS. March 20, 1984. k15.
[23] JPRS-CST-84-006. p. 7. This issue of JPRS is devoted entirely to discussions of the patent system.
[24] *Ibid* p. 19.
[25] *Ibid.* p. 17.
[26] Wu Heng and Huang Kunyi. "Established a Patent System to Promote Technical Progress." *Renmin Ribao* (hereafter, *RMRB).* January 24, 1983. In *Ibid* P. 12.
[27] *Ibid.* pp. 14-15.

make technology available that they otherwise wouldn't, and to make it available at a lower price. (China has at times paid as much as 300 percent more for the same item of technology than that paid by countries offering patent protection). (5) Finally, since China has begun exporting goods embodying its own inventions, the patent system will protect Chinese goods on the world market.[28]

Whether the patent law remains only a formal document without leading to the behavioral changes expected of it remains to be seen. As an explicit effort to reassign property rights, however, it is an intriguing case suggesting the depth of the current regime's commitment to change.

MANPOWER POLICIES

As noted above, policies relating to the treatment of scientific and technical personnel have been among the most difficult to implement. This is so for two main reasons. The first is the ideological legacy of the past. Cadres at all levels have been reluctant to "give full play" to the work of intellectuals. They fear that ideological winds could change again, and they would become known for being soft on members of the "stinking ninth category," as intellectuals were known during the height of the "gang of four" period.

Intellectuals, in turn, have been reluctant until recently to take initiatives for fear of becoming exposed to some future anti-intellectual campaign. Thus, many technical personnel have become risk averse, as the following passage indicates:

> If research and development fail, you would become accused of not having reformed your world view well . . . In more severe cases, you would be investigated as to your class origin. As time went on, this created a group of engineers and technicians who are careful, timid, detailed and humble, and willing only to "copy and calculate. Whoever wants to be creative will suffer misfortune" has become a slogan of engineers and technicians. This has greatly dampened the enthusiasm and creativity of the broad number of engineers and technicians.[29]

In addition, the growth of the "unit ownership" mentality had frustrated policies designed to improve the lot of technical intellectuals. National policy, seemingly, has not always been able to penetrate the practices of individual work units, and the fact that intellectuals could not leave their units via a labor market, meant that they were often subject to the at times arbitrary actions of the leading cadres of their units as we have seen above.

The actions of local cadres not only worked to frustrate policies designed to improve the status of scientists and technologists, they also worked to frustrate policies designed to lead to a more rational utilization of technical personnel. As noted earlier, the irrationalities of the planning system, plus the misassignments of professionals resulting from the Cultural Revolution, left China in the post-Mao period with severe distortions in the distribution of technical manpower. The situation therefore, was ripe for reform activities.

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[28] Ge Bo and Yao Yingmin. "The Patent System and Scientific and Technological Development in Our Country." *RMRB*. September 7, 1983. In *Ibid.* pp. 8-9.

[29] Xia Yulong, Liu Ji, Feng Zhijun, and Zhang Nianchun. "The Relations Between Science-Technology and the Economy." *KYLX*. February, 1981.

In addition to widespread media campaigns to promote a new official image of the intellectual, a number of reformist steps have been taken in recent years to alleviate these problems. One approach has been to try to raise the level of technical understanding among state and Party cadres. This policy is intended to make decision makers aware of the technical dimensions of their work, and indirectly, to make cadres more sensitive to the contributions that technical intellectuals should be making to the work of their units. The SSTC, again has taken the lead in implementing this policy.[30]

By far the most significant reform has been the limited commitment the regime has made to legitimize a labor market for technical personnel. Discussion of this change began as early as 1981, with the impetus coming from Fang Yi and those around him. By early 1982, there were reports of special newspapers serving as job registries carrying advertisements for available positions and for scientists and engineers to fill them.[31] At that time, the "market" could only be used by units, not individuals. Nevertheless, the value of this new institution was hailed, particularly with reference to the benefits it brought to small cities, which, through promises of better housing and working conditions, were able to attract needed technical personnel.

This more liberal approach to professional labor mobility was officially sanctioned by the State Council in late 1983,[32] has continued with the adoption of freer policies within CAS,[33] with the trial introduction of new methods for assigning IHE graduates,[34] and with a recent State Council directive supporting the growth of contract research centers having ". . . full rights to employ and advertise for staff members."[35]

INTERNATIONAL INFLUENCES

Prospects for continued progress in S&T, including S&T reform are also strongly influenced by China's international S&T relations which have expanded rapidly since 1978. China now has 51 agreements with other countries for cooperation in science and technology, involving more than 800 projects in which over 6,000 individuals participate. Since 1978, more than 26,000 students and scholars have been sent abroad for study under official auspices, in addition to the 7,000 who have gone under private arrangements. Some 14,000 have already returned, and there is mounting evidence that these returnees are assuming important positions in the research system, and are forces for reform.[36] In addition, the Chinese are making an expanded commitment to hosting international scientific meetings. Since 1981, China has sponsored more than 50 international symposiums that have been attended by over 6,000 foreign scientists and some 10,000 scientists from China.[37]

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[30] XINHUA. March 13, 1984. In FBIS. March 14, 1984. p k21.

[31] Leo A. Orleans. "Science Policy Study Group Report." Committee for Scholarly Communication with the People's Republic of China. January, 1982.

[32] Xinhua. May 3, 1984. In FBIS. May 8, 1984, pp. k8–9.

[33] Xinhua. February 3, 1983, In FBIS. February 9, 1983. p. k15.

[34] *RMRB.* May 17, 1983. In JPRS 84245 (September 2, 1983) p23.

[35] Xinhua. May 24, 1984. In FBIS. May 25, 1985. p. k20.

[36] Xinhua. November 29, 1984. In JPRS–CST–85–001, p5.

[37] Xinhua. January 17, 1985. In FBIS. January 18, 1985. p.al.

The influence of these ties on the reform program are manifold and various. In some cases, we can trace rather easily the origins of a reform idea to foreign contact, as in the case of the CAS' science fund, which was modeled on practices of the U.S. National Science Foundation. Similarly, the adoption of a patent code owes much to foreign urgings, and the recognition that foreign investments and technology transfers would be discouraged without one. Other sources of influences are of course the experiences of Chinese scientists studying abroad, and the comments and suggestions from foriegn technical personnel visiting China. Of special note are the more intimate contacts with scientists, engineers and technical entrepreneurs of Chinese descent. Some 25 senior Chinese-American scientists, for instance, reviewed drafts of the March 13 Central Committee reform "Decision." In addition, contacts with international agencies such as the World Bank, with foreign governments through cooperative S&T agreements, and with high technology foreign firms, all result in a steady stream of ideas and experiences which challenges established Chinese ways doing things.

CONCLUSION

China's S&T reform program grows out of frustrations with a system of organizing and managing science and technology which had become unproductive, wasteful, and rigid. It is a program that is both promising and bold. The promise lies in the possibilities of unleasing the considerable technical aptitude the Chinese—individually and collectively—have demonstrated they possess. The boldness lies in the fact that S&T reforms require the sacrifice of values and practices the regime has long held dear, including attitudes towards intellectual property, central planning, and the utilization and control of technical personnel. The broad international S&T contacts have contributed to making Chinese society much more open to foreign values and institutional models than it has been at any time since 1949.

Thus far, these changes have been accommodated by China's political system. Yet, China's quest for S&T modernization does produce behaviors which, at times push the political system to the limits of its established norms. A most interesting example of this pertains to the question of freedom of association.

In recent years a plethora of new research associations and consulting groups have arisen in response to the new policies. Many of these have sought to organize nationally, and many have done so.

> With the progress made in the program of the four modernizations, a number of civilian organizations offering economic and technical consultations and information services and conducting special topic studies . . . have come into being. They are playing a positive role . . . of late, however, there has been an ever increasing number of newly established 'associations,' 'academic societies' 'research societies,' 'foundations,' 'centers,' and similar organizations . . . there are already some 700 national organizations.[38]

The Party, however, has long forbidden any form of autonomous association which would threaten its monopoly on social control. Accordingly, it has recently reaffirmed its perogative to approve the formation of all such national associations, even while admit-

[38] XINHUA. December 11, 1984. In FBIS December 12, 1984. kl.

ting the positive functions they often perform in advancing the cause of modernization.[39] How the Party reconciles the pluralizing forces unleashed by its modernization policies with the historical definition of its political role takes us to the heart of the "politics of reform," and the subject of another chapter. Yet, it is appropriate to conclude with the observation that while the reforms in S&T were undertaken for instrumental purposes, their longer term significance may be *constitutional* in the sense that they promise to alter the ways "truth is organized in the service of power." [40]

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[39] IBID.

[40] Don K. Price. *The Scientific Estate.* Cited in Thomas J. Kuehn and Alan Porter (eds.). *Science, Technology and National Power.* Ithaca. Cornell University Press, 1981. pp. 127–128.

CHINA'S COMPUTER INDUSTRY AT THE TURNING POINT

By Detlef Rehn*

CONTENTS

TABLES

I. Summary

The beginning of China's modernization policy in 1978 led to a new attitude towards the computer industry which was now to be regarded as a factor of highest importance in future economic development. Initial efforts to bring this role into full effect, however, failed, since the focus was only on the most advanced technological aspects. The readjustment policy which started in 1980 paid particular attention to the overcoming of the most serious structural problems; but it also supported the beginning computerization by placing emphasis on mini and microcomputers. The goal of quadrupling the 1980 value of China's agricultural and industrial gross production by the year 2000 set the course for the shift to the production of microcomputers and their application in all sectors of the economy and society.

To make full use of the existing potential of China's computer industry will depend upon the overcoming of three major bottlenecks. In regard to *organizational structure* the Chinese intend the estab-

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lishment of research and production centers for computers and large-scale integrated circuits; this is regarded as a means of preparing the way for microcomputer mass-production. The backward *production technologies* are to be improved by technical transformation measures in key institutes and enterprises, and by a selective import policy. In regard to *manpower* an educational system is envisaged which not only aims at the establishment of a pool of highly-qualified personnel, but also at the training of people to carry out short-term application tasks.

The development of computer technology receives now wide support by China's most influential leaders, and this is an important aspect in regard to future activities.

II. Introduction

The development of China's computer industry in 1983 gave rise to much comment. In November 1983, the Institute of Computer Technology of the Chinese Academy of Sciences announced the successful development of a 10 MIPS (million instructions per second) parallel computer ("757").[1] In December, the University of Science and Technology for National Defense presented the 100 MIPS "Galaxy" supercomputer.[2] Examples of remarkable results in microelectronics include the TP-86 A, a 16 bit single-board computer,[3] and the 77-II 16 bit desk-top computer.[4]

In addition, computer installations, in particular of micro-computers (μC), underwent substantial increases. At the end of 1983, more than 30,000 μC were installed, compared with only 10,000 in 1982.[5] Computers have begun to be used, for instance, in banking offices, in the transport system, and in economic planning, and they form the backbone of networks and data bases.

Compared with the situation a few years ago, these results suggest considerable progress. Nonetheless, China's computer industry has still a long way to go. The present article gives an overview of the background of the development. In the first chapter, elements of the development policy between 1978 and 1983 will be discussed. The second chapter shows the actual quantitative performance; and in the third chapter three major bottlenecks for future development will be analyzed.

III. Policies, 1978-1984

Between 1978 and 1984, China's computer industry passed through three stages (Table 1).

(a) When China started its modernization program in 1978, electronic and computer technology as synonym for technological progress was given high priority. The National Science Plan of March 1978, for instance, declared computer technology one of the key sectors for modernization, and set the goal of establishing a modern Chinese computer industry by 1985.[6] Emphasis was not

[1] China Computerworld, No. 22, Nov. 20, 1983, p.1.
[2] JJRB, Dec. 22, 1983: See end of article for abbreviations.
[3] China Computerworld, No. 15, Aug. 5, 1983.
[4] JJRB, Dec. 28, 1983.
[5] China Computerworld, No. 10, May 23, 1984, p.1.
[6] Fang Yi: "Report at the National Science Conference (Extracts)", HQ, No. 4, 1978

only placed on research and development (R&D) in the areas which were regarded as most critical for future development (components, software, periphery); the focus was also on the development of supercomputers, on the production of series computers, and on broad application of electronic and computer technology in all sectors of the economy and society.

TABLE 1.—GOALS SET FOR CHINA'S COMPUTER INDUSTRY, 1978–84

	1978	1980	1983–84
Overall goal	Advanced computer industry by 1985.		
R&D	VLSI, LSI, software, periphery, supercomputers.	LSI, MSI, software, periphery	LSI (16K RAM, 8 bit processors), software, peripheral equipment.
Production	Series computers	Mini and micro-computers, series computers.	Mini and microcomputers; MSI/SSI; software, periphery (magnetic storages, character input-output equipment).
Application	"Broad application"		"Broad application" (industrial control, engineering and design, economic management).
Others		Manpower training, maintenance	Manpower training, maintenance, services.

Sources: Compiled from various Chinese sources.

These objectives nominally indicate the recognition of the Chinese planners that only by establishing a comprehensive system would the computer industry be able to play an outstanding role in the process of modernization. The implementation of the objectives, however, revealed that the implications of this theoretical recognition were not fully understood. First, China's computer industry was at that time still widely in the stage of numerical data processing. This means the computer was mainly seen as a tool for the processing of large quantities of numbers (e.g. for scientific calculations). Therefore, operational speed and memory size were regarded as the most important computer parameters. On the other hand, sophisticated software and peripheral equipment was not needed to carry out the computational tasks. Hence, consciousness of the importance of these two areas was hardly in existence. The bulk of the effort was devoted to the improvement of the technological performance of the central processing unit.

Second, the idea of catching up with the industrialized countries as quickly as possible was reduced to activity around the most advanced technological aspects where positive results promised high prestige for the parties involved. For instance, in the components sector R&D activity in LSI (large-scale integrated circuit) technology started on a large scale when technological and production problems even of small-scale ICs had not yet been solved. In regard to computer periphery, uncoordinated activities were carried on to develop magnetic disks even though the developing institutes and enterprises did not have the appropriate qualifications. Overlapping and waste of materials, manpower, and equipment were the results. A computer environment was not created.[7]

[7] Ye Bolin: "Why so much unnecessary overlapping emerges in scientific R&D", GMRB, March 20, 1979.

(b) The readjustment objectives of early 1980 indicate a first reconsideration of this situation: the electronics and computer industries should serve the economic and social requirements, and economic methods (e.g. the specialization and cooperation in production, the improvement of the innovation process, the establishment of distribution and service centers, etc.) should be introduced into the electronics branch.[8]

Among the specific computer objectives an important change was indicated by the giving of priority to mini and microcomputers.[9] Other objectives included not only the development of software and peripheral equipment, and of integrated circuits, but also, in line with the reorientation in regard to economic and social aspects, the improvement of manpower training, of maintenance and of services.[10]

One reason for the focus on mini and microcomputers is that the Chinese apparently had come to recognize that the planned computerization, especially of the industrial sector, was much easier to attain by using cheap mini and microcomputers than by relying upon expensive mainframes.[11]

The second reason is that retreating from the mainframe-oriented policy promised better results in catching up. China's mainframes showed for the most part poor technological performance and reliability, and most of them were produced only in very small quantities, if at all.[12] On the other hand, China had developed its first 8 bit μC prototype as early as 1977. In 1980, the gap in semiconductor technology was estimated at only 7 years,[13] compared with 15 years or so in the mainframe area. Thus concentrated efforts in microelectronics promised to narrow the gap further.

The importance of the readjustment goals lies in the fact that the application-oriented character of computer technology comes into prominence. However, the implementation of these objectives again revealed a discrepancy between what was intended and what was achieved. This led one author to the complaint that (1) catching up would (still) be reduced to a catching up only in terms of operational speed and memory size; (2) the price-performance ratio of computers would not be considered; (3) there would not be a clear division of labor between research institutes and enterprises; and (4) R&D would only end in prototypes, but not in products.[14]

(c) Application became the dominant factor in China's computer development strategy when the 12th CCP Congress in September 1982 set a new "strategic" goal for China's 1980 modernization policy, i.e. the quadrupling of China's 1980 agricultural and gross production value by the year 2000.[15] In discussing means of attain-

[8] ZGJJNJ, 1982, Beijing, 1982, p. V-172.

[9] JECC (Japan Electronic Computer Company) (ed.): "Computer Note 1984", Tokyo, JECC, Publisher, 1984, pp. 401-403.

[10] Ibid.

[11] Berney, K.: "Computer Sales to China", CBR, Sept.-Oct., 1980, pp. 25-31.

[12] Between 1958 and 1980 more than 200 Chinese computers were developed, but only ten of them were produced in quantities of more than 50 units. Xiu Jinya: "Push vigorously the research, production, and application of computers", JJGL, No. 2, 1984, pp. 12-15.

[13] Li Tieying: "The establishment of a base for the IC industry—A strategic question for the development of our country", China Computerworld, No 14, July 20, 1983, p. 3.

[14] Chen Shukai: "A discussion about some problems in the development process of our computer science and technology", Mini-Micro Systems, No. 4, 1981, pp. 35-38.

[15] Hu Yaobang: "Report at the 12th CCP Congress", ZGJJNJ, 1983, Beijing, 1983, pp. II-3 to II-25

ing this objective, attention focused on computers, in particular on microcomputers, of which broad application promised immediate and high productivity gains.

However, as it was widely acknowledged that the existing potential of China's computer industry would not be able to meet the expected requirements, means of developing this potential were discussed at several meetings in 1983. The most important one was a conference in May 1983 at which the "Leading Group for the Computer and LSI Industry under the State Council", made its first public appearance [16] after its establishment in October 1982.[17] The conference discussed and approved a development plan for China's computer and IC industry. The main points are: [18] (a) application is the goal of computer development; (b) emphasis will be on mini and microcomputers; other computers will only be developed according to existing needs; (c) special attention has to be paid to software and peripheral equipment; (d) efforts are to be made toward a selective import policy; the focus has to be on the importation of manufacturing technologies and know-how; (e) in regard to components, within the next three to five years emphasis will be on the production of medium and small-scale integrated circuits.

These targets were basically reconfirmed at several meetings in 1984 at which the role of the electronics and computer industry in China's modernization policy was discussed.[19] However, one aspect was changed. As a major outcome of the debate about the "new technological revolution" in the West, and its implications for China's future economic and social development [20] application as the ultimate goal of computer development was even more distinctly stressed.[21] The principle of the future relation between applications and production is now given by the formula "Using the applications to guide production" (Yi yingyong cu zhizao) [22] which means that the scope of production is being determined by the speed of applications.

Important implications of this new attitude can already be seen. The most prominent event in 1984 was the replacement of the "Leading Group for the Computer and LSI Industry under the State Council" by the "Leading Group for Electronics Development under the State Council" (Guowuyuan dianzi zhenxing lingdao xiao zu) and the installment of a new leadership.[23]

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[16] China Computerworld, No. 10, May 20, 1983, p.1

[17] Zeng Maochao: "Speed up the development of China's computer and information processing industry", ZRBZFTX, No. 1, 1984, pp. 2-5

[18] Fang Yi: "Speech at the National Planning Conference for Computers and ICs (extracts)", China computerworld, No. 10, May 20, 1983, p.3.

[19] See for instance Jiang Zemin's speech at a press conference on the occasion of a computer exhibition in Beijing on Sept. 5, 1984. Excerpts in China Computerworld, No. 18, Sept. 23, 1984, p. 1.

[20] The debate was launched at a meeting of leading social scientists which was convened by Prime Minister Zhao Ziyang in October 1983. Cf. Ma Hong: "Suggestions regarding the socialist modernization of our country", SJJJDB, No. 159, Oct. 31, 1983, pp. 4-5.

[21] See for instance Ma Hong: "Let us take the opportunity and welcome the challenge of the world's new technological revolution", in: "Welcome to the new technological revolution" (Yingjie xin de jishu geming), Vol. 1, Hunan Kexue Jishu Chubanshe, 1984, pp. 27-75.

[22] Li Peng: "The electronics and information industries have to serve the construction of the four modernizations", JJRB, Jan. 14, 1985.

[23] JJRB, Sept. 20, 1984. The "Leading Group" is headed by Vice Premier Li Peng. Deputies are Lü Dong, Song Jian, Zhao Dongwan, Nie Li, and Jiang Zemin. Ibid. The office of the "Leading Group" is headed by Li Xianglin. China Computerworld, No. 1, Jan. 8, 1985, p. 1.

There are two major reasons for this step. First, the idea behind the establishment of the "Leading Group for the Computer and LSI Industry" has been the organization of computer and LSI R&D, production, application, and manpower training in the most efficient way possible. In other words: the stress was on the "hardware" side.

In contrast to this, the establishment of the "Leading Group for Electronics Development" reflects the intention to transform the electronics and information industry into a new industry which will permeate the entire economy and society.

Moreover, the tasks of the new "Leading Group"—definition of development strategies and policies, approval of development plans and implementation control, control of key importations, etc.[24]—conform to the basic ideas of the reforms of China's economic system, as they were laid down in the "Resolution of the Central Committee of the Communist Party of China on the Reform of the Economic System." [25] One aspect of the reform will be the separation of the functions of government agencies and enterprises, and to allow economic aspects to predominate. According to the "Resolution" the future tasks of the government agencies will include the setting up of a framework within which enterprises can act, but no longer, or to a much smaller extent, the direct involvement of the administration in the economic activities of the enterprises. It is obvious that the tasks of the "Leading Group for Electronics Development" correspond to these requirements.

IV. Performance of China's Computer Industry: A Quantitative Overview

At present, China's computer industry has a workforce of around 90,000 people who are engaged in research, design, production, application, and teaching in more than 130 institutions.[26] These institutions are spread all over China, but centers are located in the coastal areas. Here, Liaoning, Beijing, Tianjin, Jiangsu, Shanghai, Fujian, and Guangdong deserve special mention.

In 1983, the gross production value of China's computer industry amounted to around 829m yuan.[27] This figure corresponded to 5.4 percent of the total GPV of China's electronics industry. For 1984 the GPV was expected to double compared with 1983; given this, the computer industry has reached a share of more than 7 percent of the total electronics GPV (Table 2).

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[24] JJRB, Sept. 20, 1984.

[25] BR (German edition), Vol. 21, No. 44, Oct. 30, 1984.

[26] In the "Yearbook of the Machine Building and Electronics Industry 1984" this figure is made up, as follows: 8 research institutes, 111 factories, 13 application and service units. In addition to these institutions which are under the Ministry of Electronics there are 5 research institutes under the Academy of Sciences; the Ministry of Machine Building supervises 3 institutes of automation and 4 producers of industrial controllers and peripheral equipment. ZGJXDZGYNJ 1984, p. II-205.

[27] Ibid., p. II-260.

TABLE 2.—GROSS PRODUCTION VALUE, COMPUTER INDUSTRY, 1979–84

Year	GPV (in millions of yuan)	In percent of total GPV of electronics industry
Prices of 1970:		
1979	850	4.95
1980	731	3.44
1981	611	2.66
Prices of 1980:		
1981	416.4	3.5
1982	505.24	4.3
1983	829.64	5.37
1984	1,661	7.41

Sources: 1979, 1980, 1981–1983: ZGJXDZGYNJ, 1984, pp. II–205 and II–260; 1981 (prices of 1970): ZGJJNJ, 1982, p. V–171; 1984: calculated from statement that in 1984 the GPV was expected to increase by 100.2 percent compared with 1983. Ma Fuyuan: Retrospect and Outlook, China Computerworld, No. 1, 1985, p. 1. For electronics GPV 1979–83 cf. ZGJJNJ, 1984, p. III–25. Electronics GPV 1984: derived from statement that in 1984 the GPV increased by 45 percent compared with 1983. RMRB, Jan. 27, 1985, p. 1.

In comparison with the industrialized countries the share, however, is still very low. In Japan, for instance, the computer industry in 1983 contributed nearly 16 percent to the production value of the electronics industry.[28] On the other hand, the Chinese figure may be compared with that of India, where in 1980 the share was only 2 percent.[29]

Since 1982 the production structure of China's computer industry has been gradually changing (Table 3). Computer manufacturers responded the focus on μC with a considerable increase in the production of both desk-top microcomputers and single-board computers.

TABLE 3.—PRODUCTION FIGURES FOR THE COMPUTER INDUSTRY, 1981–83

	1981	1982	1983
Large- and medium-sized digital computers (units)	29	13	4
Minicomputers (units)	86	134	237
Analogue computers (units)	72	94	119
Desk-top computers (units)	501	1,487	5,436
Single-board computers (units)	897	5,701	10,499
Table computers (units)	20,558	13,466	...
Pocket calculators (million units)	0.6185	1.762	3.314
Peripheral equipment (units) of which	3,672	3,550	14,204
Punched tape readers (units)	147	496	659
Printers (units)	976	1,095	7,392
Displays (units)	287	835	3,218
Disk drives (units)	5	220	863
Magnetic tape units (units)	116	57	81

Source: ZGJXDZGYNJ, 1984, p. II–291.

In regard to the composition of the sub-groups, there is only limited information. Within the sub-group "desk-top computers", in 1982 production of 8 bit μC accounted for around 80 percent;[30]

[28] Denshi Kogyo Nenkan (Yearbook of the electronics industry) 1985, Tokyo, Dempa Publications, 1985, p. 106

[29] Sigurdson, J., Bhargava, P.: "The challenge of the electronics industry in China and India", Sigurdson, Jacobsson (eds.): "Technological trends and challenges in electronics", Lund, Research Policy Institute, 1983, p. 272

[30] ZGJJNJ, 1983, p. IV-71.

within single-board computers production of the 8 bit TP-801 represented more than 50 percent.[31] Within minicomputers, 75 units of the DJS-1000 series (the former DJS-100 series), 122 computers of the DJS-2000 series (formerly DJS-180), and 40 units of the DJS-3000 series ("Solar" computers) were produced in 1983.[32] In peripheral equipment the production focus shifted to the fabrication of printers, displays, and disk drives.

While the development of the physical output can only indicate production trends, sales and value figures which would show the relative importance of the sub-groups, are not known. One may, however, get an idea of the value of China's microelectronic production from the fact that in order to attain a production value of $2.7bn[33] by the year 2000, China would have to increase its present microelectronic production by an annual average of 18.2 percent.[34] If these figures are correct, the production value of microelectronic products would today be in a range of $150-160m, or 350m yuan.[35]

By the end of 1983, around 3,500 mainframes and minicomputers[36] and 30,000 μC (including single-board computers) had been installed.[37] The inventory of μC in particular is expected to grow rapidly. Stepanek[38] estimates that by the end of 1984 the inventory could reach 57,000 units.

In regard to sectoral application an evaluation carried out by the Ministry of Electronics in 1981 came to the result that around 38 percent of mainframes and minicomputers were used in the machine building industry and for scientific and educational purposes.[39] Microcomputers were used in 277 projects in 14 areas, by the end of 1981 (Table 4). The present situation is not known in detail; but reports in the Chinese press suggest emphasis being on industrial control, on application in the educational sector, and for scientific calculations.[40] Application in economic management is growing more and more important, too.

TABLE 4.—*Application areas of microcomputers—as of 1981*

Area:	Number of projects
Metallurgy and energy saving	13
Light and textile industries	17
Coal and petroleum industries, geology	10
Process supervising and controlling	22
Machine tools, other industrial machines	23
Measuring and testing	54
Scientific and technical calculations, and control	19
Traffic and telecommunications	16

[31] *Ibid.*
[32] ZGJXDZGYNJ, 1984, p. II-207.
[33] According to Yu Zhentang ("It is necessary first to develop the microcomputer industry", China Computerworld, No. 2, Jan. 23, 1984, p. 3) this is the sales figure for microelectronic products of the U.S. of the late 1970s. No source was given.
[34] *Ibid.*
[35] This is, of course, only a very rough estimation as the Chinese definition of "microelectronic products" is not known.
[36] Zhao Mingji, Li Douyuan: "A short discussion about computer application in our country", SHKX, No. 4, 1984, pp. 16-17 (35).
[37] China Computerworld, No. 10, May 23, 1984, p. 1.
[38] Stepanek, J.: "Microcomputers in China", CBR, May-June, 1984, pp. 26-38.
[39] ZGJJNJ, 1982, p. V-172.
[40] "Analysis of the present demand in the microcomputer market", JJRB, July 5, 1984, p. 3.

TABLE 4.—*Application areas of microcomputers—as of 1981*—Continued

	Number of projects
Hydraulic power generation	14
Agriculture, forestry, meteorology	11
Commerce, banking system	7
Medical sector, hygiene, pollution control	17
Office work and management	32
Defense sector, special computer equipment	22

Source: Yu Shan: "State of application of microcomputers in our country", DZKXJS, No. 12, 1982, pp. 1–6.

Excluding Beijing and Shanghai, which play a special role in China's computer industry, the regional distribution of the computer inventory was relatively even in 1981 (Table 5). The picture today is probably completely different. Although figures are fragmentary,[41] they nonetheless suggest that especially the shift to μC has led to a concentration of the installations in the cities and provinces which have computer producing facilities and a fairly developed overall industrial system, and which moreover have the opportunity to import computers from abroad. These cities and provinces are Beijing and Shanghai, Jiangsu, Sichuan, Guangdong, and the Northeast.

TABLE 5.—*Regional distribution of computer inventory, 1981*

Northeast	301
Beijing	393
Northwest	233
North	177
East	222
Southwest	225
Central South	301
Shanghai	361
Ship building system	53
Machine building system	121
Total	2,387

N.B. Only mainframes and minicomputers here counted.

Source: ZGJJNJ, 1983, p. IV-73.

V. BOTTLENECKS IN CHINA'S COMPUTER INDUSTRY

Although statistics about the performance of China's computer industry are still fairly limited in quantity, and not always clearly differentiated, available information nonetheless indicates that the computer industry is making progress. However, further development will depend very much on whether the Chinese succeed in coping with several bottlenecks.

A. THE ORGANIZATIONAL STRUCTURE

Despite several attempts in the last few years to reorganize the computer industry[42] its structure still shows three major shortcomings in wide areas. It is scattered, in the sense that mostly small computer research and production units may be found all over China. It is strongly verticalized, as there exist high barriers

[41] E.g. *Shenyang:* 72 mainframes/minis, 448 μC (JXZB, No. 192, March 13, 1984); *Beijing:* 1,000 μC (RMRB, Feb. 19, 1984); *Shanghai:* 1,600 (incl. μC); (WHB, June 19, 1984); *Sichuan:* 2,000 μC (China Computerworld, No. 11, June 8, 1984)

[42] Examples are the establishment of the South China Computer Corporation and of the North China Terminal Equipment Corporation in 1981. ZGJJNJ, 1983, p. IV–69.

between participants which belong to different administrative levels or organizational systems. Thirdly, it is characterized by the separation of developers, manufacturers, and users.

Western experience shows that the establishment of a microelectronics industry is a very comprehensive and complicated task. On the technological side, manufacturing technologies require sophisticated testing equipment or the installation of cleanrooms, etc. On the economic side, mass-production of high-quality products is required, and this in turn makes necessary the solution of various organizational and management problems in production. Against this background, the Chinese have apparently come to the conclusion that the present organizational structure of their own computer industry does not meet these requirements. A solution is seen in the concentration of R&D and production and the establishment of LSI and computer R&D and production bases in the Beijing, Shanghai, and Guangzhou areas. These are areas which already have advanced R&D and production facilities, and a qualified manpower pool, and which have fairly easy access to foreign technology and know-how.

Details of the reorganization are not fully known. In Beijing in October 1983 the "Beijing Main Corporation for the Computer Industry" (Beijing shi jisuanji gongye zong gongsi) was founded. It will presumably be the backbone of the envisaged "North China computer R&D and production base". The corporation reportedly consists of 50 research institutes and production units and has a work force of 33,000 people.[43] A similar reorganization has been carried out in Shanghai, where on July 1, 1983 the "Shanghai Joint Corporation of the Computer Industry" (Shanghai shi dianzi jisuanji lianhe gongsi) was founded.[44]

Most recently, in Nanjing the "Zijin Information Industry Corporation, Ltd." (Zijin xinxi gongye gongsi) was established. It is described as the largest economic entity of China's computer industry;[45] as Nanjing's computer industry is much smaller than that of Beijing, the statement suggests that the "Beijing Main Corporation for the Computer Industry" has only the function of an administrative body. (For details regarding the new Nanjing corporation and its role in the reform of Jiangsu's computer industry, cf. Appendix.)

When fully established, the research and production bases the Chinese have in mind will link not only institutes and enterprises which are supervised by the Ministry of Electronics and the local electronics bureaux, but also institutions of other industrial ministries, of the Academia Sinica, the military sector, and universities and colleges.

The intended combination of different organizational systems and administrative levels poses the question of how it can be realized. On the one hand, the Chinese leadership seems to be convinced that only a powerful institution would be able to overcome the "traditional" organizational barriers at the different levels.

[43] "Beijing is going to be transformed into North China's computer R&D and production base", JJRB, Febr. 17, 1984.

[44] China Computerworld, No. 14, July 20, 1983, p. 1.

[45] China Computerworld, No. 24, Dec. 23, 1984, p. 1.

The tasks set to the "Leading Group for the Computer and LSI Industry" and insights into its activities [46] indicates that the "Leading Group" was regarded as such a powerful organ. In this context it is also important to note that at the local levels "Leading Groups" have been established, too.[47]

On the other hand, as has been mentioned above, the economic reforms might change the role of the new "Leading Group for Electronics Development". In regard to the computer industry one key topic of the reforms the Chinese have to deal with will be the establishment of a rational balance between what is regarded as necessary in the establishment of a computer industry system, and which thus might even require administrative actions, and the allowing of more economic freedom and responsiblity to research institutes and enterprises. The full picture how this problem is handled is not very clear yet. Vice Premier Li Peng pointed out that in regard to large-scale key projects of the electronics and information industry unified planning and control would be necessary.[48] With respect to the computer industry this will concern mainly large and medium-scale computers, and the set-up of LSI production lines. Due to the strategic importance of these topics one may expect here a direct involvement of the "Leading Group for Electronics Development". Control and involvement, on the other hand, will laxen or even stop where the development of the actual demand for a certain product requires a quick response on the part of the production units. Li Peng mentions microcomputers in this context. As far as such economic reasons are concerned, the main task of the "Leading Group" will probably be the definition of a political and economic framework for the actors involved.

Apart from the activities in the reorganization of the R&D and production sectors of China's computer industry, there are also efforts which aim at an improvement of the weakly-developed organization in the area of application; in this context the recognition that R&D, production, and application form an interrelated network will be very important in the process of further development.

Current activities, especially in the software sector, indicate a growing awareness of the problem: the Ministry of Electronics, for instance, established the "China Software Corporation"; [49] in Shanghai [50] and in Jiangsu [51] software development centers were founded. The tasks of these centers are manifold. They include software research and development, manpower training, provision of technical information, etc. Computer users can directly contact the centers to assign them the task of developing application software. This is undoubtedly a step forward compared to the wide-spread phenomenon that users have to write application software by

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[46] In May 1983 the "China Computerworld" reported that the "Leading Group" had instructed the municipal government of Shanghai to set up the above-mentioned "Shanghai Joint Corporation of the Computer Industry". China Computerworld, No. 10, May 20, 1983. Moreover, in March 1984 it was known that the "Leading Group" was represented in the board of directors of the newly-established "Beijing Joint Corporation for the Information Industry" (Beijing xinxi lianhe gongsi). China Computerworld, No. 5, March 8, 1984, p. 1.

[47] China Computerworld, No. 6, March 23, 1984, p. 1. For instance, the Jiangsu Leading Group was established in January 1984. XHRB, Jan. 18, 1984.

[48] Li Peng, loc. cit.

[49] China Computerworld, No. 4, Feb. 23, 1984, p. 1.

[50] China Computerworld, No. 2, Jan. 23, 1984, p. 1.

[51] XHRB, June 1, 1984.

themselves.[52] It means, moreover, a step in direction of improving the weak contacts between developers/manufacturers and users. Of course, in view of the fact that the centers have been established only recently, one has still to wait for the results of these efforts.

B. MANUFACTURING TECHNOLOGIES

In the last few years China has made considerable strides to improving the technologies for the development of computers and components. For instance, in order to raise circuit density and to reduce the line width of chips, Chinese research institutes have studied and applied technologies like electron beam exposure and ion-implantation.[53] The results for R&D have been remarkable. An example is the development of a 16K random access memory (RAM).

However, in contrast to R&D, production technologies lag very much behind. A look at the situation in the IC industry illustrates the problem. Manufacturing is still widely being done in the form of manual production.[54] Most of the equipment is outdated, and the level of automation is very low. Computer-aided design, which is a necessary technology to cope with the increasing complexity of the chip structure, is in China still in an initial stage.[55] Other problems include insufficient purity of the basic materials and of the environment, lack of quality control, and lack of compulsory product standards.

All these factors result in high production costs and prices for the chips, while the reliability and the yield rates are mostly low. Exact figures are not known. Considering the state-of-the-art of China's IC industry, however, I estimate that the yield rate of a 4K RAM, for example, is roughly 5–10 percent (U.S. and Japan: almost 100 percent). Regarding chip prices, in 1982 the Dongguang Electric Works in Beijing, one of China's leading IC manufacturers, sold a 16K RAM for 110 yuan; [56] in the U.S. such a chip is available for a few cents.

Apart from the organizational measures described above, technical transformation in leading enterprises and research institutes represents another means of improving production technologies. In regard to the LSI industry the State Council has selected 7 institutions, and in regard to the computer industry 21 enterprises and institutes, in which during the Sixth Five-Year Plan (1981–85) technical transformation projects will be carried out (Tables 6 and 7).

TABLE 6.—*China's LSI industry: Key enterprises and institutes for technical transformation projects in the Sixth Five-Year Plan*

1. Beijing Dongguang Electric Works.
2. Shanghai Components Factory No. 5.
3. Gansu Tianguang Electric Works.
4. Shanghai Institute of Semiconductors.

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[52] Stepanek: "Microcomputers . . .", p. 28.
[53] An overview of the activities in 1983 gives ZGBKNJ, 1983, Beijing, 1983, pp.498–500.
[54] Xu Juyan: "Characteristics and China's conditions (Theory and politics of developing the IC industry, Part I)", GMRB, May 11, 1984.
[55] Zhuang Zhenquan: "Summarizing the CAD process for electronic circuits", DZKXJS, No. 10, 1982, pp. 1–5.
[56] "Introduction to the products of the Beijing State-owned Factory No. 878", DZKXJS, No. 9, 1982, pp. 49–56.

TABLE 6.—*China's LSI industry: Key enterprises and institutes for technical transformation projects in the Sixth Five-Year Plan*—Continued

5. Ministry of Electronics, Institute No. 24, Wuxi branch.
6. Ministry of Electronics, Institute No. 47, (Liaoning).
7. Shipbuilding Main Corporation, Wuhan Institute No. 709.

Source: Jixie Zhoubao (Machine Building Weekly), No. 149, July 29, 1983, p.2.

TABLE 7.—*China's computer industry: Key enterprises and institutes for technical transformation projects in the Sixth Five-Year Plan*

1. Beijing Wire Factory.
2. Beijing China Computer Service Corporation.
3. Beijing Computer Corporation.
4. Tianjin Computer Corporation.
5. Hebei Baoding North China Terminal Equipment Corporation.
6. Taiyuan Dazhong Machine Factory.
7. Hohhot Factory for Electronic Equipment.
8. Mudanjiang Factory for Electrical Equipment.
9. Shanghai Regulator Factory.
10. Shanghai Electric Meter Works.
11. Shanghai Computer Corporation.
12. Suzhou Computer Factory.
13. Nanjing Wire Factory.
14. Hangzhou Factory for Magnetic Recording Equipment.
15. Hunan Jiannan Machine Factory.
16. Guangdong Shenzhen Aihua Electronic Corporation (Ltd.).
17. Ministry of Electronics, Shanghai Institute No. 32 (= East China Institute of Computer Technology).
18. Ministry of Electronics, Beijing Institute No. 6.
19. Shanghai Institute of Industrial Automation and Instruments.
20. Wuhan Institute of Peripheral Equipment.
21. Ministry of Electronics, Beijing Institute No. 15 (= North China Institute of Computer Technology).

Source: Jixie Zhoubao (Machine Building Weekly), No. 149, p. 2.

Technical transformation projects are not known in detail; but one may assume that the most weakly-developed areas will be given highest priority. In the IC industry this includes the installation of new clean rooms, or the upgrading of the existing ones, the improving of the testing equipment, etc.[57]

Some of the institutes and enterprises in the Tables 6 and 7 are military institutions (e.g. Dongguang and Tianguang Electric Works, and the Nanjing Wire Factory). As in other branches, in the computer and IC industry the technological advantages of these institutions in the form of sophisticated equipment and a qualified manpower pool are being directed more and more toward the production of civilian goods. An example is the production of the "Zijin II" μC (similar to the Apple II) in the Nanjing Wire Factory.[58] Whether a direct transfer of technology and know-how from the military to the civilian sector will occur in the computer industry is not quite clear yet. It is, however, not unlikely, given the organizational attempts to link the two sectors.[59]

The Chinese are aware that without foreign technology manufacturing technologies cannot be improved. In the discussion about the direction of imports, a selective import policy is being emphasized: the focus is especially on the importation of know-how and equipment which is regarded as crucial for future development, but

[57] "Our IC industry is on the rise", JJRB, Aug. 27, 1983.
[58] "A commodity fair of the provincial military sector opens in Nanjing", XHRB, June 15, 1984.
[59] For details concerning the utilization of military capacity for the production of civilian goods, cf. the article of June Dreyer in this volume.

which, for the time being, cannot be developed in China. The Japanese example shows that such a policy can be very successful if the imports are understood as a means to support and promote the development of the domestic industry.

However, in carrying out this selective import policy the Chinese are confronted with several problems. First, uncertainties about the range of available technologies due to the revision of the Cocom-regulations make the formulation of development goals very difficult. This fact might result in time-lags; [60] in the binding of limited manpower, materials, and funds to develop what cannot be acquired abroad in due course; and in a general frustration about sudden changes in Western policy. Clearly-formulated export regulations which leave no doubt about what may be acquired will play an important role in the creation of a positive business climate.

Second, warnings that imports cannot buy modernization [61] indicate still-existing tendencies to rely solely upon foreign technology rather than to combine it with domestic technologies. In order to overcome these tendencies, strict import controls are envisaged.[62] However, in view of the many institutions which are engaged in foreign trade, this will not be an easy task.

Third, the absorption of foreign technology has to be given the highest priority.[63] Otherwise, problems may emerge like the one that in Guangzhou the production of minicomputers on an imported production line had to be "temporarily" interrupted due to bottlenecks in the supply of domestic components earmarked for assembly into these computers.[64]

C. MANPOWER

Further development of China's computer R&D and production on the one hand, and broad application on the other, will be highly dependent upon whether a sufficient number of qualified personnel will be available.

At present, China has a pool of around 30,000 computer specialists who were educated at universities and colleges; in addition, there are 7-8,000 graduates from secondary technical schools.[65] Although these figures look impressive, they do not mean that all these people are employed according to their specialty. For instance, according to a report from Jiangsu Province, which has a pool of 5,000 computer and IC specialists, 1,000 people are assigned tasks outside their specialty.[66] As Jiangsu stands at a fairly ad-

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[60] Cf. "Business Week" of June 11, 1984 ("Can China become a high-tech powerhouse?") for the problems of the Wuxi Jiangnan Radio Equipment Factory arising from the delay in the shipment of U.S. equipment for IC manufacturing.

[61] Ma Fuyuan: "The computer industry has to orientate itself towards application", China Computerworld, Extra, No. 1, April 29, 1984, pp. 1-2

[62] Yu Zhensheng: "Conclusions about several questions regarding the development of the microcomputer industry", China Computerworld, Extra, No. 1, p. 3. Controls will be placed especially on the importation of technologies which are already well-developed in China, for instance in the 4 bit μC sector.

[63] This aspect is discussed in detail in the article by Denis Simon in this volume.

[64] "Can China become a high-tech powerhouse?", loc. cit.

[65] Tao Shi: "Discussion of questions of our computer manpower training prior to the year 2000", China Computerworld, No. 15, Aug. 5, 1983, p. 3

[66] "Nearly 1,000 microelectronics technicians of our province do not work according to their specialty", XHRB, March 22, 1984

vanced level in the computer industry and its applications, one may assume that the situation might be even worse in less developed areas.

Of the 100,000 people engaged in computer R&D, production, and application, 90 percent are working in the hardware sector. The software manpower pool is still weakly developed. Of the 10,000 working in the software area in 1981, the bulk worked as programmers, and only 600 held a university degree.[67]

In view of increasing application one may expect a restructuring in the composition of the manpower pool. In regard to software this has already been recognized by the Chinese, as is illustrated by the fact that at a software conference in March 1984 the goal was set to increase the present figure of software personnel to 100,000, or tenfold, by 1990.[68] Regarding services, the situation is somewhat different. As the service sector has not yet emerged as an independent sector within the computer industry,[69] it is doubtful whether, for the time being, there exists a considerable number of specialized service personnel. Moreover, there is very probably still a lack of understanding of the significance of service for the establishment of a computer system; against this background, it is not surprising that detailed quantitative information about future manpower requirements in the service sector is generally not available.

According to rough estimates China by the year 2000 will require around 1m computer people.[70] Of these, around one half ought to have a university or college degree, the other half ought to have been educated in technical schools. However, an extrapolation by the same author of the present output figures to the year 2000 shows that the universities will be able only to meet one-fourth of the future demand, while in regard to technical schools the situation will be even worse.[71]

Although this is not necessarily a representative analysis, it nonetheless indicates that the educational sector will be put under considerable pressure. Considering the fact that in computer technology knowledge becomes outdated within a very short time, a regular upgrading of knowledge will be necessary, and might thus result in even greater pressure upon the training sector.

Against this background, one may expect strong efforts toward improving of manpower training both in quantity and in quality. Measures which already have been taken to meet future demand show that an extended system of training institutions is obviously envisaged. While universities and colleges will educate the backbone of China's computer manpower pool, emphasis is now also being placed on the training of people who will be immediately needed in the area of application. This regards, for instance, programmers, who may be trained in a comparatively short time. Soft-

[67] Chinese Academy of Electric Information Technology: "A brief introduction of computer software development in China", Gesellschaft Für Mathematik und Datenverarbeitung: "Bericht über den Besuch der GMD-Delegation zum Thema "Software-Technologie" vom 24.5. bis 9.6.81 in der Volksrepublik China", Bonn, GMD, Publisher, 1981, pp. 84–91

[68] Stepanek: "Microcomputers . . .", p. 28.

[69] Sun Qiangnan: "Develop vigorously computer services, serve the popularization and application of computers", China Computerworld, No. 10, May 23, 1984, p. 3.

[70] Tao Shi: "Discussion of questions . . ."

[71] Ibid.

ware and service institutions, in addition to enterprises, are being assigned this task. Moreover, it is interesting to note that also the computer education of young people is being given attention. Although these efforts are still in an initial stage,[72] they are nevertheless very important in the process of creating some familiarity with computers.

VI. Conclusions

In the last few years, China has made considerable efforts to make full use of computer technology for the country's modernization. The shift to microcomputers in particular is an important and necessary step toward broad computerization. In order to respond to the new requirements, which are linked to large-scale application, the organizational and production structure of China's computer industry is in the process of undergoing basic changes. Moreover, China is very active in the way of "sinification" of computers, i.e. the attainment of character-processing capability in computers. This is a factor of the greatest importance not only in regard to popularization of computers, but also in regard to a new "social role" of computer technology in China.

In 1984 aspects of the "new technological revolution" in the West and its implications for China were discussed at all levels. It was stated that in the West knowledge-intensive industries, in particular microelectronics, would replace the traditional industries, and that the general trend would be towards the information (post-industrial) society. The leading Chinese planners seem to believe that against this background catching up with the industrialized countries will only be possible for China through pursuing a similar course. As a result the computer industry has received active support from many influential leaders; moreover, the policies which have already been set in motion have resulted in a fundamental change of tack which will be worthwhile following closely.

Appendix. The Establishment of a Microcomputer and an LSI Research and Production Network in Jiangsu Province [73]

At a conference convened by the Jiangsu Computer and LSI Leading Group in Wuxi in February 1984, the establishment of a microcomputer and an LSI research and production network was discussed. The two networks will consist of four levels which cover the entire province.

(a) *Core level* (hexin ceng). Centers of the networks will be Nanjing (UC) and Wuxi (LSI). As it is intended to centralize manpower, funds, materials, production, supply, and sales, one may expect the establishment of a microcomputer corporation in Nanjing, and of an LSI corporation in Wuxi. Key enterprises are presumably the leading UC and LSI producers: in Nanjing these are the Nanjing

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[72] Zhang Shaowei: "Disseminate vigorously computer knowledge among young people", China Computerworld, April 8, 1984, p. 3.

[73] Information is mainly taken from XHRB, March 3, 1984: "In order to open a new stage in the development of the microelectronics industry, our province has to go the way of combination"; and RMRB, April 20, 1984: "Jiangsu is going to establish an integrated research and production body." For the general background of Jiangsu's electronics industry see Rehn, D.: "The electronics age comes to China—The case of Changzhou City (Jiangsu Province)", Bonn, Ostasien-Institut, Editor and Publisher, 1984, ch. 4.

Wire Factory and the Jiangsu Radio Factory, and in Wuxi the Jiangnan Radio Equipment Factory (Jiangnan wuxiandian qicai chang).

(b) *"Skeleton level"* (gugan ceng). This level encompasses universities and colleges which will be linked to the core level in the form of voluntary contacts, and important enterprises probably in the cities which have a fairly advanced electronics industry. These are Suzhou (e.g. Suzhou Computer Factory); Changzhou (e.g. Semiconductor Factory); Nantong (e.g. Nantong Computer Factory); and Yangzhou (e.g. Yangzhou Semiconductor Factory). Production, supply, and sales will be centralized, too, at this level. The organizational shape of the links of the enterprises to the core level, however, is not yet clear.

(c) *Accessories level* (peitao ceng). Units at this level will probably be responsible for water supply, the provision of chemical materials, etc. In the initial stage of the network, the links of the accessories level and the core level will only be loose.

(d) *Cooperational level* (xiezuo ceng). Institutions at this level are linked to the core level in the form of economic contracts.

With respect to Nanjing, information given above was confirmed by the establishment of the "Zijin Information Industry Corporation" in November 1984. Key enterprises of this corporation are: The Nanjing Wire Factory (Nanjing Youxiandian Chang), Nanjing Printer Research and Development Center (Nanjing Dayinji Yanjiu Kaifa Zhongxin), Jiangsu Radio Factory (Jiangsu Wuxiandian Chang), and the Nanjing "Qianfeng" Radio Factory (Nanjing Qianfeng Wuxiandian Chang). Activities of the new corporation will focus on research, development and production of printers, computers and character terminals.

ABBREVIATIONS

CBR—China Business Review
DZKXJS—Dianzi Kexue Jishu (Electronic Science and Technology)
GMRB—Guangming Ribao (Guangming Daily)
HQ—Hongqi (Red Flag)
JJGL—Jingji Guanli (Economic Management)
JJRB—Jingji Ribao (Economic Daily)
JXZB—Jixie Zhoubao (Machine Building Weekly)
RMRB—Renmin Ribao (People's Daily)
SHKX—Shehui Kexue (Social Sciences)
SJJJDB—Shijie Jingji Daobao (World Economic Herald)
WHB—Wenhui Bao (Wenhui Daily)
XHRB—Xinhua Ribao (Xinhua Daily)
ZGBKNJ—Zhongguo Baike Nianjian (China's Yearbook)
ZGJJNJ—Zhongguo Jingji Nianjian (Almanac of China's Economy)
ZGJXDZGYNJ—Zhongguo Jixie Dianzi Gongye Nianjian (Yearbook of China's Machine Building and Electronics Industry)
ZRBZFTX—Ziran Bianzhengfa Tongxun (Journal of the Dialectics of Nature)

TRANSFER OF COMPUTER AND DATA PROCESSING TECHNOLOGIES: FIRST-HAND EXPERIENCES OF A FOREIGN CONSULTANT

By Joseph Y. Battat*

CONTENTS

I. INTRODUCTION [1]

The foundation of China's modern industry was established through the massive transfer of technology from the Soviet Union in the 1950s. Entire new industries were set up and others modernized or expanded following the signing of the Sino-Soviet treaty for economic cooperation. The transfer included equipment, materials, blueprints and technical knowhow. The training of scientists, engineers and technicians, and the provision of Soviet technical and management advisors were significant aspects of the transfer.

The Sino-Soviet rift and China's isolation from the world economy during the 1960s forced the country to adopt a narrowly defined self-reliant development policy, reducing its international economic contacts and the transfer of technology to exceedingly low levels. Transfer of technology was considered a necessary evil to

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[1] For this paper, I am indebted to numerous Chinese colleagues who have taught me more about China than I can ever teach them about systems engineering and management. I would like to thank Professor Paul Marer, Indiana University, for his valuable comments.

help fulfill the yearly economic plans. Since 1978, the post-Mao leadership has put into practice a different version of self-reliance. It holds the view that, in this technological age, a truly long-term self-reliant development ought to begin with a massive injection of technology to form the foundations of a modern technological infrastructure, on which further advances are to be built.

This study focuses on the crucial role played by the Chinese, as recipients of the transferred technology, in managing the transfer process and creating an appropriate environment for its efficient absorption and dissemination. Three cases are examined. One involves computers, with a focus on the process used to select and purchase the equipment, to prepare for its arrival, and to install it. The other two cases are about the transfer of electronic data processing knowhow to put computers to management-related uses. Two recipient organizations are examined: a university, which acquired computer equipment as part of the development of a modern management education program; and an industrial enterprise, which imported computers to modernize its production management.

The case studies are developed from the point of view of a participant observer at both institutions. My educational and professional background in systems engineering and international business, and my Chinese language proficiency were of great interest to my Chinese employer, a large industrial ministry. I was hired as a consultant with the title of "Technical Foreign Expert," the first in that field, I was told, since the departure of the Soviet and East European experts in 1960. I worked at one of the ministry's universities for most of the fifteen months of my employment, and fully participated in the entire process of the technology transfer. I also helped design, develop and administer two systems engineering courses. In the case of the factory, my participation was limited essentially to that of serving as a data processing consultant for one year.

The ministry, the university and the factory are not named in this paper. The publication of the following cases was not discussed with my employer at the time of my employment, and to get its approval at this stage would be impractical. Also, my decision fits with common practice in case studies, without diminishing the value of the cases.

II. China's Computer Industry in 1978 [2]

The Chinese produced their first computers in the late 1950s, with the help of the Soviet Union. Research and development in the computer industry suffered initially from the Sino-Soviet break, but picked up in the late 1960s and in the 1970s. Second-generation computer hardware was being installed at the turn of the 1970s, and third-generation a few years later. Reverse engineering conducted on a few imported computers provided one major source of computer technology. Typically, an organization developed the software to match its prototype computer. Considering the infant

[2] Information on the state of China's computer development and industry was collected by the author during numerous visits to computer installations in research institutes and unversities, and in discussions with computer scientists and users in China.

stage of its electronics industry, and its being a developing economy, China's efforts may be considered, on balance, as successful.

Yet, upon closer examination, at the end of the 1970s, China's computer research and development and computer industry were backward as compared with the rest of the world. Research and development efforts produced individual pieces of medium-speed central processing units, neglecting input, output and storage equipments. China was unable to develop any meaningful system or application software that would have allowed an efficient use of computer equipment. Computers were sold with simple versions of language compilers and operating systems, and even those were not always available. China emphasized machinery and hardware at the expense of software and knowhow.

All through the 1970s, the Chinese were proud to show foreign visitors selected prototype computer installations in universities and research institutes. A closer look at the national computer industry gave, however, a less impressive picture. Manufacturing was at the stage of a craft industry, with outdated and rudimentary production facilities. Although it was under the central authority of the then Fourth Ministry of Machine Building, the industry lacked much of the infrastructure and strategy to develop rapidly and successfully. No national production standards existed and equipment of low quality broke down repeatedly. Suppliers' after-sale support was nonexistent. No computer user group or active professional association was formed.

In the late 1970s, computer users were an elite few in China. The largest group was the military, which had relatively advanced equipment and software to help it achieve a few technical feats such as the launching of intercontinental ballistic missiles, and the launching and recovery of space satellites. The scientific and educational establishment was another large group of users. Both groups used the computers as "number crunchers," to solve scientific and technical problems. The serious weakness of information systems, the neglect of enterprise management, and the lack of the necessary software and equipment—fast input and output, and high capacity storage devices—all hindered the use of computers for management purposes.

III. The Transfer of Computer Technology

In 1978, the Education Bureau of one industrial ministry planned to conduct a Systems Engineering Teachers Training course, a first for China, at one of the universities it supervised. The course was to introduce mid-career university lecturers to quantitatively oriented management topics, emphasizing the use of computers. The ministry and the university agreed that the course should stress practical training. In addition to management subjects, close to two hundred hours of instruction in computer languages, operating systems, and systems design and analysis were offered for a class of thirty-eight students for a period of six months.

DOMESTIC SOURCING OF THE TECHNOLOGY

In October 1978, the university had two China-made second-generation computers, with slow central processing units, and rudimentary peripherals. They could only operate as the equivalent of a programmed calculator dedicated to one user at a time, and were totally inadequate for managerial training.

In the early stages of the course design, whenever I raised the question of the availability of adequate computer facilities, my Chinese colleagues repeatedly assured me that that was being taken care of, yet, they were unwilling or unable to discuss specifics. Four months prior to the start of the course I was informed that a Chinese-made DJS–130 computer would be delivered to the university two months later. Although details of the computer configuration were not known, it was clear to me and to some of my Chinese colleagues that the equipment did not meet the course requirement.[3] Unless appropriate actions were taken, the conduct of the course was in jeopardy.

Sophisticated equipment in short supply, such as computers, are allocated according to plan in China. Irrespective of whether the equipment is domestically sourced or imported, the time span between the user's first request for that equipment and his taking delivery of it is measured in years. Both ministry and university representatives cooperated closely to obtain the computer system. Powerful connections, including one with a computer engineer from the factory producing the computer system, resulted not only in their getting the equipment at all, but also in an amazing short delivery time.

A few representatives of the university suspected that the computer configuration would not meet the key specifications. They knew prior to the purchase that the plant had a reputation for producing poor quality products. Also, they were aware that the manufacturer could not supply much software, not even the one needed to operate many of the peripherals purchased. Yet, they were pleased with their coup: the allocation, purchase and delivery of a whole computer system hardware in less than three months!

Clearly, their strategy for getting the needed equipment adopted an incremental approach: first, obtain a basic system from wherever possible, irrespective of quality, configuration and software support; then solve the problems one at a time to bring the system as close as possible to specifications. In their minds, there was no other satisfactory alternative. One alternative, to work through the regular planning process, implied a long waiting period, with no guarantee that the allocation of the equipment would eventually be made, or that equipment and software specifications would be met. Another tempting alternative of course was to import a much-coveted foreign-produced computer system. Again it implied a normally long waiting period and presented its own risks: denial of foreign exchange, delays due to backlogs caused by the sudden surge of China's foreign trade in 1978, and still no guarantee of getting a computer to specifications.

To remedy the problem of the inadequacy of the computer system's configuration, university officials decided to send me to

[3] The computer system turned out to be an elementary minicomputer, with 32,000-word internal memory, a slow teletype operator console, a cathode-ray tube (CRT) terminal, a printer, a paper tape reader and punch, and a plotter. Apart from a BASIC interpreter, the supplier provided no software to support the operation of the equipment.

North America to purchase additional software and hardware compatible with the DJS—130, to support the conduct of the course due to start in three months.[4]

Through elaborate, complex and time consuming procedures, involving several Chinese organizations dealing with foreign trade, representatives of the ministry were granted the permission and the foreign exchange to import the equipment. Members of the State Council, the highest government body headed by the Premier, had to grant special permission to have an individual, who also happened to be a foreigner, purchase the equipment and sign contracts on behalf of the university, since, by law, only foreign trade corporations were entitled to represent Chinese organizations.[5] These permits took four weeks to complete, a record time by Chinese standards.

The computer engineer from the plant, who had helped the university obtain the computer, acted as the technical advisor for hardware, I, as the advisor for software. The engineer was confident that his plant could and would attach the peripherals to be imported to the main frame with little effort.[6] I did not share his confidence, and believed that China's lack of experience in the equipment to be imported and possible management-related problems at the plant were likely to cause serious delays. Also, even if the hardware was installed on time, to be able to use the computer, imported software had still to be adapted to the Chinese computer, usually a complex and lengthy process. To the university representatives and the engineer "system operationality" meant hardware installation with little regard to software.

SELECTION AND PURCHASE OF FOREIGN TECHNOLOGY

On arriving in North America, I quickly identified feasible equipment and potential sellers. However, I soon became aware of the revolutionary development of the microcomputer industry. It was clear that with the available foreign exchange budget entire microcomputer systems could be acquired, providing the university with a more advanced and powerful computing technology, a wider range of software, and better suppliers' technical and marketing support than the original plan would have allowed.

Disregarding the deadline I was working under, I made none of the purchases originally planned. Rather, I collected the technical and commercial data on microcomputers, and returned to China to present the new microcomputer alternative. My Chinese colleagues approved my initiative. Permision was soon obtained from the ministry to modify the original plan and to purchase the microcomputers. The Chinese computer engineer played a crucial role: although he had been unaware of the development of the microcomputer in-

[4] The purchase order included terminals, disk drives, an operating system with a time-sharing or multi-user capability, and language compilers. Clearly, the probability to get the equipment and software by the start of the course was extremely low.

[5] Later on, it was revealed that the permission was obtained despite a strong opposition from within quarters of the Chinese bureaucracy.

[6] The DJS-130 computer is a reverse-engineering copy of a Data General mini-computer. The plan was to acquire peripherals compatible with Data General and expected to be compatible with the DJS-130 too. The opportunity to study foreign technology possibly compatible with the computers it produced provided the plant with strong incentives to cooperate with the university.

dustry, still, he was in a position to confirm the benefits of the new alternative I had suggested. He was Chinese and a computer expert, and was thus trusted.

My Chinese colleagues and I jointly determined the computer configuration and selected the United States supplier. I succeeded in having the Chinese reverse their original decision on the supplier, which was based on one criterion only: hardware availability. I convinced them to adopt a mult-criteria decision-making approach, including software, technical and marketing support. At the university and ministry's request, I negotiated the purchase and signed a contract with a U.S. trade agent in Beijing.[7]

The U.S. supplier and agent obtained the export license and readied the order for shipment within a few weeks. Despite the pressing need for the equipment for the course, which had already started, the opening of the lettter of credit was delayed for reasons initially unknown to me. One month into the delay, I was informed that the Bank of China and the foreign trade corporation refused to authorize the opening of the letter of credit. They claimed that I was granted the authority to sign the contract abroad, but not inside China, and by doing the latter, the trade corporation's legal prerogatives were infringed. After lengthy but unsuccessful negotiations, and to preserve a good working relationship with the trade corporation, the ministry acceded to its demands. The original contract was cancelled, replaced with a new identical one signed this time by the corporation and the U.S. agent. This incident delayed the delivery of the computers by more than two months. They were installed and became partially operational only during the last three weeks of the six-month course.

RECEIVING THE TECHNOLOGY

Soon after the signing of the original contract, the university drew up plans for the installation of the computer equipment. The ministry allocated a generous budget to remodel an existing facility into a computer center. With the support of the ministry, the university was allocated manpower and materials by the municipal government in record time. Thanks to its strong industry connections and time-consuming negotiations, the university acquired auxiliary machinery, including environment control equipment, from outside the national material allocation plan.

The university leadership appointed a young faculty member as the director of the new Systems Engineering Computer Center. He had a background in automation control, a limited experience with the university's Chinese-made computers, and no working knowledge of English. Four of his immediate tasks were to design the physical layout of the center; to coordinate the installation of the equipment; to train the center's personnel; and to set up procedures to govern faculty and students' use of the facilities.

In addition to the director, the university leadership assigned eight people to serve as the center's technical personnel, and three

[7] The university purchased four microcomputer systems, various software packages, and spare parts. Two of the systems supported a multi-user environment each up to seven users. Thus, up to sixteen users could access the computers simultaneously. Also the contract provided funds to buy yet unspecified parts in the future.

younger people to provide clerical support. Most of the technical personnel were recent young graduates of the university.[8] Only two members of the center were of a more senior position, one assigned to head the hardware and the other the software group responsible for installing and supporting the equipment and the software respectively. The Chinese computer engineer and I acted as advisors to the computer center.

The technical personnel's computer experience was limited to the use of the university's outdated second-generation computers. Only a few could read English comfortably enough to benefit from the written materials supplied by the manufacturer. In view of these handicaps, it was decided that each person would learn one aspect of the computer hardware or software, with the proviso that the self-acquired knowledge would be shared with the rest of the team through presentations and discussions. Also, the decision was made to translate key manuals into Chinese.

The university faced close deadlines, yet, for weeks, it seemed that no action was taken. The actual remodelling of the facility began about two months later than planned, seemingly without shaking the university leadership's confidence in meeting the deadline. Only after I repeatedly reminded the university leadership of the delay and pressed for action, were the equipment layout and installation plans formulated by the center director. That none of the original deadlines was met had little effect, because shipping the computers to China was also delayed for over two months, as was mentioned.

Overall, the hardware installation went smoothly in an atmosphere of great excitement, due to the dedication of most members of the team, and to the ease of installing microcomputers. Equipment or parts damaged in the shipment and difficulties of following installation instructions in English caused slight temporary difficulties.

The first computer became operational about three weeks before the scheduled end of the course. The students were given access to a computer as soon as it became operational. Yet, their use of the equipment was rather rudimentary: there was not enough time to develop teaching materials.

With the installation of the microcomputers, the importance of the management of the computer center became evident. The center director put into effect a set of regulations concerning faculty and students' access to the computer facilities. Despite the pent up demand for computer access, the center was open six days a week for only one shift of less than seven hours a day. Time slots allocated to the class could not satisfy the needs of the Systems Engineering Teachers Training course. The center director had yet to formulate a training plan for his personnel.

Considering how slow and inflexible a centrally planned economic system can be, the purchases of the DJS-130 and the microcomputers have shown, at least in China, that there is still room to undertake projects from outside the plan. The selection of microcomputers illustrated the significant improvement in quality of the

[8] Because education was neglected during the Cultural Revolution, those graduates received poor training.

technology selection process when a Chinese organization has truly unimpeded access to the foreign technology market. Note should be made of the presence of a combination of exceptionally favorable factors: a strong and direct support of State Council members, the ministry and the university's powerful connections, and my freedom of movement and access to the West.

IV. The Transfer of Data Processing Know-How

THE CASE OF THE UNIVERSITY

One of the main objectives of the Systems Engineering Teacher Training course was to introduce students to electronic data processing. The computer-related component of the instruction spanned a wide range of topics to develop the students' ability to write computer programs, to assess computer configurations, and to design, develop and implement computer-based management applications. When the course ended in July 1978, it was obvious that, despite two hundred hours of computer science instruction, that objective was not attained, and as such the course was less than successful.[9]

A lack of trained instructors, the late arrival of the computers, an overcrowded curriculum, and a static and bookish pedagogical approach led to the ineffectiveness of the course. Responding to strong demands, the university authorities allowed many people to audit the course, inflating class size to more than one hundred from the original thirty eight. Also, students were selected based on quotas the ministry had assigned to organizations nationwide, with little consideration to their education level and background, motivation and English reading proficiency (most of the teaching and reference materials were in English). My recommendation to lighten the curriculum, reduce the size of the class and emphasize practical training went unheeded.

Before the end of the course, one of my Chinese colleagues and I recommended that, beginning in August, the university conduct a second electronic data processing training course for a small number of students selected from among the best of the current class. To provide a heavy emphasis on practical training, the course would consist of the design and development of systems engineering projects. The ministry adopted the recommendation, and twelve of the best students were retained.[10]

The second training program consisted of two parts. The first was a short workshop to introduce the students to the structure and organization of a data processing system through the analysis of a computerized production planning and control package marketed by a major United States computer firm. This time, the students played an active role in class, presenting and discussing the materials under my supervision. This first part was a prelude to the second, more substantial part: the undertaking of data processing projects.

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[9] For comparison purposes, let us note that in the late 1960s, IBM's systems engineering training programs consisted of a comparable amount of instruction and subject coverage. Yet, because of quality instruction and teaching methodology, those programs produced highly qualified personnel worldwide.

[10] Twelve is an approximate number because some of the participants had other responsibilities concurrent with the second stage of their training, and participated only part time.

To allow students to experience all stages of project development in a reasonably short period, project selection criteria were set. The projects had to be of manageable size; address practical uncomplicated managerial problems, the solution to which employed systems engineering and computer data processing techniques; and be supported by the hosting organization.

Three projects were selected. One was to help develop an algorithm for a computerized inventory management and control system. The second project was to develop a simple production planning and control system for a factory (see "The Factory Case" below). The third project was to computerize the payroll of the university's 1,400 staff and faculty.

Eight students, or the majority of the class, were assigned to the payroll project. In view of the students' high educational and professional level, and of the practical nature of the training class, I conducted the project work, which was under my direct responsibility, in a real life situation. The class acted as the project team, I, as the project leader and technical advisor. No classroom instruction was scheduled. Only when the students or I found that there was a need for clarification of a technical concept, was a lecture conducted. The team established a plan of action and a schedule, and defined the various stages and substages of the project. A division of labor, and assignment of individual responsibilities within the team were adopted in the course of the implementation of each stage. The objective of this real life approach was to provide the students not only with a technical, but also managerial training in the conduct of data processing projects.

The project team included five lecturers, who were in their thirties and mid-forties, two junior instructors, in their twenties, one engineer, and a payroll department liaison person, also in her twenties. None of the team members had any experience in data processing systems design and analysis, or any expertise in computer programming despite the long hours of ineffective computer instruction they had just finished. All but two students had a functional reading and comprehension of English, giving them each access to technical materials.

After a slow start the work of the team began in earnest. With hands-on computer sessions, the students remedied lacunae in their basic computer skills. I provided supplementary, yet minimal instruction on writing programs, concepts of data files and data base management, and systems design and analysis.

In the first six weeks of the actual start of the project, my role was crucial. I acted as the team's technical and managerial leader, helped raise the students' technical competence to a reasonable level, and closely guided them in the first stages of the project.

Soon, the students demonstrated a quick learning ability and a high degree of maturity, and were ready to shoulder a much larger responsibility. The management of the project was then turned over to two team members. Most technical and organizational problems were resolved by the team, and I acted only as a technical and managerial advisor, meeting with the team one half to one day a week. The student selection had paid off.

By the end of the fourth month, I left China. Within a period of five months from the actual beginning of the project, preparations were being made to test the application in its entirety. At that point, the team disbanded and each member returned to his respective work place. The two junior members of the team, who were from the university, performed the final test and ran successfully the system in parallel with the manual one for three consecutive months. Seven months had passed from the time the team began to sharpen their computer skills to the parallel run.

The result of the class project was a data based computerized payroll system, at the time probably the most advanced in design in China. It reduced human computation and data manipulation from ten-fold to one thousand-fold (depending on which of the subsystems was considered), and manpower by a factor of twelve. Moreover, the university-wide faculty and staff identification code system and the data base created by the application were designed to form the basis for other computerized systems that could be developed at the university.

Yet, despite the successful parallel run, the payroll department decided not to adopt the application. With substantially low labor costs, there was little economic incentive to implement the system. Problems of relocating would-be displaced personnel discouraged its adoption. To the payroll department and many at the university the system was dismissed as being merely a student exercise. Notwithstanding repeated claims for the need to introduce computerized management to China, the university leadership did not truly appreciate the significance and level of the technology embodied in the payroll system. Finally, my departure from China and the disbanding of the project team soon after the system was developed left nobody of influence at the university to lobby for its adoption.

THE CASE OF THE FACTORY

This case is about the introduction of data processing in a Chinese factory one year following the delivery of imported computer equipment. I acted as a data processing consultant to the factory for a period of over one year, visiting the factory several times, up to a week on each occasion.

The factory was established in the 1950s with the help of the Soviet Union to produce large industrial machinery. In its production capacity and product quality it ranked among the top five plants within the industry in China. It was under the joint jurisdiction of the ministry that sponsored the Systems Engineering Teacher Training course and local provincial authorities.

As part of an early and mid-1970s wave of technology transfer to China, the ministry decided to update the plant's product line and production technology. Millions of dollars were spent to license product designs and production technologies, to purchase a complete computer system [11] and to import equipment from West Europe and Japan to set up new production facilities.

In line with their policy of self-reliance and to save foreign exchange, the Chinese severely limited their suppliers' role in providing technical training. Capital equipment suppliers provided sup-

[11] The imported system was a medium-size minicomputer, with a battery of input, output and storage devices, and system software packages, including time-sharing capability.

port for its installation, but none for its operations or management. The licensor offered a short training to a small group of Chinese technicians and engineers in West Germany. The computer purchase contract included the provision of technical manuals but none of training.

The Chinese selected the same computer brand and model their West German licensor used. During the negotiations the licensor offered to sell the Chinese its software, but the Chinese declined, claiming that their plant operations differed from those of the West German's, and preferring to develop the software themselves.

Upon installing the computer equipment, a computer team was formed to develop the applications to help modernize the factory's production management. The team was headed by a computer center director, who also acted as the systems development manager. Only one team member seemed to play the role of the systems analyst, the rest were operators and programmers. Since none of the team members had adequate, formal or informal training in their respective areas of responsibilities, the computer center's first priority was to train self-reliantly its own personnel.

One year after the installation of the computer, the center's programmers were still studying on their own how to write programs. The operators were confident in operating the equipment. Yet, not one single application was running on the computer. The factory was still debating the best strategy for introducing data processing applications. Should it develop, and in what order, a production planning and control system, an inventory management and control system, a payroll system, or a data base similar to the one used by the West German licensor? The computer center director preferred to begin with an inventory control system. Others had different views.

The ministry, displeased with the factory's lack of progress, requested that at least one data processing application be developed within a year, and recommended that the factory management seek the help of members of the Systems Engineering Teachers Training program.

Seeing an excellent opportunity for the students of its second systems engineering course to partake in a practical project, the university leadership was initially pleased with the prospect of its collaboration with the factory. Following its initial reluctance and responding to the ministry's pressures, the factory agreed to cooperate with the university, under the condition that the students' role be limited to programming the applications that the factory—mainly in the person of the computer center director—wanted to design. With the sudden availability of trained progammers and to impress the ministry, the plant decided to develop simultaneously all of the four computerized applications mentioned. The timeframe was one year, to correspond with the ministry's deadline.

The university would not commit the students, actually faculty members, for one full year, nor did it think that project selection criteria were met: the factory projects were large and complicated, and provided limited students' involvement. Also, it viewed the factory's proposal as flawed, grossly underestimating the amount of work required to develop all four applications, and totally disregarding the need to conduct feasibility studies and design analyses.

The negotiations were deadlocked and the university requested permission from the ministry to have me take part in them. Up to then, I was unaware of the conflict that had developed between the university and the factory. Only when I was invited to join them, did my university colleagues brief me on the situation.

First, I was introduced to the factory through presentations and a site visit. Once the negotiations started, it became clear that both parties wanted to get my opinion on the factory's data processing plans presented to me by one of the plant's deputy-directors, the computer center director and the systems analyst.

In my opinion, the university's views were confirmed: the factory personnel were clearly under pressure to develop computerized applications, yet lacked the needed direction, knowledge, experience and resources. Moreover, the factory's top management considered those applications too technical for it to make the final decisions.

Soon, the deputy-director and some of his colleagues began to suspect that their plans were flawed, and turned the negotiations into discussions on issues of project selection, project development resources, respective roles of plant management and computer center personnel, and the impact of the introduction of computer applications on the management of the factory. At the end of the first round of negotiations, the factory's deputy-director invited the university faculty and me to give formal presentations on systems engineering and data processing to the executive of the factory, and its computer personnel. That invitation marked a positive turning point in the factory-university relationship.

The university seemed to have three main objectives for bringing me into the negotiations. First, to make the factory management realize that its plan was not feasible. Second, to alert the factory leadership to the complex implications of introducing computerized management in the factory. Third, to have the negotiations succeed.

A verbal agreement was finally reached between the university and the factory, with the ministry's approval. A general production planning and control application, using operations research, would be jointly developed to serve as a foundation for other computerized production management systems. There would be two project co-leaders, one from each institution. The project team would include the students, selected personnel from the factory's computer center, and other factory employees. The factory management would provide the project team with the necessary support and participate in decisionmaking. As part of a compromise reached between the two institutions, the university acquiesced in having two of its students take part in the development of an inventory control system, the factory's computer center director's pet project, which he wanted to lead.

In the early stages of the implementation of the agreement, reservations were raised about the factory's commitment to the project. But, thanks to pressures exerted by the ministry, the university and key employees at the factory, and to the factory management's gradual realization that its cooperation with the university was turning out to be beneficial, the factory's support was finally obtained. A few months after the start of the project, the team finished its work, the high quality of which was recognized by all parties.[12] The factory leadership then proposed that it and the university enter into a formal long-term cooperative agreement to develop jointly more data processing applications.

V. Factors Determining the Efficiency of the Technology Transfer Process

Three cases of the transfer of two related technologies, computer and electronic data processing, were presented focusing on the recipients' management of the transfer itself and on their early attempts to adapt and use the technologies. Serious managerial problems and weaknesses, but also strengths and successes were noted.

Six types of factors appear to have significant influences on the management of both the transfer process, and the assimilation and use of the technology itself: ideological values, economic concepts, systemic factors, human resources, the type of technology, and the presence of foreign consultants.

IDEOLOGICAL VALUES

Two ideological values appear to influence crucially the Chinese in their technology transfer decisions. First, Chinese interpretation of Marxist materialist economic philosophy puts greater stress on hardware (part of the production forces) than on knowledge (belonging to the superstructure). This interpretation clearly disregards the growing importance of managerial and technical knowhow in creating a modern industrial society. When Marxist philosophy was formulated in the earlier stages of the Industrial Revolution one hundred years ago, terms such as hardware, software, knowhow, did not exist. China's ideologically-based pro-hardware bias is a key reason why equipment and plants have been imported with little regard to the transfer and development of software and knowhow.[13] As shown in the case of the factory, China was unwilling to purchase much technical training and software. The university's original choice of foreign computer supplier was based solely on one hardware-related factor: the availability of hard disk drives, overlooking software, marketing and technical support.

Second, China's self-reliance policy is feasible only if there is a minimally favorable environment to implement it, including the presence of a basic core of managerial and technical skills. Otherwise, not only is it unproductive, but also counterproductive: waste of scarce resources, dampening psychological effects, and shoddy standards, to name a few. The data processing cases have shown the factory's self-reliant approach wasteful and unsuccessful, but not so for the university where there was a presence of basic expertise.

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[12] In contrast, the inventory control project ran into serious difficulties before it was suspended.

[13] In December 1979, Bo I-bo, then Vice-Premier, stated that China had failed to transfer know-how, equating technology transfer with equipment acquisition, and that China's new foreign trade policy should remedy this problem (interview with the author).

ECONOMIC CONCEPTS

In the West, many economic concepts, translated into standards, criteria and measurements, have governed the efficient allocation of resources. In China those concepts or their equivalent are either nonexistent or weak.

Opportunity Cost.—Opportunity cost implies a degree of freedom in selecting one from among various opportunities, and the access to the resources to truly exercise a choice. In a sense, opportunity cost requires that the enterprise operate in an environment that possesses substantial market elements emphasizing the efficient use of limited resources. In 1978, "opportunity cost" did not exist in the Chinese language.

In the 1970s, when showing installed imported equipment to visitors, enterprise representatives proudly stated that the machinery was operated self-reliantly, that is with no training provided by the foreign supplier. Political considerations notwithstanding, what was the opportunity cost of that self-reliance, i.e., which of the alternatives—presence or absence of foreign training—was economically beneficial to the enterprise or the society as a whole? Also, opportunity cost was not a part of either the university's or the factory's decision-making process when they purchased the DJS-130 and the West German computers respectively.

Marginal Analysis.—A typical approach to cost or revenue analysis in China is average rather than incremental values. Consequently, as in the case of the factory's computer import, foreign exchange expenditure is reduced by cutting down on the (intangible in the Chinese view) software and technical training, even though their marginal returns are usually very high. They are the key to the transfer recipients's ability to utilize the technology effectively, or at all, as the case of the factory has shown.

Investment Analysis.—Although the concept of return on investment existed in China, it is weak both conceptually and operationally. Other criteria or factors, such as political considerations, economic objectives, and cultural-ideological values, play a by far more important part in the allocation of resources. China's appropriation system makes capital appear to be a free good to the enterprise, making deficient any investment analysis. Had the return on investment been part of performance evaluation, the computer purchase decisions in the case studies would probably have been different.

SYSTEMIC FACTORS

Of the numerous systemic factors relevant to the transfer of technology to China, only a few, of great significance, are mentioned.

Scarcity.—Facing a resource scarce economy and a highly centralized taut planning, enterprise management dreads supply shortages, which can not be remedied through market mechanisms and imply high costs and non-fulfillment of state quotas. This, and the practically free availability of resources once they are allocated, caused excessive hoarding. Also, facing a sellers market, management is satisfied with whatever production input it can get. This is illustrated by the ministry and the university being proud of their acquisition of the DJS-130 computer system, notwithstanding the fact that it was of a questionable usefulness to the systems engineering course. Their strategy was to get any computer and then modify it step-by-step to the desired state—probably still an optimum approach in view of the environment they faced.

System Inertia.—This is a major flaw in an overly centralized planned economy. Any project outside the plan meets serious implementation difficulties. The result is the dampening of managerial initiative and unwillingness to take advantage of the rare opportunities that may arise.

The decision to conduct the first, unplanned systems engineering course was made partly to take advantage of the offer of my services. The university and the ministry surmounted serious obstacles to hire me, find Chinese instructors to teach the course, allocate funds for the course and acquire the DJS-130. They were forced to accept clearly sub-optimum choices. Nevertheless, the very conduct of the course was in itself a success made possible by the ministry's determination, power, prestige and connections.

Lack of Accountability.—There is a lack of an *operational* accountability system for economic performance. Poor decisions and performances are often blamed on difficult external conditions. One may expect better management to alleviate constraints posed by unfavorable conditions. Yet, in China, the lack of an accountability system seems to generate just the opposite effect. Nobody within the ministry or the factory was held accountable for not purchasing software or technical training. Such a decision had effectively prevented the use of over one million dollars of investment for two years.

Goal Dichotomy Between Central and Local Organizations.—Centrally planned economies offer little room for enterprises to make strategic decisions, such as setting corporate objectives, allocating resources, and formulating corporate policies. Consequently, a dichotomy of goals and objectives exists between the enterprise and its superiors in the bureaucracy. Since strategic decisions are removed from it, an enterprise has weaker incentives and less commitment to implement them adequately. The examples of the factory's poor performance in developing data processing applications, and the running of the management education program at the university illustrate this point.

Goal Dichotomy Between Foreign Trade Corporations and Endusers.—Similar to the point above, and of great import to technology transfer to China, goal dichotomies exist between a foreign trade corporation and an end-user. The former's principal performance criterion is to respond to the end-user's request with the least possible cost to itself and expenditure of foreign exchange, often at the expense of the effectiveness of the transfer of technology. Equipment specifications, post-sale technical and marketing services, personnel training, and the import and adaption of software and knowhow, all of great benefits to the end-user, are neglected to various degrees. Moreover, the end-user is under tremendous pressure to please the trade corporation, its only possible representative to the international technology market.

The decision not to purchase training services and software with the computer equipment might be partly explained by the trade corporation's wish to save foreign exchange. Also, to preserve its working relationship with the trade corporation, the ministry, despite its might, had to bend to the corporation's demands and cancel the original purchase contract.

Closed System and Information Control.—China's semi-closed economy, its highly centralized decision-making system, a general attitude of providing information on a need-to-know basis and a neglected statistical system have all contributed to creating barriers to accessing up-to-date, reliable information. The removal of China from the world's main streams for more than two decades has forced scientists and technicians' search for technology solutions to be restricted to the closed environment of the country. The Chinese computer engineer's sub-optimum advice to import outdated peripherals to attach to the main computer resulted from his unawareness of the development of the microcomputer industry. The lack of adequately trained instructors was a major factor in the not so successful conduct of the first systems engineering course.

Foreign trade corporations are a major source of information on foreign technology and foreign trade knowhow. Yet, the effectiveness of this source is put to question considering the goal dichotomy that exists between them and the end-users, their removal from end-users by many bureaucratic layers and end-users' lack of exposure to the foreign trade process. Moreover, the control of the search, access and diffusion of technical information and foreign trade knowhow constitutes an interesting factor in the balance of power of the involved parties.

Technical, marketing and software support were initially not appreciated as the case of the university's purchase of microcomputers demonstrates. Also, following the delivery of the equipment, the university found it difficult, almost embarassing, to establish a post-sale relationship with its foreign supplier for fear of overstepping the proper boundary of such a relationship.

Foreign Trade & Technology Transfer Policy.—Foreign trade policy reflects China's ideological bias for hardware. The outcome of such a policy has been the attainment of at best a suboptimum transfer of technology. Even if such a policy were to change, as it is now, trade corporations, from lack of experience, would find it difficult to adapt quickly to the new transfer modes, e.g., licensing, training and consulting services and joint ventures.

HUMAN RESOURCES

The most important of all, the human resource factor is examined on three dimensions: technical, managerial and entrepreneurial.

Technical Resources

From problem diagnosis, to the search and selection of feasible technologies for solutions and to their adaptation and further development within the recipient environment, technical support is lacking seriously to the point of jeopardy to the transfer of technology. Even when technical support exists and is sought, only the expertise China's closed environment permits is available. Note should be made that the willingness to utilize that scarce expertise varies among organizations. The university, an engineering school, was more amenable to seek technical expertise—mine and that of the Chinese computer engineer—than was the factory.[14]

The university case has demonstrated that a rapid and successful technical resource development is possible with the presence of a minimum of favorable conditions: support from the organization leadership, proper selection of trainees and training methodology, and presence of expertise. The successful and fast development of the payroll system is a case in point.

Managerial Resources

For our purposes, the managerial resources include the enterprise's general management and its technology management.

General Management.—Handicapped by a low educational level, general management lacks the training and experience to help facilitate the technology transfer process, not only because of the novelty of the technology,[15] but mainly because the overly centralized economic system did not foster the development of those skills and knowhow. Enterprise management is trained to, and can only perform, administrative rather than managerial functions.

Yet, while technology transfer decisions are made at higher levels, general management is culturally and politically expected to comply with its superiors and implement those decisions within its own organization, under usually difficult conditions: scarcity of resources, and rigid bureaucratic and systemic constraints. Also, management believes that the responsibility for the outcome of the implementation is shared with the higher-ups. Thus, with such a frame of mind, management usually adopts a satisficing-the-bureaucracy attitude, makes repeated demands for additional resources, and feels only partially accountable for its decisions.

Technology Management.—Technology management acts as the linchpin between the technology and the organization, manages its transfer, and adapts and further develops it within the recipient environment. Serious difficulties are encountered in the discharge of technology management's responsibility.

Management operates from a weak technical training and experience. Both computer center directors at the factory and the university, and the dean in charge of the systems engineering program (see "Entrepreneurship" below) had little managerial and technical training to conceive, define and perform their jobs adequately. But, once positive working and training conditions are created, middle-level management, if willing, shows an ability for rapid development of both technical and managerial skills. A case in point is the impressive progress shown by the dean and the leaders of the factory and university data processing projects. Gradually, that newly

[14] Lack of cooperation between universities and factories elicited many complaints from the Chinese leadership. Two reasons might explain it: on the one hand, enterprises perceived intellectuals as being too theoretical, with little understanding of the business world, often politically under fire, and on the other, many a confucian-bent intellectual looked down upon his being involved in worldly activities. Also, in a highly centralized economic system, with little incentives for risk taking and a weak accountability system, the enterprise was not pressed to look for outside help and support.

[15] See next section titled "Type of Technology."

acquired expertise trickled up to top management within the two organizations.

In all observed cases, technologies have been in effect transferred in varying degrees of success. Yet, the transfers were conducted inefficiently under difficult conditions. Plans had to be revised frequently. Deadlines were met only exceptionally. Subordinates' lack of experience, initiative and authority forced higher-level management to get involved in implementation details. Its lack of authority over its own subordinates severely limited its control over implementation.[16]

Management shows a mixed ability to take advantage of technical advice because it faces systemic constraints and unfamiliar technologies. For example, contrary to such advice, the Chinese preferred not to purchase computer training services and software, and conducted close to two hundred hours of computer instruction in overly large classes with little regard to quality of students and teaching methodology. Yet, when a clear demonstrability of the benefits of the advice existed, such as in the cases of the microcomputer and of the second systems engineering course following the mixed results of the first one, the leadership was willing to take it into consideration.

Entrepreneurship

To conduct the transfer of systems engineering and data processing knowhow, the university found in the person of one of its deans the combination of an entrepreneur and a transfer facilitator, without whom the transfer could not have taken place.

Space limitation permits us to mention only a few aspects of the dean's extensive role in the transfer. He represented the university in negotiations with the ministry and other organizations. He build up the team of Chinese instructors by scouting for them across the country. Within the university, he acted as the project leader, and the academic director of the course. He played a key role in the selection and purchase of the microcomputers. He was an effective bridge between me, with whom he worked closely, and the rest of the Chinese environment.

He displayed the personal qualities and skills of an entrepreneur, and possessed a high achievement need and strong patriotic feelings. He repeatedly took calculated risks and initatives within a centralized and rigid administrative structure, and displayed unusual skills working with it or around it. He showed a resourcefulness in tapping scarce resources. Finally, his intellect, quick learning abilities and versatile mind compensated for his initial lack of training in systems engineering, and experience working with non-Chinese.

TYPE OF TECHNOLOGY

Two aspects are considered: China's general technological culture gap, and its past experience with transferred technology.

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[16] For example, when it became aware that the management of the computer center was neglecting the training of the center's personnel, and was reducing the service to the users, the university leadership had little effective leverage to modify the situation.

Technological Culture Gap

Both computer and data processing technologies have been developed and widely used in technologically advanced societies. Living in a culture underdeveloped technologically and materially, Chinese are unaccustomed to the daily use of high technologies common in other societies. Thus, they lack much of the technological infrastructure, attitudes, mentalities and world outlook congruent with, and supportive of, the creation and use of advanced technologies. Consequently, China's wide technological culture gap is bound to present serious obstacles to the transfer of high technology.

That gap manifests itself in many ways one of which is what I called the "Jade Buddha Temple"syndrome. The university computer center director imposed stringent limitations on users' access to the facilities, claiming that such measures were necessary to protect the highly valued equipment. The usefulness of the computers to the university was thus paradoxically reduced substantially.[17] Also, the leadership inability to appreciate the technology embodied in the computerized payroll system contributed to its not being adopted by the university.

Past Experience With the Transferred Technology

Observations were made on the transfer of two technologies: computers and data processing. The presence of a computer industry in China leads us to expect that the transfer of computer technology would present no major problems. The cases studied tend to confirm this point. By contrast, the transfer of data processing faced serious obstacles because of China's inexperience in that technology, a decade-long neglect of enterprise management, and the anti-software ideological bias. The cases studied, particularly that of the factory, illustrate this point.

FOREIGN CONSULTANT

Throughout the paper, the crucial and extensive role that I played in technology transfer is noted. All through the transfer stages, I provide valuable services, which the Chinese were unable to do at the time, such as opening direct channels of communication with foreign organizations; conducting a market research of the microcomputer industry in North-America; collecting management teaching materials and books; and interpreting foreign data to Chinese recipients. The long time required to transfer software and know-how, embodied in people, made the impact of my presence particularly felt in the case of the "soft" technologies, i.e., systems engineering and data processing.

That impact can be recognized when contrasting the performance of organizations with access to a foreign expert to those without. The differences in the university and the factory's experiences

[17] The Jade Buddha Temple, located in Shanghai, houses a most exquisite Buddha statue carved out of white jade. The valuable computer, like that statue, was also housed and protected in the computer center (temple). My many requests that trainees' access to the equipment be facilitated went unheeded. Yet, only when the "Jade Buddha Temple" syndrome was mentioned, were communication channels cleared, resulting in limited positive actions. The power of cultural communication!

in developing data processing, and the university's relative success in establishing a systems and industrial engineering program compared to the earlier outcome of similar efforts of its other, more prestigious Chinese counterparts are excellent examples.[18]

The hiring of foreign experts as transfer facilitators is one way to alleviate the effects of transfer barriers. Yet, for systemic reasons discussed earlier, the Chinese authorities have not been able to devise efficient mechanisms to seek and get foreign expertise. Also, the society's ethnocentric tendencies force foreigners to its margin both socially and professionally, making it difficult to fully utilize them. Their effectiveness to Chinese employers can be improved only if a relationship of mutual trust is developed, a usually painstakingly slow process in times of constant hurry.

VI. Summary and Conclusion

The analysis of the management of the transfer of high technology and of the early stages of its utilization in China in 1978 has pointed to a number of factors hindering such transfers. Foremost among them are the scarcity of qualified managerial and technical personnel; the legacy of an unresponsive and isolationist foreign trade policy and administration; a highly centralized economic system; the absence of favorable and the presence of unfavorable ideological values and economic concepts; the existence of a wide technological culture gap; and lack of experience with the specific technology transferred. Facilitating the transfer are the system's ability to show unexpected flexibility and to concentrate resources; the admirable propensity of many Chinese people to learn quickly under favorable conditions; the past experience with the specific technology transferred; and access to foreign consultants.

Since 1979, China's post-Mao leadership has devised a series of economic and systemic reforms to pursue more favorably the country's strong economic development drive began a year earlier. Apart from addressing economic policies, the reforms focused also on modifying the economic management system to stimulate the economy and efficient decision making.[19]

Many of the factors perceived as having played a significant role in the management of the transfer of technology in this study are being addressed in the reforms. Since 1980, China has been putting considerable emphasis on the transfer of technical, managerial and marketing knowhow, on improving the transfer mechanisms and channels, and on the development of its human resources. While retaining a centrally planned economy, attempts are being made to create market mechanisms to improve economic efficiency. Serious efforts at selective economic and administrative decentralization of decision making are being made in both domestic and foreign sectors of the economy.

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[18] I was hired in 1978 on an experimental basis, the first foreigner to work in China in systems engineering and management since the Sino-Soviet Rift in 1960. Subsequently, the Chinese have employed scores of other professionals in these fields.

[19] For more detail, refer to *China Under the Four Modernizations*, Joint Economic Committee, United States Congress, Washington, D.C., U.S. G.P.O., 1982; and Chapters II and VIII in Joseph Y. Battat. "Management Practices in Post-Mao China: Policies and Their Implementations—1977–1979" unpublished doctoral dissertation, Massachusetts Institute of Technology, Cambridge, Massachusetts, 1984.

China's reforms are too recent to evaluate comprehensively. Yet, like other centrally planned economies, such as Hungary, that have implemented reforms earlier, the payoffs in some sectors (e.g., agriculture) can be quick, while in others (e.g., industry), slow.[20] Notwithstanding China's favorable economic performance of the last few years, observers inside and outside that country acknowledge the possibility that the implementation of the reforms may run into serious problems caused by the reforms' attempts at having a still strong planned economy co-exist with effective market mechnanisms, replacing administrative with economic regulators, and striking a delicate balance betweeen administrative and economic centralizations and decentralizations.

[20] Paul Marer, "Economic Reforms in Hungary—From Central Planning to Regulated Market," in *East-European Economies: Slow Growth in the 1980's,* Joint Economic Committee, United States Congress, Washington, D.C., U.S. G.P.O. 1985.

THE EVOLVING ROLE OF TECHNOLOGY TRANSFER IN CHINA'S MODERNIZATION

By Denis Fred Simon*

CONTENTS

I. KEY JUDGMENTS

China will continue to place a strong emphasis on acquisition of foreign technology, especially in such priority areas as microelectronics and computers, energy (nuclear and petroleum), communications and transportation, automated manufacturing processes, and composite materials and metals. The Chinese leadership has developed a strong infatuation with the concept of the "new technological revolution." As a result, PRC leaders are particularly interested in promoting advances in biotechnology, microelectronics and computers, information technology, and new materials. They are looking aggressively for foreign technical assistance to advance domestic programs in these four priority fields.

At the same time, China has not waned in its commitment to the principle of increased technological self-reliance. As such, Chinese acquisition efforts must be examined in the context of on-going programs to enhance indigenous capabilities. These on-going programs contain a combination of organizational reforms and efforts to up-

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grade existing technical skills. While some obstructionism to these reforms exists, it appears that the overall effort to upgrade research performance and productivity will move ahead, albeit at a gradual but steady pace.

China will continue to diversify its international technology relations, expanding contacts with Japan, Western Europe and the US in both the commercial and government-to-government areas. These programs will be complemented by expanded programs with Eastern Europe and the Soviet Union, with the latter growing at a very modest pace. Efforts to assess the full extent of China's technology acquisition efforts must include an examination of non-US sources of technology—the quantity of which has been growing quite rapidly. While the Sino-US S&T and education relationship remains the largest and most active of China's bilateral relations, a combination of financial and political factors are helping to maintain strong Chinese interest in Japan and Western Europe.

The problem of assessing China's performance with respect to the acquisition of foreign technology promises to become more complex due to foreign trade decentralization and increased local autonomy, the proliferation of additional Chinese organizations engaged in overseas activities, the expanding links between the military and civilian sectors, and the increasing sophistication of Chinese organizations with respect to the workings of the international market for science and technology.

In view of the continued importance of the R&D aspects of military modernization, and the emphasis accorded to strategic weapons programs, the role of foreign technology is likely to take on added significance. Closer interaction between military and civilian organizations will make identification of actual end-users increasingly problematic, especially as the domestic channels for diffusion of technology become further lubricated.

The Chinese have selected electronics development as their number one technology priority, both in terms of military and civilian modernization programs. China has already completed agreements for acquisition of a number of IC production lines and is in the process of negotiating several similar agreements. One of the factors that will facilitate Chinese acquisition efforts is the establishment of a "silicon valley" outside both Shanghai and Beijing. These areas are considered to be "technology hothouses" for attracting foreign investment as well as for concentrating China's most advanced electronics R&D and manufacturing facilities.

Assimilation problems still remain, eminating, in large part, from a combination of technical backwardness, managerial inefficiency, and excessive bureaucratism. Resolving these problems will require a sustained political commitment as well as better utilization of existing manpower and technical resources. In a number of critical areas, problems such as irregular supplies of power and a still largely undeveloped infrastructure will further inhibit the pace at which newly imported technologies will make a substantial difference over the next 3–5 years.

II. Introduction

In recent years, the issue of technology transfer to China has taken on added significance, especially as Beijing has affirmed its commitment to maintain an open door to the outside world and to secure foreign technology and capital to support economic modernization. For the United States, technology transfer to the People's Republic of China (PRC) seems to present some important opportunities and challenges. Most important, it raises a number of key questions regarding the role of technology as an instrument of foreign policy. Based on the attention technology transfer has received over the past several years, it is clear that technology-related issues will continue to occupy a central position on the agenda of leaders in both countries.

The United States is on record as supporting China's economic and technological modernization program. Our principal working assumption is that an economically modernizing China will be more prone to moderate foreign policy behavior than a China beset by a host of intractable political and economic problems. Given the great importance that Chinese leaders have attached to the acquisition and assimilation of foreign technology, the success or failure of the four modernizations will depend, to a great extent, on how effectively and efficiently China can apply foreign technology. Thus, not only do we have obvious commercial and economic interests in technology transfer to the PRC, but perhaps also a significant political interest as well.

Any effort to understand the evolving role of foreign technology in China's modernization program must come to grips with three fundamental questions. First, it is clear that we need to have some fix on China's technology acquisition priorities and strategies. For example, as commercial relations between our two countries develop, US business needs to better understand how to respond to the emerging opportunities provided by China's open-door to the outside world. Second, we need to have a better grasp of the principal acquisition mechanisms being used by China to secure foreign technology. Will foreign investment become a viable mechanism for Chinese acquisition of technology? Are our existing export controls still too restrictive? Are they working in desired areas or have the Chinese been able to bypass them through alternative legal and clandestine means? In this regard, we need to develop some measure of the effectiveness of China's various acquisition mechanisms.

Third, and perhaps most important, we need to evaluate China's capacity to assimilate foreign technology, specifying the implications of successful or "unsuccessful" assimilation. The last issue assumes special importance in terms of two considerations. In the economic area, we should be sensitive to the possible ramifications of China's growing presence—sustained through the increasingly effective use of foreign technology—in global markets for such products as textiles, electronics, machine tools. In the military area, technology transfer will play an important role in any potential Sino-US defense relationship. Should the US decide to assist with the modernization of the PRC military through assorted technology transfers and equipment sales, it is imperative for us to discern the principal obstacles to absorption as well as which problems are amenable to short-term versus long-term remedies.

This paper will address these critical issues through an analysis of major trends in China's S&T system as well as an examination of the multiple dimensions of China's science and technology relations with the industrialized world and the socialist bloc. It will hopefully shed some light on some of the major political and economic dimensions of the technology transfer issue by specifying how and why the technology transfer issue will continue to assume long-term importance for China's modernization and the evolving Sino-US relationship.

A. CHINA'S S&T MODERNIZATION OBJECTIVES

Since the formal announcement of the four modernizations program in February 1978, the Chinese have paid increasing attention to the critical role of science and technology for advancing their country's economy and defense capabilities. The upgrading of domestic S&T capabilities continues to be one of the regime's highest priorities—even though the PRC leadership has moved away from its over-exaggerated expectations for science and technology. Chinese leaders have increasingly recognized that their modernization problems stem not merely from China's own technological backwardness, but more importantly, from a combination of factors that include the structure of incentives, the price system, attitudes towards scientific and technical personnel, and mis-direction in their previous policies regarding the import of foreign technology.[1]

Since 1981, the Chinese have not only embarked on a major readjustment of their program for economic development, but have also attempted to modify drastically their entire programs for modernizing science and technology and expanding the application of foreign technologies to the economy and defense sector. Part of this re-orientation has included a move away from large-scale basic research, introduction of the so-called "responsibility system" within the research sector, and a shift away from primary reliance on whole plant imports as the main vehicle for acquiring foreign technology. In effect, the last several years has evidenced the increasing sophistication of Chinese leaders regarding the necessary elements for sustaining their S&T modernization drive. And, as this paper suggests, this increasing sophistication has had important consequences for China's activities concerning acquisition and assimilation of foreign technology.

From the perspective of technology transfer, one of the most salient aspects of China's current science and technology modernization program is its focus (and at times, infatuation) on what Alvin Toffler has called "the third wave" of the world's industrial revolution.[2] The leadership from Premier Zhao Ziyang on-down has high-

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[1] For a general discussion of these issues in the context of other developing countries, see Martin Fransman and Kenneth King, eds., *Technological Capability in the Third World* (New York: St. Martin's Press, 1984).

[2] Shen Huasong and Wang Huaining, "The Economics of the Third Wave," *Shijie Jingji* (World Economics), September 10, 1984 translated in JPRS-CEA-84-105, December 21, 1984, pp. 41–52.

lighted in various policy statements how important it is for China to make substantial progress in the four key emerging areas of technology cited by Toffler: computers and microelectronics, information technology, materials science, and biotechnology.[3]

The Chinese see a qualitative change emerging as the basis for both technological advance and industrial growth. Several Chinese leaders have argued that unless China is able to make significant advances in the four above-noted areas, the technological gap between China and the West will grow even wider in the future. It is clear that such a development would be politically unacceptable to the present leadership—whose credibility is based, in many ways, on an ability to close the prevailing gap and establish China as a major force in global economic and S&T affairs. In fact, the emphasis on third wave technologies has sparked a lively debate among members of the science and technology community regarding whether China should move faster in attempting to catch up with advanced country technology levels or abide by its present goal to attain Western technology levels of the 1970s and 1980s by the year 2000.

The most critical alterations in China's strategy for science and technology can be broken down into several categories. First, there is the growing stress on "intensive" rather than "extensive" development within Chinese industry.[4] Although initially announced in early 1980, this new emphasis has meant that greater attention is being paid to the modernizing existing plants and facilities.[5] In terms of technology import, this has meant that primary stress is being placed on acquisition of know-how and selected equipment rather than whole plants or large quantities of equipment.[6] (See Table 1.) One immediate beneficiary has been China's textile industry, which through technical improvements is now attempting, albeit gradually, to move into higher value added segments of the international textile market.[7]

The emphasis on know-how is designed to reduce potential long-term dependency on foreign sources and promote China's goal greater technological self-reliance. In spite of the constant reminders by China's leaders concerning the permanance of the open-door, the Chinese have not backed away from their firm commitment to national self-reliance. For example, a recent Chinese analysis of the import of 13 chemical plants in the early 1970s, suggested that China (unlike Romania which was able to produce copies of seven plants) was unable to produce any copies because it failed to purchase patents for crucial parts and secure other manufacturing

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[3] The first apparent public mention of the "third wave" came in a speech by Zhao Ziyang in October 1983. *FBIS-PRC*, November 7, 1983, p. W1.

[4] Lu Dong, "Updating Equipment and Skills," *China Daily*, December 8, 1984, p. 4. For an analysis of some of the problems see Xu Fangming, "Several Problems Concerning Technical Transformation of Enterprises," *Caizheng* (Finance), July 8, 1984 translated in JPRS-CEA-85-003, January 8, 1985, pp. 39-49.

[5] According to the State Economic Commission, between 1985-87, 90 billion yuan will be spent on technical renovation, out of which 14.2 billion will be in the form of foreign exchange for foreign technology and equipment acquisition.

[6] This basically continues the trend that was started after the retrenchment of 1978-79 when a large number of whole plant purchases were either cancelled or postponed.

[7] A good example is the Nantong Number Three Textile Factory in Jiangsu, which has spent over US$40 million on technical transformation since 1979. More than 1,600 weaving machines have been modernized, which has allowed the factory to improve the overall quality of its products for export and domestic sales, *China Daily*, October 24, 1984, p. 3.

techniques from the suppliers.[8] In fact, between 1950–1980, over 90% of China's foreign exchange expenditures on technology imports went for whole plant imports rather than the licensing and acquisition of know-how.[9] (See Table 2–4.) In general, Beijing does not want to depend on outside sources for technology; nor does China want to over-concentrate its technology purchases on one or two partners. As such, the efforts to expand global S&T relations are as much a manifestation of the desire to diversify technology sources as it is a reflection of foreign policy interests and the desire to re-integrate with the world economy.

A second dimension of the recent changes involves the upgrading and proliferation of S&T and management training programs. As a complement to the re-training of factory and R&D managers that is taking place domestically, overseas training through commercial as well as bilateral programs are being expanded. In addition, management training programs in various parts of China have been arranged with the US(Dalian), Canada(Chengdu), West Germany(Shanghai), Japan(Tianjin), EEC(Beijing) and Hong Kong.[10]

This attempt to create a well-qualified manpower base should not be underestimated. The absence of a large well-trained manpower pool, especially in the area of project management, has been one of the major weaknesses in China's modernization program as well as its efforts to assimilate foreign technology. As one Chinese author has suggested, "this is an important reason why some equipment which has high efficiency and good economic results in foreign countries loses efficiency and economic results as soon as it is transferred to our hands." [11] If successful, these on-going efforts promise to help alleviate a major bottleneck in terms of improving industrial productivity, increasing R&D output, and ensuring more efficient use of imported technologies.

A third area where recent changes promise to be of long-term significance for technology transfer involves the on-going movement towards greater decentralization of decisionmaking and the granting of greater autonomy to operating units. A system of taxation and accountability has been introduced at the enterprise level as a replacement for the previous system of profit delivery.[12] In many cases, these efforts have already improved, to a greater degree than was previously true, the process of technology selection. Field research conducted by the author in summer 1985 in Shanghai suggests that an increasing number of factory managers are seeing technology as part of their competitive arsenal.

As a result, there is also likely to be an increase in Chinese demands at the local level for foreign technology. Now that enterprises and R&D institutes can bypass the notoriously cumbersome

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[8] Lin Guang, "Several Issues on Improving the Economic Results of Technology Transfer," *Jingji Lilun Yu Jingji Guanli* (Economic Theory and Business Management), October 25, 1983 translated in JPRS-CEA-84-017, March 1, 1984, pp. 1-12.

[9] Lai Wanxian et. al., "Import of Foreign Technology and Economic Effectiveness," Caijing Wenti Yanjiu (The Study of Finance and Economic Problems), July 1982 translated in JPRS 82364, December 2, 1982, pp. 57–69.

[10] "Western Training Programs: A Hit," *China Daily*, November 7, 1984.

[11] Lin Guang, "Several Issues on Improving the Economic Results of Technology Transfer."

[12] Wei Liqun, "Enterprise Reforms Require Reform of Planning," *Jingji Yanjiu* (Economic Research), September 20, 1984 translated in JPRS-CEA-84-100, December 7, 1984, pp. 46–59.

central Chinese bureaucracy when making most purchases, they may tend to be less reluctant to seek out foreign items.[13] Increased responsibility at the local level also will make these organizations more selective in their technology choices, especially since the costs of waste and inefficiency will increasingly have to be borne directly by the receiving entity.

B. CHINA'S CHANGING S&T STRUCTURE

Perhaps the most important development over the last several years in terms of the structure of the Chinese S&T system has been the establishment of special "leading groups" or task forces for managing national and provincial priority areas. At the highest level, the most significant example has been the creation of the "Special Leading Group for Science and Technology" under the State Council.[14] Discussions in Beijing in early 1984, revealed that this leading group was created specifically because of the need to put the imprimatur of the Premier's office on the effort to promote S&T modernization.[15]

The special leading group is directly under the control of Premier Zhao Ziyang, though the day to day working of the group are now the responsibility of Song Jian, the newly appointed head of the State Science and Technology Commission (SSTC). Song's role will be to promote greater cross-institutional coordination—which is a necessity given China's present organizational structure and the related bureaucratic obstacles to such cooperation and coordinated efforts. Song's task will be facilitated somewhat by the creation of other "leading groups" in specialized areas such as electronics and the greater attention being paid to S&T activities within other national-level organizations, such as the State Planning (SPC), the State Economic Commission (SEC) and the National Defense Science, Technology and Industry Commission (NDSTIC).

In the ministerial sector, a most important development as far as technology transfer activities are concerned, is the growing linkage between civilian and military units, both in terms of research and production. In the past, primarily because of the dearth of high quality S&T resources, it was common for civilian research entities, such as those within the CAS, to assist the defense sector. Now, Chinese leaders are encouraging more two-way interaction. Personnel as well as production capacity are being turned over for manufacture of civilian goods. A good example involves the Great Wall Corporation, which manages the production and sale of civilian goods for the Ministry of Space Industry. Unfortunately, this will make it increasingly difficult in terms of specifying the actual end-users of technology and equipment secured from the US and its allies, especially since we can expect to see more of this type of interaction as the barriers to compartmentalization further break down.

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[13] For a discussion of the most recent reform that stresses the separation of government administration from enterprise management see "Ministry Discusses Foreign Trade System Reform," *FBIS-PRC*, June 20, 1984, pp. K8–9.

[14] "Zhao Ziyang to Head New Scientific Work Group," *FBIS-PRC*, January 31, 1983, p. K8.

[15] In some ways, the need to create this leading group reflects that "failure" of the SSTC as well as some of the newly introduced reforms to carry forward the S&T modernization effort.

Two other developments in the S&T system also appear to have importance as far as the evolving base for technology acquisition and assimilation is concerned. First, there has been the introduction of a contract research system and the growing number of formal cooperative efforts underway between research units, design bureaus and production entities—with many cases involving cooperation across pre-existing bureaucratic boundaries.[16] Their appearance promises to bring about a dramatic improvement in the performance of bôth R&D and production organizations, especially as the research community becomes better informed about the precise needs of end-users, and as end-users discover the profit-making potential of employing new technology and products.

Second, at the provincial and municipal level, a growing number of special leading groups concerned with both science and technology affairs and the import of technology have appeared. Shanghai, for example, has organized special task forces for handling the development of micro-electronics and import of critical technology. In Hubei province, a high-level entity above the provincial S&T commission for overseeing S&T activities has been created.[17] The appearance of these organizations suggests that as the authority for making decisions in the S&T areas has devolved to lower levels, local leaders are attempting to avoid costly errors and maximize existing opportunities by increasingly relying on a selected group of experts to assist in making appropriate policy decisions.

Summarizing, we are witnessing a significant alteration in the way things have been done in China in comparison with past practices. As Chinese leaders have discovered, the acquisition of foreign technology means very little unless domestic reforms accompany the currently stepped up acquisition efforts. As the research system improves its efficiency and effectiveness, and as current training programs begin to produce larger and larger numbers of qualified individuals, the Chinese S&T modernization program and the accompanying technology acquisition effort are likely to become even more sophisticated. In other words, there is a high degree of synergy between these various activities. This has major implications, particularly regarding the assimilation of technology—suggesting that in certain critical areas China might move much farther and faster in its modernization program than previously thought.

It is clear that there are still numerous problems to overcome and that some political opposition to reform still remains. Many vested interests are threatened by these reforms. At the same time, however, the Chinese are frank about the extent of these difficulties. As such, they are not radically over-ambitious about their ability to overcome present shortcomings. This is a real strength in terms of the fact that the new policies are being implemented with

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[16] The most successful examples have occurred in Dalian, Harbin, Shanghai, and Beijing. See *China Daily*, May 2, 1983, p. 2. According to officials in Shanghai, this may be part of a process designed to reduce the distinction between so-called "ministerially controlled" and locally controlled units.

[17] "S&T Leading Group Formally Established," *Hubei Ribao* (Hubei Daily), July 17, 1984 translated in JPRS-CST-84-034, October 29, 1984, p. 2.

a proper balance of investigation and caution as well as more realistic expectations.[18]

III. The Scope of China's Foreign Technology Relations

A. Technology Transfer and Foreign Policy

China's leaders consider the issue of technology transfer to be intimately relatedly to matters of "high politics," viewing foreign controls on the export of technology to the PRC as incompatible with their country's national sovereignty. As such, in general Beijing refuses to accept foreign-imposed end-use requirements on equipment and technology transfers. At the same time, they have indicated a willingness, though somewhat reluctantly, to accept restrictions on possible third country transfers. The essence of the Chinese position is most clearly reflected in their views on nuclear energy technology. From a domestic perspective, as a nuclear power China has resisted, for the most part, attempts to impose inspection requirements on use of the technology. From an external perspective, the Chinese have reaffirmed their support for nonproliferation—even though they have allegedly conveyed nuclear technologies to Pakistan.[19] China claims to have a special relationship with that country, which may account for the fact that if such an allegation is true, it is more exception than the rule in terms of China's previous record.[20] In non-nuclear areas as well, the Chinese are officially on record to the U.S. Government that they will not transship sensitive U.S. technologies to other parties—a substantial concession on Beijing's part.[21]

As mentioned, China's general policy orientation is to diversify its foreign technology relations. The Chinese have developed S&T cooperation programs, educational exchanges, and commercial technology relations with all the major industrialized nations, with Eastern Europe, and with the Third World. Each of the bilateral cooperation and exchange programs brings China something "special" and gives it research and training opportunities not always available in other programs. The Chinese have placed great emphasis on their respective bilateral S&T programs, seeing them as a cost-effective way to secure training and assistance from the West and Japan.[22] Cooperation with East Europe, although little in-depth information is known about such programs, is designed to complement these other programs. Since 1980, Chinese leaders have placed increasing emphasis on expanding S&T (and economic) relations with countries such as Hungary, Romania, East Germany, Bulgaria, and Czechoslovakia.[23]

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[18] Four basic changes have been introduced in China's modernization strategy: (1) less attention to speed; (2) great emphasis on balanced growth; (3) more stress on the open-door; and (4) shift from extensive to intensive development. See Dong Fureng, "Strategic Changes in Our Economic Development," *Caimao Jingji* (Finance; Trade and Economics), April 20, 1982 translated in *JPRS* 81335, July 22, 1982, pp. 57–64.

[19] U.S.-China Nuclear Agreement Runs Into Roadblock in Congress," *Asian Wall Street Journal,* July 2, 1984.

[20] Pakistan has denied that China has provided support for its nuclear program. *China Daily,* June 19, 1984.

[21] "U.S. Criticized For Delay on Signed Nuke Accord," *China Daily,* June 21, 1984.

[22] "Scientific and Technological Exchanges with Foreign Countries," *Beijing Review,* March 29, 1982, pp. 21-28.

[23] "Trade Pacts with 5 East European Nations," *Beijing Review,* June 4, 1984.

A general aspect of the various bilateral programs is the growing interrelationship between bilateral government-to-government cooperation and commercial technology developments. For example, cooperation in nuclear science with France appears to have contributed, in part, to possible sales of French nuclear energy equipment.[24] Cooperation in petroleum sciences and geology with the Japanese and the French has resulted in commercial ties regarding off-shore oil development. While this is not meant to imply that bilateral cooperation is a necessary prerequisite to expansion of commercial relations, it has been a sufficient condition; engaging in the former does seem to facilitate the latter. This is especially true in the case of China's dealings with Western Europe and Japan, where the increased China business of state-owned firms in the commercial area seems to flow naturally from expanded government-to-government S&T contacts.

B. SINO-U.S. TECHNOLOGY RELATIONS

The Sino-US technology relationship continues to be the largest and most active of China's proliferating international S&T activities. Over 20 protocols for bilateral cooperation in S&T have been signed in fields ranging from high energy physics to industrial management to agricultural science. In addition, there are close to 13,000 Chinese students and scholars here in the US, a figure which does not include the growing numbers of Chinese technical personnel who come to the US for short and medium term training in the commercial sector. Over the long term, training provided by the US private sector promises to become a major channel for "technology transfer."

One of the major questions arising out of the Sino-US S&T relationship deals with the impact that the recent relaxation of export controls (November 1983) will have on China's economic and defense modernization. To a large extent, the Chinese have institutionalized their technology relations with the US, having established a network of formal and informal channels for the flow of technology to the PRC. This network includes an extensive set of relations with Americans of Chinese descent, many of whom have become unofficial advisers to the PRC government on a host of S&T-related issues. In addition, cross border flows of information between the two countries have steadily increased via such channels as the National Technical Information Service and China's participation in various American and international professional associations such as the IEEE.

Overall, trade has begun to grow and foreign equity-based investments by American firms in China have also begun to expand. In the first 11 months of 1984, "high technology" trade grew to US $2.8 billion—up from US $1.1 billion in 1983.[25] The Chinese are particularly interested in US electronics and computer technology—a reflection of the high priority attached to these fields in

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[24] Huang Yichen, "French Experience Provides Model for Nuclear Power Development," *Dongli Congcheng* (Power Engineering), December 15, 1983 translated in JPRS-CEA-84-026, April 9, 1984, pp. 87-89.
[25] *Asian Wall Street Journal Weekly*, December 31, 1984, p. 1.

China today.[26] Accordingly, it has been recorded by the US Commerce Department that almost 70% of the Chinese requests under the newly revised export control regulations fall into the categories of microelectronics, computers, scientific instrumentation, or equipment to produce these items.

The largest portion of this newly released technology will go to support China's civilian modernization program. At a minimum, the needs of Chinese industry at all levels for precision machinery, advanced testing equipment, computerized machining, and computers for financial management, production scheduling, and inventory analysis remain substantial. At the same time, however, in spite of the restrictions in the new law that limit the transfer of technologies contributing to strategic weapons programs, it is by no means certain that US authorities or companies can prevent the unauthorized use of this technology, particularly within China's high priority strategic weapons programs.

In many cases, it has been assumed that China's appetite for advanced technology would be satiated by the relaxed controls.[27] Evidence already exists, however, that such is not the case.[28] Chinese leaders continue to complain about the continued imposition of national security controls, admonishing the US that China should not fall under any sort of restrictions. They also complain about COCOM controls and the pace of the COCOM review process. There is also evidence that the Chinese are continuing to use clandestine means to secure foreign technologies, some of which might have been approved under the existing set of guidelines. The September 1984 issue of the *China Trade Report* published in Hong Kong has noted that some equipment continues to be smuggled into China through Hong Kong.[29] Various provinces and municipalities have set up technology import offices in Hong Kong as a means to facilitate the import of technology into China.[30] In effect, China looks as if it will be taking advantage of its now "special" relationship with Hong Kong, relying on it more and more as a channel for acquisition of sensitive, and at times restricted technologies.

This suggests that the Sino-American technology relationship has not weathered its final storm and that the potential for serious political controversy still exists. There is ample evidence to indicate that within a reasonable time frame, the Chinese are likely to once again press up against the high end of the technology spectrum, demanding further relaxation of present controls. In many ways, the push for advanced technology derives from China's in-

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[26] According to China's Seventh Five Year Plan, electronics and information industries will be the major target industries; they will be provided with special funding and given preferential treatment and protection when appropriate. See *FBIS-PRC*, January 15, 1985, pp. K25-26.

See also Thomas Fingar, *Modernizing China's Electronics Industry: Prospects for U.S. Business* (Stanford: Northeast Asia Forum, August 1985).

[27] "Concern Rises Over COCOM," *China Trade Report*, September 1984.

[28] For example, in July 1984, Huan Xiang indicated in an article in the *World Economic Herald* that "in transferring really important technologies, the US has not made any concessions . . ." *FBIS-PRC*, July 26, 1984, pp. K9-12.

[29] PRC firms are also being encouraged to cooperate with the Hong Kong electronics industry in order to raise existing technical and production capabilities. See Chen Jiwen, "Prospects for Cooperation Between Hong Kong Electronics Industry and China," *Gang Ao Jingji* (Hong Kong and Macao Economic Digest), #3-4, 1984, translated in JPRS-85-002, January 4, 1985, pp. 112-121.

[30] A good example is Chongqing, which has set up a permanent office in Hong Kong to facilitate trade and technology transfer. *China Daily*, May 25, 1984.

fatuation with Toffler and the so-called "third wave" technologies. From another perspective, however, it also derives from China's long-term strategic weapons priorities. Unfortunately, little is known about the extent to which this program commands resources (technical and financial) over and above general defense budget allocations.[31]

C. CHINA'S S&T RELATIONS WITH WESTERN EUROPE AND JAPAN

In order to appreciate the full extent to which technology and know-how are flowing into China, one must go beyond analysis of the US scene and focus on Western Europe and Japan as well. In recent years, because of the rise in global competition, particularly in third country markets such as China, information about emerging commercial transactions has become more scarce. Nonetheless, a substantial body of data does exist related to China's rapidly expanding technology interactions with such countries as France, West Germany, Sweden, and Italy. What emerges from a preliminary examination of this data is that China's relations with Western Europe and Japan are developing at a very rapid and sustained pace.[32]

Nonetheless, two points should be noted. First, Chinese claims that unless the US is more forthcoming with respect to its technology export policies they will buy from Western Europe, seem to be exaggerated and unsubstantiated in many cases. According to current trade data, in most cases the Chinese have not been able to gain access to sensitive technologies through Western Europe.[33] Moreover, China's statement that it prefers US technology appears to be an accurate reflection of Chinese views. This is especially true with respect to nuclear technology. In addition, the Chinese have also come up against their own limitations in West European markets in much the same way that they have faced similar problems in their dealings with the US. At times, their own inability to sort out technological priorities and excessive caution with respect to spending their foreign exchange reserves have been just as important factors in limiting their purchases.

Second, and more important, however, is the fact that the Chinese have been working with the West Europeans in some areas where the US had been slow to respond, especially in the area of general industrial manufacturing.[34] Here again, while the Chinese have preferred US products, they have met with and discussed potential business transactions with most of the major European firms,[35] especially those in the electronics and computer fields

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[31] Gerald Segal and William Tow, eds., *Chinese Defense Policy*, Urbana, University of Illinois Press, 1984.

[32] "China's Door Opens Wider Than Ever to Europe—Zhao," *China Daily*, June 6, 1984.

[33] There does exist some concern, however, regarding the fact US requests for "exceptions" within COCOM still outnumber to a considerable degree the number of Western European and Japanese requests. One explanation is that companies from these respective areas are providing products below the COCOM technology threshold. Another explanation, however, is that these companies are ignoring COCOM and shipping equipment, etc. on their own to China.

[34] "China's Trade with West Europe Rises," *China Daily*, June 5, 1984.

[35] According to a *Xinhua* report in March 1984, Shanghai has signed contracts with the FRG, Switzerland, and Sweden to import technology and equipment on 35 projects worth US $44 million. JPRS-CEA-84-028, April 18, 1984, p. 56.

(Nixdorf, Siemens, and Phillips). In addition, they have sent substantial numbers of individuals to Western Europe for advanced training in European industry.

The key point regarding China's S&T relations with Western Europe is that they are a critical part of an emerging picture that reveals a series of multi-dimensional, cross-national interactions spread out over China's own modernization priorities, with energy, electronics, and computers, transport and communications, and industrial manufacturing being the dominant areas of activity.[36] And, as with the United States, relationships exist at all levels of society and industry.[37] A key component underlying the successful expansion of these activities has been the financial element.[38] The West German government, for example, has provided monies, in the form of technical assistance grants, to facilitate projects, particularly those that have potential commercial spinoffs.

Another point regarding the Sino-West European relationship deserves mention, i.e. the attitude of the respective members of COCOM to the present level of technology controls towards China. It is clear that Western Europe, lead by the French, have a much more sanguine view of China's intentions and capabilities, and thus feel much less constrained in their own technology transfer policies towards the PRC. In general, most of the European members of COCOM share similar beliefs about the nature of the potential Chinese threat. In reality, they are much more concerned with the Soviet Union and continue, at least informally, to see China as a potential military counterweight.[39] Many West Europeans view US policies as overly restrictive. Relatedly, they perceive US use of COCOM as well as more recent American efforts to relax COCOM controls vis-a-vis the PRC as a means to further American commercial interests. Without a full cooperation and support from the majority of COCOM members, it may be self-defeating and politically costly for the US to impose continued controls or to oppose further relaxation of present controls.

While the Sino-US S&T relationship has rapidly grown during the last several years, it is still outpaced in some important respects by the Sino-Japanese relationship.[40] This remains the case in spite of the larger number of Chinese in the US than Japan *and* Fang Yi's criticism of Japan several months ago due to the relatively modest level of Sino-Japanese bilateral scientific cooperation.[41] In reality, relations involving technology transfer, especially

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[36] A good example has been the two agreements concluded between ESAB of Sweden and China for transfer of welding technology and equipment. JPRS-CEA-84-087, October 24, 1984, p. 83.

[37] A good example is the FRG-PRC cooperation in laser research, which involves the Max Planck Institute for Optics in West Germany and the Anhui Institute of Optical and Precision Machinery in China. Each side has exchanged 6–8 researchers since the project was begun in December 1980. See *FBIS-PRC*, June 30, 1983, p. G2.

[38] France, West Germany, Italy, Denmark, and Belgium have all provided China with government credits or favorable loans for a host of industrial projects.

[39] At the same time, they also are apprehensive about accepting a formal "China differential" for fear of explicitly antagonizing the USSR.

[40] Fang Zhiji, "Economic and Technical Cooperation Between China and Japan is Developing in Depth, "*Shijie Jingji Daobao*, (World Economic Herald), March 26, 1984 translated in *FBIS-PRC*, April 20, 1984, pp. D6–8. See also "Japan Takes Aim at Chinese Market," *Boston Globe*, Aug. 25, 1985, p. 84.

[41] Fang Yi chastized Japan for being too concerned with commerce and not sufficiently concerned with scientific cooperation. "Sino-Japanese Ties 'Weak on Science' Says Minister," *China*

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in the commercial area, have substantially grown since the later 1970s.[42] Japan has helped set up some of China's largest television manufacturing facilities, has assisted with the future manufacturer of heavy trucks in China, has helped develop several semiconductor and integrated circuit lines, has contributed concessionary financial assistance for the development of PRC energy, transport, and port facilities, and is responsible for the establishment of several computer software centers in China.[43]

Japan has become deeply involved in China's technical transformation of enterprises program, forgoing some of the more "sexier" projects in China after its problems with the Baoshan steel mill.[44] The Japanese have sent over 200 experts to China over the 1983–84 period to conduct diagnoses of enterprises. Japanese firms have been working with Chinese industrial leaders and factory managers to improve plant layout and scheduling, upgrade manufacturing techniques, replace obsolete machinery, and rectify quality control problems. Japan's approach, which is similar in many respects to its strategy in Southeast Asia, Taiwan, and South Korea, has been to establish a broad network of ties at a local level, tieing Chinese industry, wherever possible, into use of Japanese raw materials, components, etc.

Ironically, in spite of Japan's increasingly active participation in China's modernization program, the Chinese have numerous complaints about Japan's failure to transfer know-how to China. As in the case of Japan's other commercial activities in other parts of Asia, PRC critics speak about Japan's willingness to provide "show-how" but not key design information and core technologies. Yet, even though these criticisms have appeared, the fact remains that Japan's role in China's modernization has become increasingly significant. While technology transfers have not been flowing as rapidly as the Chinese would like, Japan has developed into a major supplier of production lines for integrated circuits, for technology in off-shore petroleum development, and for the overall development of transportation, communications, and energy in China. There has even been a steady stream of ex-Japanese Defense Agency officials and representatives from some of Japan's major defense-oriented companies visiting China since the late 1970s to discuss military developments—an aspect of Sino-Japanese relations that has received very little attention.

In essence, Japan appears to have a national strategy vis-a-vis China. It is willing to provide China certain limited technologies in return for access to China's large array of natural resources and

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Daily, May 3, 1984. See also "Fang Yi Hopes for More Cooperation with Japan," *FBIS-PRC*, April 12, 1984, p. D1.

[42] A good example of the Japanese approach is the cooperation agreement signed between the China S&T Exchange Center in Beijing and the Mitsubishi Group. Under the three year agreement, the two sides will exchange information and technical missions in such areas as chemicals, machinery, metallurgy, construction and transportation—with an aim towards eventual commercial exchange. *Japan Economic Journal*, April 17, 1984, p. 4.

[43] The visit of Hu Yaobang to Japan in November 1983 appeared to be the catalyst in stimulating the rapid expansion of Sino-Japanese economic and technical cooperation. See *FBIS-PRC*, November 23, 1983, pp. D1–8. The subsequent visit of Prime Minister Nakasone to China in March 1984 further advanced Sino-Japanese relations, especially since during the visit an additional US$2.1 billion loan pledge was announced by the Japanese delegation. New York Times, March 23, 1984.

[44] For an analysis of Japanese involvement in China's industrial modernization program see "Tipping the Balance," *China Trade Report*, February 1985.

energy supplies. Without foreign assistance, it is clear that China would not be able to exploit these resources within any time in the near future. This appears to be the "quid pro quo" upon which China's relations with Japanese are being built. This is not meant to imply that there are not other Japanese commercial interests. For example, Japan is quite interested in pushing forward on the sale of nuclear energy technologies to China.[45] Japan, however, is concerned about China's commitment to nonproliferation and appears willing to follow the US lead within reason. Presently, the Japanese are ready and anxious to move ahead, particularly in view of a series of emerging Chinese agreements with France, West Germany, and Italy respectively.

Japan's technology relations with China form another critical component of the impressive array of technology-related contacts that Beijing has developed with the industrialized world. Taken alone, Sino-Japanese S&T relations are important; they take on added significance, however, when complemented by China's technology relations with the US and Western Europe. As was true in the case of Western Europe, the Japanese are also more sanguine than the US about Chinese military objectives. Accordingly, they have also tended to be *relatively* less concerned about the military implications of most technology transfers to China. These attitudes have been clearly reflected in Japan's commercial technology relations with China. It appears likely that the Japanese will continue to take advantage of their geographic proximity to China by being more aggressive in their approach to the China market, leaving US business and government in the position of having to act in a more concerted fashion if American companies are to remain competitive.[46]

D. SINO-SOVIET TECHNOLOGY RELATIONS

China's growing technology relations with Eastern Europe have been referred to earlier in this section. A few additional comments concerning China's S&T relations with the Soviet Union, however, are in order. Since 1983 there have been exchanges of trade and scientific delegations in such fields as metallurgy, coal, automobiles, electric power, agriculture, and textiles. Trade between the two countries also has started to climb, with China importing steel, timber, chemicals, and machinery in return for Soviet purchases of canned and frozen meats, vegetable oil, tea, and silk.[47] The Soviet Union sees cooperation with China as a means to gradually bring about a normalization of political relations between the two countries. Accordingly, the Soviet Union is on record as encouraging the expansion of educational exchanges and according to some Jap-

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[45] See "MITI Stopgap Clears Way for N-Power Equipment Export to China," *Japan Economic Journal*, October 18, 1983. See also "Japan and China Forging Links in Atomic Energy Industry," *Asian Wall Street Journal Weekly*, March 26, 1984, p. 8.

[46] Chae-Jin Lee, *China and Japan: New Economic Diplomacy*, Stanford, Hoover Institution Press, 1984. This point was emphasized over and over again during interviews conducted by the author in Shanghai in July 1985.

[47] During the December 1984 visit of USSR Deputy Prime Minister Arkhipov, the former head of the Soviet assistance mission to China in the 1950s, the two countries signed a five year trade agreement worth an estimated US$20 billion. In 1984, PRC–USSR trade equalled approximately US%1.1 billion. See *Japan Economic Journal* (Nihon Keizai Shimbun), January 31, 1984, p. 1.

anese sources has even made some overtures toward Beijing about providing nuclear energy technology to the PRC.

The Chinese see several possible advantages in pursuing expanded cooperation, the most important being an opportunity to keep abreast of Soviet science and industrial developments and to gain deeper insights into the evolution of the Soviet system. Based on several conversations with Chinese scientists and industrial managers, it is clear that China does not see great substantive benefit from expanded cooperation with the Soviets, though some Chinese have remarked that they would not oppose receiving Soviet assistance in their efforts to modernize their production facilities—many of which have large quantities of Soviet equipment.[48] For the most part, however, such examples are still of minor importance. The Chinese are, to a large extent, moving away from the Soviet model of economic and research organization, making it is highly unlikely that China will turn toward the Soviet Union in the S&T area—unless Beijing perceives the West and Japan to be intransigent with respect to technology and equipment sales.

Taking these considerations into account, it appears that aside from modestly expanding commercial ties and some limited S&T cooperation projects in minor areas, Sino-Soviet S&T relations will not rapidly expand. As indicated earlier, this stands in sharp contrast to the sustained expansion of China's S&T relations with Eastern Europe.[49] The Chinese and Soviets, however, will increasingly encounter one another in international scientific forum. For example, there is indirect cooperation between the China and the Soviet Union through an on-going high-energy physics research project at CERN in Geneva. And, Soviet and Chinese scientists regularly attend international conferences in each other's country.

E. CHINA'S PARTICIPATION IN INTERNATIONAL S&T ORGANIZATIONS

Since 1978, China's participation in international and regional S&T organizations has been steadily increasing. As of the end of 1983, Beijing had membership in over 100 major S&T-related bodies. China views such participation in terms of achieving two broad goals: 1) gaining international credibility for its scientific community and greater political legitimacy through its membership in these organizations; and 2) securing direct and indirect assistance in its S&T modernization program and facilitating the cross-border flows of technical information. Increasing numbers of Chinese scientists are participating in international meetings and projects, and as a result, there has been a steady growth in the number of technical papers flowing into China from abroad. The Chinese also perceive multilateral research projects as a means to train their personnel. Accordingly, China has become involved in a multinational research project on Antarctica, is in the process of preparing to join IIASA in Vienna, and has become active in the various UN agencies related to technology and industrial development.

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[48] Interviews conducted by author in Cambridge, Massachusetts (1983-84) and in Beijing (May 1984 and January 1985).

[49] "Chen Muhua on Trade with Eastern Europe," *Beijing Review*, September 3, 1984, pp. 16-17.

IV. Key Foreign Technology Targets

China S&T priorities are clearly reflected in its foreign technology acquisition efforts. According to Lu Dong, Minister-in-Charge of the State Economic Commission, "technology imports are a short cut that can help promote the country's technological advance by leaps and bounds." The Chinese are actively pursuing a wide variety of technologies and equipment, including such fields as electronics, biotechnology, materials and special alloys, petroleum exploration and exploitation, energy conservation, and transportation and communication. This emphasis on know-how is not meant to imply that China has decided to entirely eschew purchase of whole plants. For example, some of the petrochemical plants cancelled in the 1978–79 period are now being reinstituted or new ones are being undertaken.[50] In addition, in November 1984, a delegation from Techimport acquired a French refrigerator plant from Bauknecht—a plant that had been closed down in 1982.[51] Similarly a delegation from Tianjin recently bought an entire motorcycle factory in Munich [52] and a Shanghai group acquired a feed plant from Denmark.[53]

The following section outlines some of China's main technology import targets and the efforts underway to combine indigenous capabilities with on-going acquisition efforts.

A. Electronics and Computers

Given the importance that the present leadership has attached to the modernization of computers and advanced electronics, it is not surprising to find that these priorities are strongly reflected in China's foreign technology acquisition activities.[54]

The Chinese approach to development of enhanced capabilities in computers and electronics is premised on a two-pronged strategy that combines direct support for technical advance through larger investments in R&D and plant renovation with a well targeted foreign acquisition effort.[55] This foreign acquisition effort is characterized by its multifaceted nature, with activities stretching across a large number of Chinese ministerial-level organzations.[56] A good reflection of Chinese intentions is the August 1984 agreement signed between Hewlett-Packward and the China Electronics Import Export Corporation. The agreement, which is said to be valued at US$10 million, is part of a joint venture between the two

[50] *Asian Wall Street Journal Weekly.* May 7, 1984.

[51] "Outdated French Refrigerator Plant Purchased," CEA-84-101, December 13, 1984, p. 71.

[52] "Tianjin Signs More Joint Venture Contracts," *China Daily,* December 26, 1984, p. 1.

[53] "Purchase of Feed Plant and Know-how From Denmark," CEA-85-012, February 3, 1985, p. 96.

[54] Within the Sixth Five Year Plan, 60 imported electronics projects were identified. "Plans for Electronics Imports," *Summary of* World Broadcasts-Far East, SWB/FE/W1227/A/21, March 16, 1983.

[55] Currently, there are over 2,600 enterprises in the electronics industry and 120 research/design units, emp;oyed 1.4 million workers and staff members. *FBIS-PRC,* September 11, 1984, K15-16.

[56] Of the 3000 items listed in the 6th Five Year Plan for techology acquisition abroad, 300 involve electronics. *China Daily,* October 6, 1984.

parties for the manufacture and development of assorted electronics components in China.[57]

The Chinese have targeted large-scale integrated circuit technology as their major electronics priority. According to statements by Jiang Zemin, former Minister of the Electronics Industry, advances in IC technology are necessary to support military needs and computer development. The PRC has already purchased several IC production lines from the US and Japan *and* is engaged in negotiations with several other major US, European and Japanese firms to purchase additional proven production lines for manufacture of these critical components. According to the Planning Bureau of the MEI, there are plans to import 550 types of advanced electronic equipment in the next few years, for use in telecommunications, aerial-surveillance and control, offshore oil and gas exploration, fiber optics, and very large-scale integrated circuits (VLSI).[58]

Chinese efforts, however, are not merely focused on foreign acquisitions; there are very large on-going R&D programs underway throughout China's electronics industry to upgrade domestic capabilities.[59] One good example of Chinese progress in this regard was the development of a multi-purpose pattern generator in June 1983 by a Ministry of Electronics-sponsored R&D team composed of the Jianchang Machinery Plant (Hubei), the Institute of Automation (CAS), the Semiconductor Institute (CAS), and the Changchun Institute of Precision Optics (CAS).[60] Beijing acknowledges that foreign firms, for both commercial and security reasons, may not provide China with the state-of-the-art in these areas. Thus, China's leadership recognizes that all foreign acquisition efforts must be complemented by a strong indigenous program.

This is particularly true in the field of computer development. For example, in 1982 the Jiannan Machinery Plant in Changsha imported a magnetic disk production line from France, which has the capacity to produce 500 Type A disks and 3000 Type B disks per year.[61] This purchase was part of the on-going effort to establish the country's first, full-fledged computer peripheral equipment manufacturing line, matching foreign technology with the technical capabilities of Hunan. Similar efforts are underway in Shanghai under the aegis of the municipal computer company.

China is also expanding its efforts in software development. In March 1984, computer software experts throughout China met to develop a five-year program for software R&D. In addition, the China Association for Software Industry was formed in September 1984 in order to better coordinate software development efforts and encourage interaction among software experts.[62] The Japanese have been among the most active in working with the Chinese on software development, which has been a perennial weakness in China's attempts to expand the use of computers. A high priority

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[57] "Electronics Joint Venture Signed with US Compnay," *FBIS-PRC*, August 13, 1984, p. B5. This agreement is one of 17 foreign electronics joint ventures signed by China in 1984. See *China Trade Report*, January 1985, pp. 8-9.

[58] "Switched On and Raring to Go," *China Trade Report*, January 1985, pp. 8–10.

[59] See the chapter by Detlef Rehn in this volume.

[60] "Jianchang Machinery Plant," *JPRS* 84110, August 12, 1983, p.14.

[61] "Zhao Ziyang Visits Machinery Plant in Hunan," *Xinhua*, May 13, 1984.

[62] "Software Industry Association Established," *FBIS-PRC*, September 11, 1984, p. K18–19.

in this regard has been the development of Chinese character information processing systems and software. Several Japanese firms (e.g. Fujitsu), as well as Wang Labs and IBM of the US have been working with the Chinese in this area. The importance attached to this objective is reflected in the fact that the State Council's "leading group" for electronics has made this one of its priority goals.

Even though the main aim of electronics and computer development activities appears to be for manufacturing and national defense, China is also actively engaged in an effort to establish a national information industry to support its overall modernization. According to officials at the Institute of Scientific and Technical Information (ISTIC) in Beijing, an information center is to be established in Beijing linking ten key cities: Beijing, Shanghai, Tianjin, Hangzhou, Nanjing, Guangzhou, Wuhan, Shenyang, Chongqing, and Xian.[63] The establishment of this center will facilitate diffusion of the large quantity of technical information that is flowing into China through foreign journals, magazines, and newspapers.[64] Since 1980, 16 research institutes have received data recorded on computer tapes by foreign corporations, linking China directly to technical data bases in Europe and North America.

Another area that has received increased attention involves the development of scientific instrumentation, testing equipment, and industrial control equipment. Foreign technology has played an important role in the enhancement of existing capabilities. The Beijing Instrument Industry Corporation has been one of the most active organizations in terms of acquiring foreign technology and assistance.[65] Its range of products includes optical, analytic, and electrical instruments. At a national conference on instrumentation in October 1983, Chinese specialists mapped out their plans for improving the manufacture of components for instrument production. The key items include: silicon semiconductors, compound semiconductors, galium arsenide integrated circuits, materials for optoelectric devices and lasers, materials for microwave devices (GaAs, InP, and InGaAs), materials for sensors, amorphous magnetic materials, magnetic recording and bubble devices, and magnetic fluid.[66] In each of these areas, China is seeking to closely approximate the state-of-the-art in Japan and the United States.[67]

An important aspect of China's plans to advance domestic electronics and computer capabilities has been the consideration given to creating a "silicon valley" outside of Shanghai (in Wuxi) and outside Beijing (in Haidian).[68] In fact, in January 1984, Shanghai

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[63] "Infromation Center Construction Starts," *China Daily*, September 24, 1984.

[64] "Nationwide Information Network Planned," *China Daily*, January 24, 1984.

[65] Since the beginning of 1984, the Beijing Instruments Factory spent US$12 million on 14 projects to import advanced technology and equipment, which equals 150 percent more than its total expenditures on technology imports between 1979-1983. *China Daily* November 14, 1984, p. 2.

[66] Kang Changhe, et.at., "Prospects for Instrument Materials in China by the Year 2000, "*Yiqi Cailiao* (Journal of Instrument Materials), #1, 1984 translated in JPRS-CST-84-034, October 29, 1984, pp. 22-32.

[67] Japan has become a major source of measuring instrumentation to China, providing both equipment and technology. Yamatake Honeywell, for example, has developed a technical cooperation relationship with the Guangdong Instruments and Meters Plant for production of manufacturing-related instrumentation. Yokogawa-Hokushin will be working with the Shanghai Number 9 Automatic Instruments Plant to manufacture turbulence measuring instruments. See *Nihon Keizai Shibum* (Japan Economic Journal), February 16, 1984, p. 10.

[68] "Haidian Becomes Electronics Center," *China Daily*, September 18, 1984.

announced that electronics would be its number one priority.[69] The Jiangnan Semiconductor Plant in Wuxi, for example, is slated to become China's premier IC fabrication facility as a result of technology and equipment imported from the US and abroad. A similar facility focused on industrial ICs is to be built in Shaoxing as a spinoff of the Tianguang IC Plant in Gansu Province. China's intent is to create a "technology hothouse" environment for electronics in each of these areas through a combination of technology imports and indigenous R&D. Foreign investment and co-production by multinational firms are increasingly viewed as an effective means to secure desired technologies. Relatedly, the Ministry of Electronics Industry has taken on the role as "special adviser" to the newly opened "fourteen cities" in their respective efforts to secure foreign investments and technology to support electronics development.[70]

B. BIOTECHNOLOGY

As one of the four key areas cited by Chinese leaders in their discussions of national scientific and technological priorities, biotechnology has become a major research focus of China's S&T community. In 1984, China established a national center for biotechnology development. And, in July, 1984 a special advisory commission to the national center was formed, composed of 28 Chinese and foreign experts.[71]

The main tasks of the national center are to establish biotechnology research priorities and to coordinate research efforts.[72] The Center will also have the authority to import appropriate foreign technologies. An immediate objective is to advance China's knowledge about the application of biotechnology to agriculture. The Chinese are particularly interested in nitrogen-fixing technologies. Research related to biotechnology, however, is not limited to activities covered by this national center. In Sichuan, for example, the Chengdu Technical University and the Chengdu Institute of Biology are working together on a broad range of agricultural and food related projects.[73]

Two most notable developments with respect to foreign cooperation with China in biotechnology have occurred. In December 1983, Biogen, N.V. of the Netherlands and the Shaanxi Pharmaceutical Bureau signed an agreement to test, produce, and market gamma interferon in the PRC. The Shaanxi Bureau is responsible for producing a large percentage of the drugs manufactured in China.[74] In January 1985, a joint venture contract establishing the Sino-American Biotechnology Company in Henan was signed with US and Canadian Firms. The venture will specialize in producing instruments and biochemicals for molecular biology research.[75]

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[69] "Shanghai Puts Electronics First," *China Daily*, January 5, 1984.
[70] "Commentary Hails Ministry's Advisory Function," *FBIS-PRC*, October 30, 1984, p. K18.
[71] "Group to Study Biotechnology," *China Daily*, July 4, 1984.
[72] "US Scientist Heads Biotechnology Advisory Group," *FBIS-PRC*, July 3, 1984, p. B4.
[73] Shen Longyi, "The Prospects for Biotechnical Research Are Bright," *Sichuan Ribao* (Sichaun Daily), February 7, 1984 translated in JPRS-CST-84-025, September 10, 1984, pp. 55–56.
[74] "Biogen to Make Anti-Cancer Agent in China Joint Venture," *Asian Wall Street Journal Weekly* December 12, 1983.
[75] "Biogenetics Gains Toehold in China," *China Daily*, January 19, 1985.

C. SPECIAL METALS AND MATERIALS

Since the announcement of the eight major S&T priorities at the March 1978 National Science Conference, materials development has been receiving high-level attention within China's research system.[76] Both civilian and military organizations have taken an active interest in this field. For example, a special exhibition of "new materials" was jointly sponsored by the SSTC and the NDSTIC in September 1984. The Chinese appear primarily interested in various grades of silicon, high-temperature coating materials, metal matrix composite technologies, various types of reinforced plastics and fiber glass materials, metal oxide ceramics, and optical fiber materials.

In the area of metals and special alloys, China's State Council has decided to place special emphasis on the development of low-alloy steels.[77] China has most of the composite resources to develop low-alloy steels, including abundant deposits of molybdenum, vanadium, titanium, niobium, and related rare earth metals.[78] According to Fang Yi, the former head of the SSTC, the State Council has given its approval to significantly expand imports of technology and know-how for processing these special alloys. And, at a national conference on alloy steel in Taiyuan (shanxi) in November 1984, the policy of combining technology imports with domestic capabilities was reinforced. The Ministry of Metallurgy and its subordinate bodies have taken the lead in responding to this central directive.[79]

Chinese priorities in other areas of metallurgy have not changed much since 1978. They continue to include aluminum, titanium, and high-grade steel processing equipment and technology. Three special ores were singled out in the 38 key S&T projects announced in the Sixth 5-Year plan in August 1983: Panzhihua vanadium/titanium/magnetite iron ore; Baotou niobium/rare earth/iron ore; and Jinchuan copper/nickel ore.[80] Through S&T cooperation programs with the West Germans, Australia, and Japan, the Chinese have been exploring better ways to harness these resources for use in industry and national defense.

D. NUCLEAR TECHNOLOGY [81]

According to Jiang Shengjie, President of the Chinese Nuclear Society and Chairman of the Science & Technology Committee of the Ministry of Nuclear Industry, China plans to actively import advanced technology and equipment to speed up development of its nuclear power industry while gradually acquiring the ability to design and build nuclear power stations itself.[82] Faced with a seri-

[76] "New Materials Study Encouraged," *China Daily*, September 15, 1984.

[77] "Yao Yilin Addresses Conference on Metallurgy," *FBIS-PRC*, October 16, 1984, p. K5. See also "Reform in Metallurgical Industry Urged," *FBIS-PRC*, October 16, 1984, K.5–6.

[78] Li Dongye, "Low-Alloy, Alloy-Steel Production Progress Stressed," *Gangtie* (Iron and Steel), June 1983 translated in *JPRS* 84852, December 1, 1983, pp. 34–54.

[79] "Fang Yi Addresses Conference on Alloy Steel," *FBIS-PRC*, November 23, 1984, pp. K1–3.

[80] Zeng Shufan, "China's Three Major Paragenetic Ores," *Kexue Shi an* (Scientific Experiment), #5, 1984 translated in JPRS–CEA–84–076, September 18, 1984, pp. 70–79.

[81] See the chapter by R.P. Suttmeier on China's nuclear industry in this volume. See also Office of Technology Assessment, *Energy Technology Transfer to China: A Technical Memorandum*, Washington, DC, 1985.

[82] "Jiang Shengjie Views Nuclear Power Industry," *China Daily*, October 18, 1984.

ous national energy problem, Chinese leaders have turned to the potential of nuclear power to alleviate their country's long-term energy shortages.[83] Chinese uranium reserves are said to be sufficient enough to keep PWR reactors with a total capacity to 15,000 mw running for 30 years.[84]

Chinese plans call for initial construction of two nuclear power plants, one at Qinshan (300 mw) in Zhejiang province and another in Guangdong (1,800 mw) in the south. Additional plants may be built in Liaoning in the north and other sections of east China. The Chinese are negotiating with the French (Framatome) and United Kingdom (GEC) for the equipment for the reactor in Guangdong. Discussions have also taken place with Japan, the United States, West Germany and Italy. MITI is apparently pushing hard on the Japanese side, with Mitsubishi Heavy Industries in the lead for sale of a large pressure containment vessel. Hitachi and Toshiba are also involved in similar negotiations regarding the supply of primary coolant system pumps. Japan's decision to adopt a more aggressive approach appears to have resulted from concerns about French and West German competition.

A related issue that has recently received widespread attention deals with a potential agreement between China and West Germany for storage of nuclear waste materials in the Gobi Desert. According to the *China Trade Report* published in Hong Kong, the Chinese and a private German firm are in the process of negotiating an agreement for regular disposal of irradiated materials. Japanese officials have indicated that Japan would also be interested in a similar type of agreement. Even though China could benefit from the foreign exchange earnings that such a transaction would produce, its main incentive might be access to Geman technology—which will likely be the "quid pro quo" in any PRC agreement involving nuclear technologies and related matters.

E. PETROLEUM

While China has increased its interest in nuclear energy, it has not diminished its commitment to develop both on-shore and off-shore petroleum resources. In 1983, China produced 106.07 million tons of crude oil, ranking seventh in the world.[85] There are 16 oil and natural gas producing centers in the country, the most prominent being Daqing, Shengli, Huabei, and the newly exploited off-shore areas in the South China Sea and the Bohai Gulf region. Daqing, remains the country's largest oil producer, accounting for about 50% of China's total annual production.[86]

A major feature of China's petroleum development efforts has been its willingness to allow extensive foreign involvement in off-shore activities. Since 1980, 31 oil firms from nine/ten countries have participated in various facets of exploration and exploitation

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[83] Jiang Shengjie, "Developing China's Nuclear Power Industry," *Beijing Review*, June 18, 1984, pp. 17-20.

[84] "*Beijing Review*, June 18, 1984, pp. 17-20.

[85] "PRC Ranks 7th in World Petroleum Production," *FBIS-PRC*, August 7, 1984, p. K20.

[86] Once the profitability of the off-shore petroleum areas is established, it is likely that the Chinese will be seeking foreign assistance and technology for development of the Qaidam and Tarim basins in western China. This will involve a whole new approach as far as the technological and operational requirements of such a project are concerned.

activities. Actual drilling has been started by only a handful: Japan National Oil and Elf Aquitaine in the North; British Petroleum, Exxon and Royal Dutch Shell, and Occidental Petroleum in the Yellow Sea, and TOTAL and Atlantic Richfield in the South China Sea.[87] In most cases, these firms have encountered only limited success.[88]

China has structured its agreements with the majority of these firms to maximize opportunities for technology transfer and training. It is China's intention eventually to gain both managerial and administrative control over each of these operations. Accordingly, the Chinese have pushed hard during negotiations for access to both exploration, exploitation, and maintenance know-how. In one case, the Japan China Oil Development Corporation (JCOD) was able to sign an agreement with Shell of Japan to acquire the crude oil development know-how of its parent, Royal Dutch Shell, for use in JCOD's Bohai Gulf project.[89] The Chinese are also actively pursuing technologies for the large-scale design and manufacture of a semisubmersible vehicle. The Institute of Automation in Shenyang has been an active player in this effort. In June 1984, China announced that it had built its first domestically-designed vehicle; construction was completed at the Shanghai Shipyard and involved cooperation between the China Shipbuilding Corporation, the National Machinery Import Export Corporation, and the State Oceanography Bureau.[90] Relatively, the Chinese are also seeking co-production, joint ventures and other arrangements to acquire expertise for a) manufacture of drilling rigs, special drill bits, and special chemicals, b) for underwater drilling and extraction operations, and c) for management of operations. China has established the Shekou zone in the south as a special base for off-shore petroleum operations. Along with Shenzhen and Guangdong, it appears that south China will become a major entry point for energy-related technology and equipment flows into the PRC.

V. Primary Foreign Acquisition Mechanisms

A. KEY ORGANIZATIONS

The last several years has witnessed a proliferation of organizations in China concerned with the acquisition of foreign technology. The general decentralization of the foreign trade structure, in spite of some periodic tightening up, has further contributed to the emergence of additional Chinese orgainzations doing business overseas. Each of the production ministries as well as many of the local and provincial governments have its own "import-export" arm. In addition, various provinces and municipalities have also set up specialized bodies to attract foreign technology. A good example is the Shenzhen Scientific Equipment Export Service Company, whose

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[87] "The X Factor: Is Chinese Oil Worth China's Price," *Business Week*, March 19, 1984, p. 94-98.

[88] "The Search for Oil Off China Alters the Land and the People," *Asian Wall Street Journal Weekly*, February 11, 1984, p. 1.

[89] "JCOD to Induct Shell's Technology for Bohai," *Japan Economic Journal*, November 1, 1983.

[90] "China Launches First Domestically Built Semisubmersible," JPRS-CEA-84-070, August 24, 1984, p. 133.

purpose is to provide China with information and materials on the most advanced international science and technology of the 1980s.[91] The opening up of the country to increased foreign investement has made these local-level bodies even more important as vehicles for the acquisition of key items.[92]

Chinese economic and technical delegations have become regular visitors to leading US universities, major corporations, and government laboratories and offices. Sister city and state relationships also have grown rapidly. Massachusetts, for example, now has a special relationship with Guangdong province, the focus of which is "high technology." The Chinese have also begun to increase their business activities in the US and several other countries. A large number of PRC-funded or sponsored trading companies have emerged as active procurement organizations. These companies contract with Chinese enterprises to act as purchasing agents for designated equipment and technology. In other cases, China has actually made equity investments in a personal computer company (Santec) in New Hampshire, a meat packing plant in Iowa, and a computerized tool company (Autonumerics) in New York.

The Chinese see these investments as a means to acquire technology and management skills. In particular, they provide effective training sites for PRC nationals. And, they complement PRC activities in Hong Kong, which are also designed to increase access to technology and expand training sites. In this regard, a November 1984 report in the *China Daily* indicated that the HK-based Everbright Corporation, which has already helped China import technology and equipment worth US$300 million for 15 ministries and 13 provinces, has agreed to assist with further acquisition of technology and purchases of second-hand equipment.

B. LEVEL OF PERFORMANCE

Chinese organizations have been extremely successful in rapidly increasing the flow of foreign technology into China. In 1984, for example, transactions for 1,620 "technologies" were completed worth US$1.56 billion—2.5 times the quantity and value in 1983.[93] Through a combination of shrewd negotiating techniques, their growing proficiency and improved understanding of the global market for technology, China has taken great advantage of its open door policy to attract technology transfers.[94] And, in spite of continued complaints about remaining export restrictions and COCOM, it is clear from China's own declarations that the emphasis on securing "know-how" rather than whole plants has yielded positive results from an acquisition standpoint. The Chinese see foreign technology as having six primary benefits: (1) contribute to greater national technological self-reliance; (2) help accelerate technical transformation of enterprises; (3) assist in the expansion of

[91] "S&T Center Opens In Shenzhen," JPRS-CEA-84-107, December 26, 1984, p. 87.

[92] According to Zhu Rongji, deputy minister-in-charge of the State Economic Commission, the flexibility that will come from decentralizing technology import activitives will greatly outweigh in value the potential costs in terms of possible duplication and waste. *FBIS-PRC*, October 16, 1984, K11-12.

[93] "Import of Technology Increases in Last Two Years," FBIS-PRC, February 14, 1985, p. K19.

[94] Samuel Ho and Ralph Huenemann, *China's Open Door Policy: The Quest for Foreign Technology and Capital*, Vancouver, University of British Columbia Press, 1984.

exports; (4) shorten the time, cost, and risk of domestic research programs; (5) provide opportunities for gaining project management experience; and (6) serve as a context for training technical workers.[95]

One of the keys to the current level of success is the closer linkage between the acquisition mechanisms and the end-users of technology. This is particularly true in Shanghai and Tianjin, which have been given expanded decisionmaking power in importing foreign technology for revamping Chinese industrial plants and equipment. In addition, as noted, more of China's enterprises are directly contacting Chinese trading companies abroad, indicating their needs and appropriate specifications. Another factor is the growing presence of more technically competent individuals among the members of Chinese buying and negotiating teams. A third factor is China's improved management of technology transfer. In May 1985 a national regulatory regime was set up to control the use of restrictive business practices by foreign firms willing to make their technology available to the PRC. While the regulations leave some issues unresolved, they do reflect China's maturation as a purchaser of foreign technology.

The Chinese are also on record as indicating that Western firms providing expanded amounts of technology will be given preferential treatment in the development of commercial relations.[96] According to one Chinese official, "while some countries may export equipment a little more cheaply to China and withhold advanced technological know-how, others may meanwhile sell equipment at a somewhat higher price but include advanced technology also. To be frank, we would prefer the latter [though] of course cheaper equipment plus transfer of technology would be more welcome." Zhang Jingfu, former head of the State Economic Commission, stated in May 1984 that such firms would be provided increased access to the Chinese market, particularly if the technology was not already available in China.[97] Zhang was particularly interested in electronics technology. In April 1985, China implemented its first patent law as an incentive to attract foreign technology.

According to official Chinese statements, China plans to spend over US$1 billion on foreign technology over the next several years. The Sixth Five Year Plan contains a list of 3,000 key items targeted for foreign acquisition. This list contains the following categories of items: light industry, textiles, food processing, packaging, machinery and electronics, chemicals, medicine, construction technology, iron and steel, nonferrous metals, timber processing, coal, petroleum, electric power, energy conservation, transportation, and agriculture and forestry. According to a November 1984 report in the *China Daily,* many of the priority items have already been purchased or are under negotiation with foreign companies in Japan, the US, and Western Europe. Under the machinery and electronics category, the first batch of equipment and technologies has included: high-voltage appliances, hermetic sealing devices, hydraulic

[95] Chen Lianzhen, "A Breakthrough Is Necessary in Importing Advanced Technology," *Fujian Ribao* (Fujian Daily), January 23, 1983 translated in JPRS 83440, May 10, 1983, pp. 76–79.
[96] "PRC to Reward Countries That Transfer Technology," *FBIS-PRC,* September 13, 1983, p. A5.
[97] Zhang Jingfu on Technology Cooperation with U.S.," *FBIS-PRC,* September 18, 1984, p. B1.

press devices, bearing technology, electronic instrumentation, low voltage electrical appliances, and electrical equipment for machine tools.[98] A similar list of technology acquisition priorities will be issued within the soon-to-be-implemented 7th Five Year Plan.

One factor that has facilitated Chinese acquisition efforts has been the growing availability of foreign exchange funds. At present, China has approximately a US$7-9 billion foreign exchange reserve—which is partially being used to support the import of technology. Moreover, various factories, through the processing of imported raw materials or increased domestic sales of consumer products, are using their profits for acquisition of new equipment and know-how. China also has increased its foreign exchange earnings through growing exports of conventional arms. It is clear, however, that the Chinese still remain cautious in their spending practices. Nonetheless, in the short term, financial constraints are no longer a major impediment to foreign acquisitions, especially if a project is supported by the central government.

C. IMPACT OF IMPORTED TECHNOLOGY

While this paper has been primarily concerned with the question of technology acquisition, it is clear that the issues of acquisition and assimilation cannot be easily separated. As argued earlier, improved S&T capabilities have led to greater selectivity as far as recent acquisition efforts are concerned and visa versa. And as the capabilities of the end-user have become better matched with the available technology, China's ability to absorb imported items has steadily improved over the last several years. The primary factor contributing to this improvement has been the new economic and S&T reforms introduced into the industrial and R&D sectors since 1984. These reforms have forced factory and research managers to pay attention to the more effective use and expanded application of imported technologies and equipment. Without such reforms to complement stepped up technology imports, it is likely that the present level of progress would have been unattainable.

While acknowledging the appreciable progress that has been made, it goes without saying that some absorption problems remain. Studies of previous cases such as the Spey engine project and the Wuhan steel mill, to name a few, indicate that many of these problems have a long history. Yet, we should also be careful about under-estimating the difficulty that any society, advanced or less-developed, would have in handling some of these complex technical efforts. The manufacture of aero-engines, for example, is a difficult task even here in the US. In addition, as China concentrates its efforts on the acquisition of know-how, it is hard, at least in the short term, to determine whether or not "assimilation" has, in fact, been successfully achieved.

Still, one must distinguish between case-specific problems and those that derive from more generic causes. At a symposium held on technology import in Guangdong in August 1984, three continuing problems concerning technology import activities were cited: 1)

[98] Apparently, the specific items to be acquired from abroad are noted in a document entitled "Trial Regulations Concerning the Transformation of Technology in the Machinery Industry," issued by the State Council at the time the Sixth Five Year Plan was announced.

lack of an overall plan, resulting in excessive duplication; 2) excessive emphasis on hardware while neglecting imports of "software;" and 3) poor preparation, leading to inadequate results and unfulfilled expectations.[99] These same problems had been identified in March 1984 in a State Economic Commission circular that admonished organizations to do a better job of coordinating their activities and sharing information.[100] As in the past, computer imports have once again been singled out as representative of these larger problems. For example, there is a tendency to buy machines based on their advanced state rather than based on actual needs and purchases are often made without considering software availability. In certain cases, organizations could share computers, but instead individually make purchases of machines that are consistently underutilized.[101]

These examples of shortcomings in planning and approach are compounded by a series of other limitations that fall into three categories: financial, managerial, and technical and equipment related. First, even though foreign exchange may be available for technology imports, in many cases domestic investment capital is still lacking. Thus, local firms do not have the funding to provide the auxillary inputs on the domestic end to support the introduction of foreign technology. This is especially true regarding investment in infrastructure to support new projects.[102] Second, a dearth of qualified managers at all levels continues to plague Chinese industry. While efforts to rectify the situation through testing and additional training are underway, it will take a long time before there exists a cadre of qualified managers to handle the complex task of putting foreign technology and equipment to work within Chinese industry.

And third, because of the financial constraints noted above, as well as China's own technical backwardness, much of the machinery, testing equipment and special instrumentation needed to efficiently employ imported technologies is still absent. In essence, there is a lack of uniformity in the system and a great unevenness in the quality of enterprises. Even in such advanced industrial areas as Shanghai, plant and equipment are old, and the machinery tends to be from a variety of sources and of widely varying vintages.[103] This is especially true in light industry, where investment has been severely lacking. The key exceptions appear to be in the electronics and computer industry, where it is clear that large quantities of technical, financial, and personnel resources are being

[99] "Technology Import Symposium Held in Guangdong," *FBIS-PRC*, August 2, 1984, p. P2.

[100] "Circular Urges Improved Technology Import Work," *FBIS-PRC*, March 28, 1984, pp. K10-11.

[101] Wu Weixiong, "On the Information and New Technological Revolution," Shuliang Jingji Jishu Jingji Yanjiu (Quantitative and Technical Economics), August 5, 1984 translated in JPRS-CEA-84-105, December 12, 1984, pp. 34-40.

[102] For a sense of shortfalls in the transportation sector and the strategy for overcoming them see Xiao Haitao and Tian Dashan, "Transportation Development Strategy and Aviation," *Ziran Bianzhengfa Tongxun* (Dialectics of Nature), October 10, 1984 translated in JPRS-CEA-85-005, January 18, 1985, pp. 100-113.

[103] In some cases, there continues to be a certain degree of randomness in the approach used by China to buy foreign technology and equipment. In the author's view, many of China's problems concerning the mix of equipment in the industrial sector can be traced to the "success" of the export controls that had been previously applied against China in the 1950s, 1960s and 1970s. This could work against the development and application of a viable code of standards as well as improved systems integration.

made available to enhance China's capabilities. A good example is the microelectronics R&D and production center being set up in the Caohejing district of Shanghai. In fact, because of the priority attached to this area, electronics is supposed to attain the 1970s and 1980s levels of the West by 1990—which is 10 years sooner than China's other industries.[104]

What is suggested by this combination of recent progress and continued problems that it is likely that we will witness the emergence of a limited number of so-called "pockets of excellence" in the Chinese economy over the next several years—created through a combination of foreign technology and indigenous efforts. From an overall national perspective, it appears that the most likely candidates will be those that are now being given a substantial dose of support and nurturing by the central government. In this regard, electronics and textiles seem to stand out. Of course, certain specific enterprises will develop at a rapid and sustained pace due to managerial competence and a variety of firm-specific or location-specific advantages. This does not undermine the above hypothesis, but merely confirms that, in contrast to the situation in the pre-1978 period, substantial opportunities now exist for enterprises that are capable of overcoming organizational and managerial inefficiencies.

VI. Foreign Technology and Defense Modernization

Defense modernization remains a critical Chinese priority. One merely has to examine the high level attention being given to the increased role of R&D and education in the military to recognize the continued importance that China's leaders attach to the defense sector.[105] A good example was the attention given to the Institute of Computer Research under the University of Defense Science and Technology for its development of the "Galaxie" computer, a machine that resembles the US-built CRAY-1 and apparently can perform more than 100 million operations per second. The institute, which was cited by the Central Military Commission of China, was commended for, among other things, its effective use of foreign technology.[106]

An article in China's *Economic Daily* in May 1983 best captures the prevailing attitude of the top leadership toward military modernization and its relationship to the civilian economy:

> If the defense industry is separated from the development possibilities of the national economy in a quest for instant success, we will only end up with results contrary to our expectations, or it will be a case of more haste, less speed. On the other hand, too little investment in the defense industry will hinder the progress of the modernization of our weapons and equipment. This will not only hamper the improvement of the fighting power of the PLA units, but also concerns the safety of the state. . . . It is entirely necessary to develop military industries. We must have factories devoted to the production of products for military use. But military indus-

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[104] According to Li Deguang, general Manager of China Electronics Import and Export Corporation, if [China's] industrial and agricultural output is to quadruple by the year 2000, then electronics industrial output has to be raised eight times. *China Daily*, October 6, 1984.

[105] See Zhang Aiping, "Speeding Up Reforms of the Economic Structure of the Defense Industry," *Jingji Ribao* (Economic Daily), November 5, 1984 translated in *FBIS-PRC*, November 13, 1984, pp. K12-14.

[106] "Central Military Commission Honors Research Institute," *FBIS-PRC*, June 27, 1984, p. K8.

tries cannot be developed in isolation and must be built on the basis of powerful civilian industries. This is an important guiding idea we must observe. (Jingji Ribao, May 7, 1983, p. 3)

Looked at from this perspective, it is clear that there is gradually emerging a close working relationship between the civilian and military sectors. Chinese leaders view the defense sector and projects such as the NASA-led space program as the driving force behind American industrial and technological advance. Thus, the newly emerging civilian-defense relationship in China may lead to the creation of a "military-industrial" complex structure that more closely approximates the situation in the US than the highly compartmentalized structure of defense industry in the Soviet Union.[107] One of the major beneficiaries of this close relationship has been the PRC navy, which has good working relations with various components of the Chinese shipbuilding industry.[108]

Chinese expressions of interest in a variety of weapons systems and technology have been well publicized over the last several years. They have indicated possible purchases of items ranging from the TOW missile to the French Mirage fighter. China's main priority continues to be acquisition of know-how rather than purchase of large quantities of foreign-made equipment.[109] Discussions have not been limited to the US, Western Europe or Japan. Recent information indicates that the Chinese have obtained technology and design know-how from the Brazilians (for armoured personnel carriers) and possibly the Israelis (tank armour and weaponry).[110] According to a report in the December 1984 issue of *Janes Weapons,* the Chinese have allegedly signed a broad agreement with Israel for additional defense-related technical assistance.[111] In addition, there are reports that China has obtained defense technologies and weapons through Pakistan and several other Third World countries.

The big push for foreign technology appears, in large part, to be coming from China's National Defense Science, Technology and Industries Commission. The role of the NDSTIC seems to have expanded with the appointment of Zhang Aiping, its former director, to head the Ministry of National Defense. Although a strong believer in greater national self-reliance, Zhang has encouraged the defense industry to rely on foreign technology wherever appropriate. The defense industry and R&D structure have three advantages over the civilian sector: (1) better qualified personnel; (2) more advanced equipment; and (3) a larger budget.[112] Generally speaking,

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[107] A good example is the experience of Tianjin, which has been selected by the central government as a site for specifically developing close coordination and cooperation. See "Tianjin and Defense Industry Cooperate in Development," *FBIS-PRC,* August 10, 1984, p. R1.

[108] See "Shipbuilding Industry Contributes to Defense," *Zhongguo Xinwen She* (China News Agency), July 25, 1984 translated in *FBIS-PRC,* July 26, 1984, p.K5. See also "Navy's Development Over 35 Years Chronicled," *FBIS-PRC,* September 26, 1984, pp. K12–13.

[109] Even the Chinese navy has paid close attention to the "new technological revolution." See Liu Huaqing, "The Ocean, the Navy, and the New Technological Revolution," *FBIS-PRC,* September 21, 1984, pp. K14–17.

[110] This information is based on the observations of several foreign journalists who viewed the military equipment displayed at the October 1st celebration in Beijing in 1984.

[111] "Israel Beats UK to PRC Weapons Deal," The Sunday Times (London), October 14, 1984, p. 23.

[112] Ye Zitong, "On the Shifting of Science and Technology from Military to Civilian Use," *Jingji Yanjiu* (Economic Research), November 20, 1982, pp. 44–47.

the presence of these capabilities and assets makes it likely that the defense sector can make more effective use of imported technologies than its civilian counterparts.[113] This will become even more true as current programs to expand technical training and education for the military yield anticipated results.[114]

Strategic weapons development has been designated as China's number one defense priority.[115] Work in this area has been complemented and supported by China's efforts to establish a series of satellite-based communication and broadcasting systems. China has put 15 earth satellites into space over the last 15 years, the most recent being a 900 kg. satellite sent up in April 1984.[116] The launching vehicle was a three stage carrier rocket, designed and manufactured within China.[117] The launch was supported by recent advances in radar technology by the Nanjing Technical Research Institute of Electronics.[118] These achievements suggest that China's defense forces are well on their way toward acquiring "the eyes and ears" needed for a radically improved intelligence collection system. Developments towards this goal have also been complemented by recent advances in remote sensing capabilities, with a large portion of the technology coming from Canada, the U.S., West Germany, and Japan.[119]

For the most part, it appears likely that the military will be a beneficiary of the technologies flowing into the civilian sector.[120] It will become increasingly difficult to discern final technology end-users, particularly as the channels for internal diffusion of technology become more lubricated. Most defense-related foreign acquisitions will be designed to enhance indigenous capabilities and to avoid dependence on any specific foreign supplier. It can be expected that the military will continue to push hard for acquisition of advanced technologies in areas such as microelectronics and materials to support on-going domestic R&D programs. Many of these same technologies also have relevance for China's conventional force modernization, where there is a major need for improving

[113] This is one of the main reasons why the defense sector has been tasked with assisting civilian organizations overcome their production and technology-related problems. In Shanghai, for example, over the next three years the military will provide scientific and technical assistance for 97 special projects, with special focus on four areas: robots, infrared technology, solar cells, and optical fibers. See "Shanghai Military Transfers Work to Civilians," *FBIS-PRC*, November 19, 1984, p. 07.

[114] See Yu Qiuli's comments on the importance of training, "PLA Air Force Development Over Past 35 Years," *FBIS-PRC*, October 3, 1984, pp. K12-15. See also Yang Shangkun, "Building Chinese-Style Modernized Armed Forces," *Red Flag*, August 1, 1984 translated in JPRS-CRF-84-018, (October 3, 1984, pp. 1-13.

[115] Zhang Aiping, "Several Questions Concerning Modernization of National Defense," *Red Flag*, March 1, 1983 translated in *JPRS* 83318, April 22, 1983, pp. 33-39.

[116] "Nation Said to Rank High with 15 Satellites," JPRS-CST-84-030, October 10, 1984, p. 27.

[117] For an overall analysis of China's capabilities in this area see Tong B. Tang, "The Chinese Aviation and Space Industries: An Overview," *Xiandai Junshi* (Conmilit), December 1, 1983, pp. 4-11.

[118] "Nanjing Institute Commended for Radar Devices," FBIS-PRC, September 11, 1984, pp. 02-3.

[119] "Remote Sensing Center Set Up," *China Daily*, January 25, 1983. See also "Applications of Remote Sensing Technology in China," *Dianzi Shijie* (Electronics World), #5, 1983 translated in JPRS-CST-84-026, September 18, 1984, pp. 1-6.

[120] Through this type of cooperation, the military not only can gain additional revenue by putting idle capacity to work, but can also further sharpen production capabilities, perfect more flexible manufacturing techniques, and gain valuable engineering and technical experience. For a description of the variety of tasks performed by the military see "Defense Sector Fulfills Civilian Goods Plan," *FBIS-PRC*, November 20, 1984, p. K17.

command, control, communication, and intelligence collection devices.

VII. Implications for Overall U.S. Policy

From a policy perspective, the most important conclusion is that acquisition of foreign technology will continue to be a major Chinese priority. As such, it appears that the technology issue has not ebbed as far as Sino-US relations are concerned. China's penchant for wanting larger quantities of more advanced technology will continue to be an important factor in the political relationship between the two countries. This is true in spite of the fact that China's fear of falling behind may lead it to seek technologies that are inappropriate from the perspective of its existing economic base and technical capabilities. It is likely that China will try and play off the US, Western Europe and Japan—and perhaps even the Soviet Union—against one another in its efforts to gain greater access to technology and equipment and to obtain a "better deal" once specific negotiations are underway.

China remains committed to the principle of achieving greater technological self-reliance. As such, any effort to understand the role and contribution of foreign technology must be made within the context of assessing on-going indigenous programs designed to enhance domestic capabilities. The Chinese will continue to rely heavily on foreign technology to support current priority programs, especially in electronics and computers. Nonetheless, they will not retreat in their commitment to enhance their own R&D and manufacturing productivity with the eventual objective of reducing over the long term, as much as possible, the need to rely on external sources for technology. The Chinese clearly feel uneasy about the necessity of having seek technology from abroad, as it represents the main form of leverage that other countries have over Beijing.

The priority given to strategic weapons programs is not likely to diminish in the near future. And, as the modernization of economy gets well underway, it is likely that the military will push for a greater share of the resources. Presently, military R&D programs apparently have not suffered, even as budgetary-limitations have forced inefficient and obsolete production lines to be closed down. As a result, it is likely that a portion of the technology flowing into China will be drawn, albeit gradually, into the military sector. In this regard, it will become even more difficult to track and evaluate end-user applications of advanced technologies. US policymakers will have to determine whether these increased risks are offset by the value of the Sino-US political relationship.

Given China's top priority of promoting a more sustained pattern of economic growth, it will continue to seek a range of vehicles for acquisition of technology and assistance. Foreign investment promises to become increasingly important—though corporate concerns about competition rather than government controls are likely to be the major inhibitor to transfer of advanced technology. In all likelihood, China will maintain its focus on the following key technologies: electronics, computers, special materials, nuclear energy, petroleum, energy conservation, biotechnology, special alloys, aeroengine technology; avioncs, comunications, and transportation. The

Chinese will still follow their policy of diversification, choosing to not overly rely on the US or any other country for meeting their technology import requirements. Informal links with foreign universities and members of the Chinese American scientific community will become increasingly critical to China as will PRC links with commercial contacts in Hong Kong.

APPENDIX

TABLE 1.—CHINA'S MACHINERY IMPORTS, 1978–82

[In millions of U.S. dollars]

Type of machinery	1978	1979	1980	1981	1982	1983
Power generating (711)[1]	141.6	156.0	264.5	238.1	355.2	340.9
Electricity trans (723)	16.6	9.5	44.1	77.7	022.5	25.6
Agricultural (712)	56.0	53.9	59.4	27.4	034.8	36.0
Metalworking (715)	116.3	173.8	201.6	208.6	104.2	122.9
Textiles (717)	14.7	113.3	280.0	246.5	173.5	180.5
Office machines (714)[2]	22.1	46.7	122.1	125.5	149.7	298.1
Specialized machinery (718)[3]	231.5	590.2	496.3	276.4	234.1	144.8
Electric power (722)	52.1	57.2	279.7	314.2	133.1	....
Transport (73)[4]	934.1	1,303.8	1,488.6	703.5	1,055.0	1,275.1
Ball and roller bearing (7197)	23.7	16.2	7.7	8.9	10.9	12.5
Telecommunications (724)	31.0	195.9	366.8	530.9	285.0	378.7
Precision instruments (861)	72.6	151.2	161.1	169.5	169.9	260.0
Total (71/72/73)	2,047.8	3,032.0	5,350.2	4,597.7	3,277.5	4,286.9

[1] Includes aeroengines.
[2] Includes computers.
[3] Includes papermaking, food processing, construction and mining equipment.
[4] Includes railway, motor vehicle, aircraft and ship equipment.

Source: Central Intelligence Agency, China International Trade, Assorted Issues, 1978–84, Washington, DC.

TABLE 2.—CHINA'S IMPORTS OF FOREIGN TECHNOLOGY, 1973–82

[Number of Cases]

Mechanism	1973–82	1973–78 (a)	1978–82 (b)	Ratio b/a
Whole plants	281	172	109	0.63
Licensing	157	18	139	7.72
Tech consultation	15	3	12	4.00
Technical service	37	5	32	6.40
Coproduction	31	....	31	....
Other	89	27	62	2.30
Total	610	225	385	1.71

Source: Ministry of Foreign Economic Relations and Trade, Beijing, January 1984.

TABLE 3.—CHINA'S TECHNOLOGY IMPORTS BY INDUSTRY, 1973–82

[Number of cases]

Industry	1973–82	1973–78 (a)	1978–82 (b)	Ratio b/a
Energy	106	69	37	0.54
Metallurgy	75	21	54	2.57
Chemical engineering	78	52	26	.50
Machine building and electronics	227	35	192	5.49
Light industry/textiles	62	35	27	0.77

TABLE 3.—CHINA'S TECHNOLOGY IMPORTS BY INDUSTRY, 1973-82—Continued

[Number of cases]

Industry	1973-82	1973-78 (a)	1978-82 (b)	Ratio b/a
Others	62	13	49	3.77

Source: Ministry of Foreign Economic Relations and Trade, January, 1984.

TABLE 4.—SOURCES OF CHINA'S TECHNOLOGY IMPORTS, 1983-82

[Unit: percent]

Source	Share of total value			Share of total number		
	1973-82	1973-78	1978-82	1973-82	1973-78	1978-82
Japan	49.7	53.4	45.0	33.3	34.2	32.7
Federal Republic of Germany	22.0	23.8	19.9	22.0	25.3	20.0
United States	6.9	5.2	9.0	14.9	8.0	19.0
United Kingdom	3.7	5.3	1.9	10.3	16.0	7.0
France	7.0	7.6	6.2	4.7	4.5	4.9
Western Europe*	8.2	4.0	13.2	11.5	11.6	11.5
Eastern Europe	2.4	.6	4.7	.8	.4	1.0
Other	.1		.1	2.5		3.9
Total	100.0	100.0	100.0	100.0	100.0	100.0
Top 5	89.3	95.4	82.0	85.2	88.0	83.6

Source: Ministry of Foreign Economic Relations and Trade, Beijing, January 1984.

TECHNOLOGY TRANSFER IN CHINA: POLICIES, PRACTICE AND LAW *

By Stanley B. Lubman **

CONTENTS

Summary

The legal and practical aspects of technology transfer are of increasing importance as China's international economic relations expand. Chinese legislation on aspects of such transfers are beginning to appear and this paper discusses relevant regulations particularly the Technology Import Contract Regulations of May 1985. Practical issues include Chinese interest in up-to-date technology and comprehensive technical documentation, valuation of the tech-

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nology to be transferred, payment terms, the terms and costs of technical training, and acceptance tests of the products manufactured using the transferred technology. Patent infringement and protection of proprietary information are also issues of concern to companies involved in technology transfer transactions. Such transactions may also be complicated by the blurred lines of authority that exist in China. The new Chinese Trademark Law provides more comprehensive protection to both the foreign investor and the consumer than its predecessor. The recently promulgated Patent Law also eases some of the previous uncertainties, but careful negotiation of contract clauses remains essential. If China sustains a long-term commitment to import technology, the legal framework for transactions should continue to develop and increase in definition. However, problems arise from differences in the legal cultures of the participants.

A. INTRODUCTION

As Chinese interest in importing foreign technology continues to grow, legal and practical aspects of technology transfer to the PRC require increased attention. This discussion draws on the experience of the author and others in negotiating transactions in the PRC involving the transfer of technology, and discusses both the developing legal framework and practical considerations in such transactions.

Limitations of space make it impossible to discuss general characteristics of the Chinese economy and of Chinese policies as they affect technology importation, but foreign businessmen and policymakers interested in practical possibilities in China ignore these at their peril.[1] Important, too, is an awareness of the flux in the Chinese bureaucracy which has appeared as a result of frequent extensive reorganizations and ongoing tensions between increased local autonomy and the maintenance of central supervision.[2]

A partial recentralization of foreign trade occurred in early 1984,[3] but later in the same year plans were announced to endow the foreign trade corporations under the jurisdiction of the Ministry of Foreign Economic Relations and Trade ("MFERT") with greater independence.[4] Further impetus for trade decentralization has been given by the designation of fourteen major cities, most of them coastal ports which were the centers of the pre-1949 China trade, as special economic zones endowed with considerable auton-

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[1] It is important, for instance, to understand the evolution of Chinese policies toward technology transfer. See, Stanley B. Lubman, "Technology Transfer to China: Policies, Law and Practice," in Michael J. Moser, ed., *Foreign Trade Investment and the Law in the People's Republic of China*, Oxford University Press, 1984; Denis Fred Simons, "China's Capacity to Assimilate Foreign Technology: An Assessment," in *China Under the Four Modernizations-Selected Papers Submitted to the Joint Economic Committee*, U.S. Congress, Washington: Government Printing Office, 1982, pp. 514-552.

[2] See, e.g., Stanley B. Lubman, "Trade Contracts & Technology Licensing," in *Legal Aspects of Doing Business in China*, 1983, New York: Practicing Law Institute, 1983, pp. 9-64, at pp. 12-27, and "Equity Joint Ventures in China: New Legal Framework, Continuing Questions," in this volume.

[3] See, Amanda Bennett, "Peking Exerts Control on Foreign Trade," *Asian Wall Street Journal* (AWSJ), March 16-17, 1984, p. 3 and "China '85," *Far Eastern Economic Review* (FEER), March 21, 1985, p. 75.

[4] See "China Carries Our Reforms on Foreign Trade System," *China Economic News*, September 24, 1984, pp. 2-3; "Laxer Laws Attract Foreign Technology," *China Daily*, October 10, 1984, p. 1.

omy to attract and make agreements with foreign investors. While the precise content of the new policy toward these cities has not yet fully emerged, the extent to which investment incentives in the "14 cities" will differ from those in the existing Special Economic Zones in Guangdong and Fujian is becoming clearer.[5]

The Chinese leadership has been aware of the need for legislation to provide a framework for transactions which have only in recent years become common. The first rules specifically applicable to non-tax aspects of technology transfer, the "Provisional Regulations for Importing Technology into the Shenzhen Special Economic Zone" ("Shenzhen Provisional Technology Regulations"), were promulgated by the Guangdong Provincial People's Congress in February, 1984. In addition, "Regulations Involving Foreign Economic Contracts for the Shenzhen Special Economic Zone" ("Foreign Economic Contracts Regulations"), also promulgated in February 1984, set forth rules applicable to all contracts involving foreign and Chinese enterprises in the Shenzhen SEZ. "Regulations for Importing Technology of the Xiamen Special Economic Zone" were adopted in July 1984. In May, 1985, the "Technology Import Contract Administration Regulations of the PRC" were promulgated ("Technology Import Contract Regulations").

B. Contract Practice in Technology Transfers

Enough transactions involving technology transfer have occurred in recent years to permit useful generalizations about practice in such matters. The discussion which follows is focused principally on contracts for technology licenses, but is generally relevant also to other transactions involving technology transfer such as contracts for the establishment of a joint venture.

It has become less easy in recent years to generalize about the Chinese participants in licensing transactions. Although in the past virtually the only Chinese organization involved in such negotiations was the China National Technical Import Corporation ("Techimport"), other Chinese organizations have appeared recently as counterparts in negotiations involving technology transfer with foreign parties. Techimport has built up a considerable amount of expertise over the years in negotiating technology transfers with foreign parties, and has developed a customary practice which is followed with considerable consistency.

From the perspective of the foreign party, the implications are mixed. Techimport negotiators are familiar with legal and business concepts and concerns which foreign negotiators bring to the table. However, Techimport negotiators have also developed firm attitudes toward certain issues that frequently arise in technology transfer negotiations, and are sometimes aggravatingly rigid. As other Chinese entities become involved in technology transfer nego-

[5] The "Interim Provisions of the State Council of the PRC on Reduction in and Exemption from Enterprise Income Tax" and the Consolidated Industrial and Commercial Tax for the Special Economic Zones and the Fourteen Coastal Cities" ("Special Area Provisions") were promulgated in November, 1984. The Special Area Provisions provide, for the first time, a comprehensive framework of preferential tax treatment for both the 14 cities and the Special Economic Zones. The 14 cities are divided into "Economic Development Zones" and "original urban areas." Different sets of tax incentives are provided for these two kinds of Special Areas and for the SEZ's. The tax treatment in the Economic Development Zones is slightly more favorable than in the Special Economic Zones and both these Special Areas provide more favorable tax treatment than the Original Urban Districts.

tiations, they will bring their own attitudes to the table, which may result in both new opportunities and new obstacles for foreign parties negotiating technology transfers.

(1) COVERAGE OF THE CONTRACT

As in many developing countries, both end-users and commercial negotiators in China are likely to be concerned that the technology which they purchase is up-to-date and, furthermore, will not soon become outmoded or outdated. Chinese buyers require the seller to provide the Chinese party with all updates and improvements which are developed during the period of the license. If sellers are unwilling to include improvements developed during the term of the license without requiring any additional technology fee, the Chinese side may insist that the royalty rate should decline after the expiration of the period during which improvements will be transferred. At the same time, Chinese buyers are sometimes unwilling to cross-license improvements which they may develop.

The Chinese buyer [6] will attempt to define the scope of the contract and the technical documentation which the licensor is expected to deliver as broadly as possible. Chinese negotiators may want to include documents which a licensor does not ordinarily supply, such as engineers' notebooks and design information. In some negotiations, however, Chinese buyers have agreed to accept clauses which require sellers to supply only material that is readily available.

(2) PRICE, PAYMENT, AND VALUATION

Chinese transferees commonly offer to pay a lump-sum contract price in installments. The first installment is payable after the signing of the contract and receipt of an export license. Other subsequent installments are usually tied to deliveries of the technical documentation and to equipment, if any, with the final payment linked to successful completion of the acceptance test. The percentages of the contract price to be paid at each interval are subject to some negotiation.

An alternative method of payment that has been acceptable to Techimport involves a "small" down-payment, and royalties—computed according either to an agreed number of planned units or to the number of units actually produced.[7] It has also been possible to negotiate a paid-up royalty. A seller can expect Chinese negotiators to propose quite low royalty calculations, often supported by insistence that they are more in tune with "world market" levels. Chinese buyers usually prefer to key royalties to net profits or to actual sales, although transferors may be more interested in establishing a minumum royalty without regard to either of these factors.

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[6] The Chinese negotiating team will normally be comprised of representatives of a trade corporation and an end-user. The "buyer," as the Chinese insist on calling the transferee, will nominally be the trade corporation, except in relatively rare instances in which the end-user possesses the authority to enter into licensing transactions itself, or if the transaction involves countertrade, which many Chinese enterprises may engage in directly with foreigners. The Chinese characterization of the transaction as a "purchase" of technology tends to distort the nature of technology transfer as a *process*.

[7] See Moga, "Making Foreign Things Serve China: A Master Licensor's Guide to the Chinese Market," *St. Louis University Law Journal*, no. 28, 1984, at p. 774.

Negotiations are often marked by considerable differences of opinion regarding valuation of the technology to be transferred. The Chinese inevitably and understandably prefer low fees and low royalty rates. They express considerable antipathy to even considering the cost of the licensor's research and development efforts. In recent discussions with the author, several Chinese negotiators and law professors have expressed a preference for calculating the cost to the Chinese side of developing the technology without a license, or, put another way, the value of the benefits to be gained from using the imported technology. Negotiations, however, do not suggest that such a practice is in use.

An important recent expression of continuing Chinese concern with overvaluation of technology can be found in the Shenzhen Provisional Technology Regulations, which provide that when technology is capitalized as part of the establishment of a joint venture, the value of the technology may not exceed 20 percent of the registered capital of the enterprise, and the foreign side must also supply an equivalent amount of "cash or materials as investment capital." [8] According to statements reported by other Americans, similar percentages have been invoked by Chinese negotiators in other parts of China. At the same time, considerable disagreement has been encountered among Chinese experts on foreign trade as to whether the Shenzhen regulations will or should be taken as a model.

(3) BUY-BACK AND EXPORT CLAUSES

Chinese desires to save foreign exchange can be expected to play an important role in the negotiations. The Chinese may want the seller to buy back some quantity of the licensed product. The problem in this regard may be especially thorny: The licensor may not want the product at all, and even if he is willing to accept some shipments the Chinese may not be able to sell to him competitively. Price may be difficult for the parties to agree on, especially if the Chinese want to sell at a fixed price for what the seller regards as a long period, since the seller will probably want the price to reflect changes in world market prices.

Foreign sellers who contemplate obtaining Chinese products from a Chinese enterprise other than the one at which the licensed technology will be used are likely to be disappointed. The Chinese economic system does not currently permit such flexibility, although Chinese officials are sometimes hopeful of being able to achieve it and the approval of sweeping changes in the structure of the economy at the third plenary session of the Twelfth Central Party Committee, in October, 1984, makes it likely that such flexibility is indeed imminent. [9]

Chinese buyers frequently attempt to obtain rights to export products manufactured along with the licensed technology, and internal regulations apparently make it mandatory or near-mandato-

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[8] "Provisional Regulations for Importing Technology into the Shenzhen Special Economic Zone," *China Economic News*, October 22, 1984, pp. 1-3, Article 23 at p. 3.

[9] The thrust of the changes is to loosen the state-controlled price system and to transform state-owned industrial corporations into independent companies. See "China Sets Historic Revision of Economy," AWSJ, October 22, 1984, p. 1.

ry for Chinese licensees to exact *some* export rights. Despite these requests, it has usually been possible for the parties to agree that the Chinese party will export to markets about which the licensor is not greatly concerned.

(4) DURATION

Chinese buyers usually want to limit the time during which they must pay for the technology to be transferred. They also want to limit their dependence on sellers for components and raw materials. In this author's experience, a five year contractual relationship has been common, although longer periods are possible. The Technology Import Contract Regulations provide that the period of the contract must be suitable to the purchaser mastering the imported technology and shall not exceed ten years without special approval of the approving authority.[10] At the same time, end-users are often realistic about the length of time it may take them to begin serial manufacture and sale of products incorporating licensed technology, and may be willing to buy considerable quantities of such subassemblies, parts and components.

(5) TRAINING AND TECHNICAL ASSISTANCE

Chinese buyers have not been consistent in their attitudes about foreign training and technical assistance. Even when they are willing to accept it, Techimport negotiators are usually reluctant to pay more than a limited *per diem* fee (several hundred dollars has been common) for such assistance.[11] Whatever the parties finally agree to, standard Chinese documentation requires specifying the number of man days to be spent in either country by the personnel of the other side. Responsibility for international travel and for living expenses is negotiable.

It is essential to reach a specific agreement on living and working conditions of foreign personnel in China. Sometimes conditions for foreign personnel are not discussed in detail by the two sides at the time the contract is negotiated. The burden of resulting misunderstandings then falls on the personnel sent to the site, not the negotiator who has returned to the comforts of home.

(6) ACCEPTANCE TESTS

At the heart of the contractual relation is the "acceptance test," which is intended to demonstrate to the satisfaction of both sides that the agreed-upon technology has been transferred to the point where the Chinese recipient is able to manufacture one or more

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[10] Technology Import Contract Regulations, *Guoji Shangbao,* May 30, 1985, Article 8. The Shenzhen Regulations provide that "the term of the contract must, in general, not exceed five years, except in a case where technology is regarded as investment capital although the term may be extended with the approval of the Shenzhen government." *China Economic News,* October 22, 1984, Article 19 at p. 2. Where the technology is contributed to a joint venture, the ten-year limit is not applicable because, according to an interview with an unnamed official of MFERT, the laws on equity joint ventures apply when technology is capitalized (*Guoji Shangbao,* May 30, 1985). Since the joint venture law permits ventures to have durations longer than ten years, presumably these longer terms are possible.

[11] There may also be disagreement on *when* the payment for technical training is to be made. See "Starts and Stalls on the Road to Successful Licensing," *Business China,* Vol. X, No. 2, June 27, 1984, p. 90.

prototypes or trial batches of the products involved, and that the products thus produced conform to contract qualification.

Clauses on acceptance tests commonly provide that the tests shall be conducted in China in the presence of the sellers' technicians, with test methods and other technical aspects to be provided for in detail in an appendix. If the acceptance test demonstrates that the product conforms to the specifications agreed on in advance, then the parties are required to sign an acceptance certificate.

If, however, the product fails to pass the acceptance test, the clause requires both parties to consult together, analyze the causes, conduct another acceptance test, and "clarify the responsibility." The clause may also require that in such an event, the period for which the seller is required to keep its technicians in China may be extended for an agreed upon number of weeks.

If responsibility for the failure of the acceptance test is determined by the parties to lie with the Buyer, the parties shall sign a certificate of acceptance tests "termination," but standard Techimport language requires the Seller to "assist the Buyer in taking means to eliminate the defects". If responsibility lies with the Seller, Techimport contracts require the Seller to "correct his mistakes as soon as possible, supply the Buyer with the correct documentation, and assist the Buyer in taking measures to eliminate the defects." If the defect cannot be remedied within an extended time period agreed to by the parties, the Seller must pay a penalty under the penalty clause in the contract, to which the acceptance test clause cross-refers, and which is normally expressed in terms of a percentage of the contract price. Since the penalty clause is by its terms directly addressed to the problems of incompleteness, incorrectness and unreliability of the *documentation* rather than the product or process which may be involved, the cross-reference is somewhat misleading. Techimport negotiators are usually very reluctant to change this wording, which seems to assume that an unsuccessful acceptance test is due to a defect in the transferee's documentation.

It is important to note that negotiations over the language of this clause are sometimes difficult and affect other aspects of the contract such as price, because of the very different emphases of the parties. The Chinese side wants the licensor to take as much responsibility as possible for a successful transfer of technology, while limiting costs to the Chinese side to a fixed amount. Licensors, while they also want to accomplish a successful transfer, are frequently concerned about their inability to choose technicians for training and their lack of control over infrastructural problems, such as poor quality of Chinese materials employed, delays caused by bottlenecks in the domestic economy, or poor workmanship in the course of erection of facilities. Out of concern for such problems licensors frequently want to limit the time spent in China by their personnel, or charge at a per diem which is very high by Chinese standards, or both.

It is essential to define the test methods that will be used, and the standards that will be used to measure conformity of tested samples or prototypes to contract specifications. If the end-user's representatives are technically competent, it should not be too difficult to reach agreement with them on these matters, which are normally the subject of a detailed appendix.

(7) THE GUARANTEE AND PENALTY

The lengthy guarantee clause in the standard Techimport contract requires the Seller to guarantee that the documentation "shall be the latest technical achievement possessed by the Seller" at the effective date or while the contract is in effect, and makes performance of the product a function of the "correctness" of the documentation. Penalties (a negotiated percentage of the contract price) are theoretically applicable to "incorrect," "unreliable" or delayed delivery of the documentation. Since it is the product or process being transferred to which the guarantee is really meant to refer, the confusion noted above in the discussion of acceptance tests is repeated here.

The standard Techimport contract has in the past provided for a ceiling on all the above mentioned penalties at five percent of the contract price. Since, as noted above, the penalties are cross-referred to in the clause covering acceptance tests, this ceiling presumably also applies when the Chinese manufactured sample product does not pass the acceptance test.

Since the quality of materials and equipment used by the Chinese side, the technical level of the personnel on both sides, and the test methods may influence the performance of the tested product there are numerous opportunities for delays and setbacks, and it may be impossible to pinpoint who is responsible for them. Chinese negotiators emphasize the desire of both sides to assure a satisfactory outcome, and cooperation seems to be the keynote.

In practice, Techimport and other Chinese licensees are likely to be most reluctant to invoke penalty clauses, preferring first to investigate and decide the nature of the defect and the best method of eliminating it, and then to concentrate on bringing the quality of the product up to contract specifications. At work here is the pervasive and basic Chinese assumption that the transferor has entered into a long-term relationship with the Chinese transferee, and that both parties have a primary duty to see that relationship through to fruition. The Technology Import Contract Regulations provide that the supplier must guarantee that it is the owner of the technology, that the technology is complete, good and effective, and that it can achieve the goals stated in the contract.[12]

C. The License Agreement and Third Parties: Patent Infringement, Confidentiality, Restrictions on Use, and Approval of the Transaction

(1) PATENT INFRINGEMENT

The standard Techimport clause on patent infringement has in the past required the licensor to bear full "relevant legal and economic responsibilities" arising out of alleged patent infringement. Lately, Techimport has insisted on more specific language requiring the licensor to assist the licensee and defend at its expense any

[12] Technology Import Contract Regulations, supra note 10, Article 6.

claim against the licensee for patent infringement. The Shenzhen Provisional Technology regulations state that,

> If the patent rights are invalidated halfway through the process or if the applications for patent rights are refused, the recipient will have the right to revise or terminate the contract.[13]

Some licensees have insisted on contract clauses that would give them the same rights.

(2) CONFIDENTIALITY AND UNAUTHORIZED USE

The problem of protecting proprietary information in China is a legitimate concern for any company considering a transaction involving technology transfer. China's new patent law, discussed below, provides for damages for patent infringement, and the Technology Import Contract Regulations require the purchaser ". . . within the time period and the scope agreed by the parties to be responsible for preserving the secrecy of that portion of the technology provided by the supplier which has not been publicly disclosed".[14] Whatever the legal framework, foreign companies should also obtain clear contractual expressions of the obligations of the Chinese partner not to disclose or duplicate licensed technology or other proprietary information without the licensor's consent. It is also necessary to insist that the licensee agree to require key employees to sign agreements obligating them not to disclose or transfer the protected technology.

Although Chinese courts can enforce contractual stipulations prohibiting technology transfer, foreigners would be well advised to look initially to extrajudicial remedies. They should try to contact the Chinese party whom they suspect may be breaching the agreement to keep the technology concerned confidential. Tactful expressions of concern that duplication of the company's technology would violate a prior agreement may be convincing. If problems persist, the company should contact either a high-level agency such as a ministry, whose authority runs *vertically* downward to the Chinese organization involved, or other organizations that can approach the bureaucratic hierarchy involved *horizontally*. These choices are not mutually exclusive. For example, a licensor might complain to the superiors of a Chinese enterprise, such as a provincial chemical industry bureau or a Beijing ministry, to the local government (the horizontal route), and also to the Ministry of Foreign Economic Relations and Trade.

Settlement of disputes involving foreigners is more likely to be accomplished through negotiation than through any form of third-party adjudication. Until the Chinese court system, and the legal system generally, achieve a greater degree of stability and reliability, foreigners will do best to eschew recourse to courts and to appeal to Chinese administrative agencies with a large stake in China's commercial credibility abroad.

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[13] *China Economic News*, October 22, 1984, Article 12 at p. 2.
[14] Technology Import Contract Regulations, supra note 10, Article 7.

(3) APPROVAL

All transactions involving foreign parties will require at least one, and often several, approvals from various Chinese governmental entities. Given the blurred lines of authority that exist, a foreign firm may have to discount assurances by Chinese organizations that claim to possess the authority not only to enter into technology transfer agreements, but to protect the foreign firm in certain necessary ways.[15] The U.S. company should adopt an attitude of healthy skepticism towards such claims. Sometimes the foreign company may be confronted with a choice between accepting a local organization's assurances at face value, or seeming to be impolite or mistrustful. It is probably wise to try and obtain fuller assurances and support at the central level, and to tell the local Chinese organization that such action is being taken. It behooves the foreigner to risk embarrassment in order to avoid disaster further down the road.

The Technology Import Contract Regulations provide that after the contract is signed it must be submitted to the approving authority, which is stated to be MFERT or any agency designated by MFERT. A decision must be made by such approving authority within 60 days after the contract has been submitted to it. If no decision is made within that period, the law provides that the contract shall take effect "automatically." [16] This last provision seems intended to prod a sluggish bureaucracy into prompt action. However, it is doubtful that the policies of strictly supervising both imports of technology and expenditures of foreign exchange could be so easily frustrated through bureaucratic inaction.

D. DISPUTE SETTLEMENT

Techimport has often agreed to third-country arbitration, and a standard Techimport arbitration clause calls for arbitration in Stockholm under the rules of the Stockholm Chamber of Commerce, or of the United Nations Commission on International Trade Law [UNCITRAL] Agreement on the applicable substantive law may be more difficult. In a relatively small number of transactions not involving technology transfer, particularly loan transactions involving the Bank of China, Chinese parties have accepted clauses providing that a foreign law would govern. Sometimes Chinese negotiators prefer that the Contract not refer to any governing law, but allow the arbitrators to choose that law, an approach that creates rather than reduces uncertainty. Recently, in a variety of negotiations, Chinese negotiators have insisted on the applicability of Chinese law.

Chinese legislation has begun to deal with the issue of the applicable law. The Shenzhen Foreign Economic Contract Regulations provide that in arbitrations arising out of contracts performed in the SEZ, cooperative activities, contracts relating to natural resources, and other contracts which have a "close relationship to Chinese sovereignty," Chinese law must be applied. Under the law

[15] See Ruben Kraiem, "The All-Too-Easy Path to Misunderstanding in China," AWSJ, October 10, 1984, p. 10.

[16] Technology Import Contract Regulations, supra note 10, Article 5.

on foreign economic contracts, the parties may choose the law to be applied except in a contract for a joint venture in China or for exploitation of Chinese natural resources.[17] The Technology Import Contract Regulations make no reference to dispute settlement, but indicate that technology import contracts must comply with the Foreign Economic Contract Law.[18] The Shenzhen legislation emphasizes Chinese sovereignty while the later nation-wide legislation emphasizes party autonomy to choose the governing law. To the extent that Chinese law is applicable, the obvious problems of ascertaining its content and the extent to which practice may shade the implementation of legislation are likely to persist in the forseeable future.

Chinese legal officials continue to advocate compromise and conciliation as the most desirable methods of settling disputes.[19] Indeed, at the moment of writing, although perhaps thousands of contracts between Chinese and foreign parties containing Swedish arbitration clauses have been signed, no trade dispute involving the PRC has yet been brought to Stockholm.

E. Taxes

Since the new Foreign Enterprises Income Tax Law ("FEITL") was enacted, income earned in China by foreign companies is subject either to taxation at a progressive rate up to 40 percent if the foreign company has an "establishment" in China, or at a 20 percent withholding rate on interest, royalties and other passive income if the company does not have an "establishment". As a result, foreign companies stand to be taxed at one or the other rate on royalties paid under license agreements. A variety of methods are available for enabling a licensor without an "establishment" to escape the withholding tax on royalties.

In some transactions, especially just after the new tax law was promulgated, foreign licensors and Chinese licensees have agreed that the Chinese side would pay the tax. This practice has met the disapproval of the Ministry of Finance. Although the Chinese side may sometimes offer to agree to reimburse the foreign side after withholding tax is withheld from royalty payments, Ministry of Finance officials have stated that although this practice is not illegal, it violates Ministry policy.

In order to promote import of advanced technology, in January 1983 the Ministry of Finance adopted regulations which provided that the tax rate could in some cases be halved to 10 percent, and certain transactions, "where the technology is advanced and the

[17] "Regulations of Shenzhen SEZ on Economic Contracts with Foreign Elements," *China Economic News*, October 15, 1984, pp. 1-5, Article 35 at p. 5; "Law of The PRC on Foreign Economic Contracts," Articles 5, 6, *Renmin Ribao*, March 22, 1985, p. 2, *Business China*, March 28, 1985 at pp. 44-45.

[18] Technology Import Contract Regulations, supra note 10, Article 5.

[19] Their adoption of this attitude in the area of foreign trade agreements is an expression of a deep-seated and long-standing Chinese preference for compromise and conciliation, which is expressed in domestic contract disputes as well. A recent expression of current Chinese views on this subject is Shao Xunyi, "Conciliation Is a Good Method for Settling International Economic and Trade Disputes—An Introduction to China's Practice of Conciliation," paper presented to the 7th International Arbitration Congress, Hamburg, West Germany, June 7-11, 1982. *Cf.*, Tang Houzhi, "Arbitration—A Method Used By China to Settle Foreign Trade and Economic Disputes," *Pace Law Review*, Vol. 4, No. 3, 1984, pp. 519-536. See also "Law of the PRC on Foreign Economic Contracts," *ibid.*, Article 37.

terms preferential," would be wholly exempt from FEITL.[20] These cases involve fees for the use of "proprietary technology" in certain named activities. The regulations state that the fees which may fall under the exception include fees for technical documentation, technical services and training. Also exempt are fees for consulting services for Chinese "engineering or construction enterprises," "technology instruction fees" arising out of instruction in or seminars on "enterprise management and application of production technology," "technical assistance fees" related to assistance for "present equipment or products of Chinese enterprises," and technical services and design or documentation fees for construction sites or equipment.[21]

Under the new regulations, the agencies charged with approving the transactions must submit relevant documents to the local tax authorities. Tax *reductions* will be decided locally, but complete tax *exemptions* will be decided by the Ministry of Finance upon application from local tax bureaus. Prospective foreign licensors desiring tax reductions or exemptions must at the moment rely on informal interpretations and suggestions from local tax bureaus and the Ministry of Finance. Contract negotiations are often affected by the need to submit applications for tax reductions to local tax bureaus or to the Ministry of Finance. It seems to be increasingly possible to obtain opinions in a reasonable timely fashion, at least in Beijing.

It should be noted that some problems under FEITL may legally be avoided if payments by a Chinese party to a foreign one are not denominated as "royalties" and are not otherwise classified as a type of passive income to which the withholding tax applies. The Ministry of Finance has confirmed, for instance, that where the foreign side is repaid for its know-how in products, such payments are not taxable under the Foreign Enterprise Income Tax Law.[22] Thus, a considerable tax incentive exists to meld technology transfer into co-production or countertrade transactions, rather than to enter into pure technology licensing agreements.

F. Chinese Patent Law

The new Patent Law now extends legal protection of industrial property rights beyond the protection afforded by contract, which previously was all that was available to foreign parties. After many years, marked first by neglect of patent matters and then by slow and patient study of foreign patent legislation and administra-

[20] "Provisional Regulations on the Reduction and Exemption of Income Tax on Fees for the Use of Proprietary Technology," East Asian Executive Reports, April 1983, pp. 24-25, Article I at p. 24.

[21] Chinese tax officials have recently been willing to grant tax rulings *prior* to contract approval.

[22] "Finance Ministry Spokesman on Income Tax Reduction & Exemption for Foreign Companies," *China Economic News* 1983, No. 11, March 21, 1983, pp. 3-4.

tion,[23] the PRC has enacted a patent law, whose salient points are summarized below,[24] as well as implementing regulations.[25]

(1) PATENTABILITY

The new law affords protection to three classes of property, namely "inventions," "utility models" and "designs,"[26] to which are applied general tests of patentability. "Inventions" must meet criteria of "novelty," "inventiveness," and "practical applicability."[27] It should be noted that "novelty" is measured on a *world-wide* basis; the law provides that,

no identical invention or utility model has been publicly disclosed in publications in the country or abroad, or has been publicly used or made known to the public by any other means in the country, nor has any other person filed previously with the Patent Office an application which described the identical invention or utility model and was published after the said date of filing.[28]

As a consequence, foreigners will be able to apply for patents only on their newest inventions, subject to the 12-month priority discussed below.

Different standards of "inventiveness" are applied to "inventions" and "utility models," respectively: "inventions" must have "prominent substantive features" and represent "a notable progress," while a utility model need only have "substantial distinguishing features and represent an improvement".[29] The distinction between these two levels of creativity, while permitting embodiments of both to be patented, is not recognized by the U.S. patent system, but is familiar to some other foreign systems. The concept of "practicality" is not clearly defined in the patent law, nor is "exterior design," the third category of patentable property.

(2) APPLICATION, EXAMINATION, AND APPROVAL[30]

The application and examination process hinges on the date the Patent Office receives the application (or, if it is sent by mail, the date the application is postmarked).[31] Publication must occur

[23] A series of articles published the past few years by Chinese observers explaining the importance of a new patent law have been collected together in "China Report: Science and Technology: Formulation of China's First Patent System Debated," Joint Publications Research Service (JPRS), February 21, 1984. A major theme of the Report is the importance of the patent system to technological progress.

[24] The law was promulgated on March 12, 1984, and is to become effective on April 1, 1985. For the text of the patent law and a discussion of the history of the law's preparation, see "China's New Patent Law and Other Recent Legal Developments," report prepared by the Far Eastern Law Division of the Library of Congress, 1984; Xue Yipin, Sun Xueyin, "Chinese Invention Award & Patent System," in *International Economic Law Seminar: Proceedings of Shanghai Conference on International Transfer of Technology*, 1984; Timonthy A. Gellatt and Ruth O. Sweetman, "China's Patent Law Needs Clarification," AWSJ, April 2, 1984, pp. 6–7; Michael J. Moser, "China's New Patent Law," in Michael J. Moser, ed., supra note 1.

[25] "Implementing Regulations of the Patent Law of the People's Republic of China," approved by the State Counsel and Promulgated by the Patent Office of the People's Republic of China, January 19, 1985, *China Economic News*, February 18, 1985, Supplement No. 2 ("Implementing Regulations").

[26] "Patent Law of the PRC," in "China's New Patent Law and Other Recent Legal Developments," supra note 24, Article 2.

[27] *Ibid.*, Article 22.

[28] *Ibid.*

[29] *Ibid.*

[30] The outlines of the procedure provided by the Patent Law have been supplemented in great detail by the Implementing Regulations, which are not discussed here due to lack of space.

[31] "Patent Law of the PRC," supra note 24, Article 28.

within 18 months of the filing date, after a preliminary examination by the Patent Office.[32] Applicants for invention patents must request an examination within three years of the filing date. If they do not, their application shall be deemed to have been withdrawn.[33] Opponents of registration have three months after the announcement of the pendency of a particular application to file notice of their opposition;[34] procedures for filing opposition and standards will presumably be detailed in further implementing regulations. The Patent Office will grant the patent, issue a certificate and announce its action if its review has yielded no cause for rejection.[35] A patent Reexamination Board is established by the statute, to which disappointed applicants may appeal a decision of the Patent Bureau rejecting their applications.[36]

(3) PATENTEES

Patentees of "service invention-creations" may be state-owned organizations (in the language of the Patent Law, "entities under ownership of the whole people"), collectives or individuals.[37] If inventors have done their creative work in execution of tasks for state organizations or using the "material conditions" of such organizations, those organizations become the patentees; when patents are filed for by collectives, the patentee may be either the collective or an individual.[38] A further distinction is drawn between state-owned units, which "hold" patent rights, and collectives and individuals, which "own" such rights, although the significance of the distinction is not clarified by the Patent Law. Individuals may also apply for and own patents on "non-service-invention creations."

(4) NATURE OF PATENTEES' RIGHTS; COMPULSORY LICENSING AND ASSIGNMENT

The statute gives patentees the exclusive right to use the patented technology, subject to a provision that allows "competent departments concerned" of the State Council and the people's governments at the central and provincial levels and in autonomous regions of cities directly under the central Government to decide that any state-owned entity within their system or under their administration must allow designated entities to exploit the invention-creation, subject to a patent fee according to a schedule that is yet to be established.[39] Patents owned be collectives may be subject to compulsory licensing if they are "of great significance to national or public interests".[40] Individual inventors are to receive economic

[32] *Ibid.*, Article 34.
[33] *Ibid.*, Article 35.
[34] *Ibid.*, Article 41.
[35] *Ibid.*, Article 44.
[36] *Ibid.*, Article 43.
[37] *Ibid.*, Article 6.
[38] *Ibid.*
[39] *Ibid.*, Article 14. According to James V. Feinerman, "the curious wording of Article 14 suggests that there may be the possibility of local government involvement in granting rights . . . This could lead to considerable confusion in local practice, although it is hard to know how many 'local' patents may be applied for or issued once the patent system is established," "PRC Patent Law Offers Basic Protection, But Questions Remain," *East Asian Executive Reports,* June 1984, pp. 9-11
[40] "Patent Law of the PRC," supra note 24, Article 14.

rewards from organizations which hold or own patents on their inventions, and, after the inventions are exploited, should be rewarded according to the "extent of spreading and application and the economic benefits yielded".[41]

If patentees of an invention or utility model fail to make the patented product or "use" their patents for a period of three years after registration "without justified reason" and an entity which is qualified to exploit the invention or utility model requests permission to use such a patent, the Patent Office is authorized to grant a compulsory license, subject to a fee to be agreed upon by the parties or, if no such agreement is reached, decided by the Patent Office.[42] Disputes related to such a license or fee may be heard by a People's Court.[43] Although the statute does not specify which courts shall have jurisdiction over patent matters, interviews with patent authorities before the Patent Law was promulgated suggested that basic-level courts were not meant to have such jurisdiction. This as well as a number of other administrative and enforcement questions will have to await further clarification by implementing regulations.

Patent rights may be assigned, subject, as to state-owned entities, to higher level approval.[44] The patent office is to register and announce the assignment of the patent right. It is not clear if this means that the patent office must approve the assignment. Chinese entities may not transfer patents to foreigners without approval by the "competent department concerned of the State Council".[45]

(5) DURATION

Inventions are to be protected for fifteen years counting from the date of filing; the duration of the patent right for utility models and designs is five years (also counted from the date of filing) with the possibility of a single three-year renewal period.[46] In any case, patentees must pay an as yet unspecified annual fee.[47]

(6) EXCLUSIONS

Excluded altogether from patent protection are "scientific discoveries," "rules and methods for mental activities" and "methods for the diagnosis or treatment of diseases".[48] Processes but not products are protected for foods, beverages and flavorings, animal and plant varieties, and substances obtained by means of "nuclear transformation," as well as pharmaceutical products and chemical compounds.[49] Separate regulations, in existence or being drafted, apply to scientific discoveries, while some of the other types of excluded products are regarded as too essential to health and welfare to be allowed to become the exclusive property of anyone, even of their inventors.

[41] *Ibid.*, Article 16.
[42] *Ibid.*, Articles 52, 53, 57.
[43] *Ibid.*, Article 58.
[44] *Ibid.*, Article 10.
[45] *Ibid.*
[46] *Ibid.*, Article 45.
[47] *Ibid.*, Article 46.
[48] *Ibid.*, Article 25.
[49] *Ibid.*

(7) PROTECTION OF PATENT RIGHTS OWNED BY FOREIGNERS

Non-resident foreigners may file patent applications in China, provided that reciprocity exists between the applicant's country and the PRC by virtue of a bilateral treaty, adherence to an international convention (such as the Paris Convention), or otherwise.[50] Foreign applicants are given a 12-month right of priority in China beginning with the date on which they first filed a foreign application for the same invention or utility model (six months for an exterior design), subject to the same qualifications stated above with regard to reciprocity.[51] Applications by foreign applicants who are "not usually residents" or who have "no business office in China" must appoint a Chinese patent agency designated by the State Council, of which one will be CCPIT, which has functioned in a similar manner in trademark matters for many years;[52] others designated since the law was promulgated include the Shanghai Patent Agency and China Patents Ltd, a Hong Kong affiliate of CCPIT. The law does not state the criteria for determining whether a foreigner is a "resident" or has a "business office" in China.

(8) INFRINGEMENT

Patentees may request "the administrative authority for patent affairs" to enjoin a violator who commits "any action that infringes upon the patent right without the knowledge of the patentee," and to order payment of damages.[53] The implication that some organization other than the Patent Bureau is to be created or that an existing body shall act as a super-agency with respect to patent matters is suggested by use of this term in some places in the statute, rather than uniform reference to the Patent Bureau. Implementing regulations are needed here, as they are to define the "infringing act" which may be punishable under the new law.

Another provision in the law excludes from patent violations "use or sale [of] a patented product [by someone] not knowing that it was made and sold without the authorization of the patentee".[54] The standard of "knowledge" that will be applied remains to be clarified both in connection with "use or sale," and in connection with "passing off," defined as the intentional or knowing replication of another's patents, and which is punished by fines and, possibly, criminal prosecution and punishments, including imprisonment for up to three years.

(9) GENERAL COMMENTS

In some respects, the Chinese patent law differs from U.S. patent law, especially in placing emphasis on priority in filing the patent application rather than on the date of actual invention, and in providing for a deferred-examination system. These differences from U.S. patent law are common elsewhere in the world. Common, too, in the patent legislation of other developing countries, is the exclu-

[50] *Ibid.*, Article 18.
[51] *Ibid.*, Article 29.
[52] *Ibid.*, Article 19.
[53] *Ibid.*, Article 59.
[54] *Ibid.*, Article 62.

sion from patent protection of products perceived to possess an especially important relationship to the general health and welfare. Plant materials, for instance, are not patentable in the Soviet Union or in many developing countries.

Of greater concern to some foreign companies is the denial of patentability to pharmaceutical products and chemical compounds. If Chinese enterprises or research organizations succeed in differentiating their process from one used abroad to produce a similar compound—and the degree of variation between the processes remains to be defined—they can presumably patent their process in China. In addition to threatening valuable proprietary knowledge, this provision of the new law may also vary from U.S. law enough to raise a question of whether the Chinese law gives "equivalent" protection to that afforded under U.S. law, which China is bound by its Trade Agreement with the United States to accord to U.S. nationals.

Although some concepts and provisions of the patent law require clarification,[55] and although careful negotiation of contract clauses remains essential to prevent unauthorized disclosure or replication of proprietary technology (as it is elsewhere in the world), the new law should be welcomed. It is another affirmation of Chinese intentions to participate in trade and investment as a member of the international economic community, and to recognize widely accepted rules and practices of that community.[56]

G. Trademarks

A new Chinese Trademark Law came into effect on March 1, 1983, replacing an earlier statute which need not be discussed here.[57] Implementing Regulations for the new Trademark Law were promulgated on March 10, 1983. The new Trademark Law protects the registrant's right to exclusive use of his duly registered trademark.[58] The registration of trademarks is voluntary except for certain kinds of goods which must bear a registered trademark before they are sold.[59] So far, only pharmaceutical products fall into this category.[60]

Trademarks may be registered if they are "characteristically distinctive." They may not be registered if they are identical with or similar to marks that have already been registered for use in the same or similar goods. Certain names and symbols may not be registered, including the names, flags, and national emblems of coun-

[55] See Michael Kirk and David Denny, "Recent Developments in China's Treatment of Intellectual Property," in *China Under the Four Modernizations*, Vol. II, supra note 1, p. 290, 302–305.

[56] A growing body of descriptive literature on the patent system has followed the publication of the Patent Law. For a recent Chinese example, see *Products and Technology Abroad*, Special Issue on Patents, September 1984.

[57] For a recent Chinese view of the new Trademark Law, see Zhu Yunjian, "On the Trade Mark Law of the People's Republic of China," in *International Economic Law Seminar: Proceedings of Shanghai Conference on International Transfer of Technology*, 1984. The new Trademark Law is discussed in Jerome Alan Cohen and Jamie D. Horsley, "The Trademark Law of the Peoples Republic of China," in *Private Investing Abroad* at pp. 211–225; *cf.*, Timothy A. Gelatt, "China's New Improved Trademark Law," AWSJ, October 22, 1982, p. 6.

[58] "Trademark Law," *Patent and Trademark Review*, February 1984, pp. 79–84, Article 1 at p. 79.

[59] *Ibid.*, Article 5.

[60] "Detailed Regulations for the Implementation of the Trademark Law of the PRC" ("Implementing Regulations"), *China Economic News*, October 3, 1983, pp. 1-3, Article 4 at p. 1.

tries, intergovernmental international organizations, the Red Cross and the Red Crescent, the commonly used names of the commodity in question. In addition, marks which "directly indicate the quality, main raw materials, functions, uses, weight, quantity and other characteristics of the commodity," "contain [material of] a racially discriminatory nature," "promote in an exaggerated manner and contain [material of] a deceptive nature," "are harmful to the customs of socialist morality or have other bad influences," or "promote in an exaggerated manner" may not be registered.[61]

Officially the Trademark Bureau is responsible for all matters concerning trademarks, but foreigners are not permitted to deal directly with the Bureau[62] and must apply to the China Council for the Promotion of International Trade (CCPIT), which has been designated as the attorney-in-fact for foreigners in all matters before the Bureau.[63] In addition to the required application documents and files, foreigners must submit a power of attorney in favor of CCPIT, stating the scope of its powers and the nationality of the applicant (or principal).[64] All documents submitted must be in Chinese or accompanied by a Chinese translation.[65]

Article 9 of the Trademark Law permits registration applications in accordance with any agreement concluded between the PRC and the applicant's country, or according to international treaties to which both countries are parties, or on the basis of the principle of reciprocity. Reciprocity has formed the basis of U.S. registration in China in recent years, and does so at present.

There is no requirement of prior use of a trademark before it can be registered. The Chinese give priority to the date the application is filed, regardless of the first date of "use."[66] After the application is given a preliminary approval and published, there is a three-month period within which objections to the registration can be made.[67] If there are no valid objections, the registration is approved for ten years and renewable for ten-year terms.[68] If an application for registration is rejected or opposed, procedures for reexamination or opposition proceedings before a Trademark Review and Adjudication Board are provided for by the Law. Unless approval of registration is ultimately obtained, the registrant is not protected by the Trademark Law.[69] The relationship between the Board and the Trademark Bureau itself is not clearly explicated by the Law.

The Trademark Bureau retains the right to cancel the registration if the mark has been changed or assigned without notification, or if the registrant has not used the mark for over three years after registration, or has passed off inferior goods bearing the mark.[70] Publication or advertising in certain Chinese periodicals appears to constitute "use" for the purposes of this provision.

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[61] "Trademark Law," supra note 55, Article 8.
[62] *Ibid.*, Articles 9 and 10.
[63] Implementing Regulations, supra note 57, Article 30.
[64] *Ibid.*
[65] *Ibid.* Article 31.
[66] *Ibid.*, Article 5.
[67] "Trademark Law," supra note 58, Article 19.
[68] *Ibid.*, Articles 23 and 24.
[69] *Ibid.*, Articles 20 to 22.
[70] *Ibid.*, Articles 30 and 31.

It should be noted that contracts for license of trademarks must be filed with the Trademark Bureau, and the new law both imposes on licensors the obligation of supervising the quality of the commodities bearing the registered mark, and also requires the licensee to "guarantee" the quality of these commodities.

The new Chinese Trademark Law protects trademarks more comprehensively than its predecessor. Infringement is defined as unlicensed use of an identical or similar mark on the same or similar goods, unauthorized manufacture or representation of another person's registered mark, or other injury to the registrant's right to exclusive use of the mark.[71] Again, as in matters of registration, the foreign owner of a registered mark must apply to CCPIT for protection against infringement.[72] Domestic Chinese applicants, as well as registrants complaining about infringement, deal with county-level or other local bureaus of the General Administration of Industry and Commerce (GAIC).[73] In cases of alleged infringement of foreigners' trademarks, after CCPIT has reviewed the matter it will turn to the State Administration for Industry and Commerce ("SAIC"). In a number of cases which have not been publicized, the SAIC has investigated infringement. In one such case, it stopped a Chinese factory from counterfeiting a consumer product bearing a registered trademark.

The Patent Law also makes consumer protection a factor in enforcing its trademark law.[74] The Trademark Bureau, in addition to overseeing the registration of trademarks, is supposed to insure that trademarked goods are of satisfactory quality and are not misrepresented to the consumer.[75] Indeed, it may revoke the mark if the goods are "manufactured in a rough and slipshod way" and are used to "pass off" inferior goods.[76] It is not entirely clear how this consumer-oriented part of the law will be applied, if at all, for foreign marks.

Some questions remain unanswered about the role to be played by CCPIT, the Trademark Bureau and local county departments of the SAIC in enforcing the Trademark Law both against abuse by registrants and against trademark infringement by others. There are a number of junctures at which the rights of foreigners are not made clear. In the two years since the Trademark Law was first promulgated, these have been the subject of much discussion in foreign and domestic publications, and the Chinese have addressed and clarified certain areas of concern to foreign businesses.

Over time some of the questions which remain, particularly regarding applicability of the economic protection aspects of the law and the mechanics of enforcement of the law, will become more settled. For the moment, though, of greatest importance to foreign companies is the need to register their marks. Since no prior use need be shown by a registrant, true owners of valuable marks would be well advised to register them in China to avoid their registration by others.

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[71] *Ibid.*, Article 38
[72] Implementing Regulations, supra note 57, Article 29.
[73] "Trademark Law," supra note 55, Article 39.
[74] For a discussion of this point, see Gellatt, supra, note 22.
[75] *Ibid.*, Article 31.
[76] *Ibid.*, Article 34.

H. Conclusions

The foregoing discussion has touched on only some of the problems that may arise in the course of the parties' negotiations and other relations with each other. Other forces may shape transactions or their outcomes. For example, the influence of U.S. export controls on technology transfer to the PRC has not been considered here. During the summer of 1983 the Reagan Administration decided to loosen the controls on sales of strategic goods to China, but only time and continued scrutiny will tell whether the U.S. Department of Defense will become less of an obstacle than it has been in the past.[77]

This chapter began with reference to changing Chinese policies, which will no doubt continue to show variations that will affect transactions of the type discussed here. At the same time, though, if any current Chinese policy is likely to be a long-term one, it is the commitment to import technology. China's leaders could not contemplate carrying out a genuine effort to modernize Chinese industry without continuing that commitment. If this perception is accurate, the legal framework for transactions giving expression to this policy should therefore continue to develop and increase in definition.

Yet even if policy remains consistent and new laws add greater certainty to the expectations of the parties to technology transfer transactions, some problems in negotiations between foreign transferors and Chinese transferees of technology are likely to continue to appear, particularly problems of style. The legal cultures of the negotiators on each side of the table differ greatly, and these differences sometimes matter.

It has been common in the past for Chinese negotiators to prefer broader, often imprecise expressions of licensors' obligations in contracts, and to disdain detailed documentation, especially if they regard it as legalistic. Although foreign licensors would be doing themselves and their Chinese counterparts a service if they rendered some of their favorite legalisms into plain English, at the same time they should insist on documentation that covers the contingencies which most concern them.[78] Unfortunately, it is not easy to generalize about the reactions to such clauses by the Chinese side. Techimport negotiators in particular seem to insist on using their standard clauses, which are often unclear, incomplete, or both, on such issues as liability of the licensor to licensors or to third persons.

Perhaps the greatest source of problems between licensors and licensees in the PRC is the frequent gap between high Chinese expectations and the inadequacy of the Chinese infrastructure to pro-

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[77] See Stanley B. Lubman, "Technology Transfer to China: Policies, Law and Practice," in Michael J. Moser, ed., supra note 1, and Richard Holbrooke, "The Drag on Sino-U.S. Trade," *Wall Street Journal*, February 15, 1985.

[78] The foregoing advice seems especially appropriate in light of the fact that the Chinese side, viewing the contract as a document that creates a strong and ongoing relationship between the parties, may later request favors or other actions by the licensor which the licensor may view as imposing added and sometimes costly burdens on him. Also, as elementary as it may seem, unwritten commitments by either side should be avoided as much as possible. This is particularly true in view of the fact that the Chinese side may have difficulties in performing obligations which involve the participation of other Chinese organizations which were not consulted when the contract was drafted. See the discussion of such matters in Lubman, supra, note 2.

vide support for the realization of such expectations. This is reflected in many aspects of transactions involving transfers of technology, ranging from Chinese hopes about the speed and effectiveness with which the technology can be transferred, learned and applied to such mundane but important details as the availability and adequacy of Chinese utilities, transportation, goods and services and living quarters for expatriate employees.

Responsibility for misunderstandings which may arise because of the distance between Chinese hopes and the limited resources of the Chinese economy should not be laid exclusively on the Chinese side. Foreign businessmen are frequently inexcusably ignorant about the realities of the Chinese economy simply because they have not taken the trouble to inform themselves adequately. Perhaps because China is so distant and is assumed to be unknowable, Western businessmen often take less trouble to inform themselves about China than they would if they were going to another Western nation to discuss a similar transaction. At the same time, the flow of information is increasing, not only in English but also in other Western languages. The failure to follow recent developments in China has even become more unwarranted than it was before. Especially because of the consequences of decentralization and economic reform, the foreign businessman who takes China as an impenetrable monolith does so at his peril.

For all the uncertainties noted above and the risks they create, the PRC promises to be an attractive market for foreign technology in the near future, especially if the transfers can be accomplished in the context of transactions that especially fit with Chinese needs and limitations. The ideal transaction, from a Chinese point of view, involves advanced technology, a substantial amount of labor, and a product for which there are considerable export markets. The absence of any of these factors does not necessarily mean that the transaction will not be consummated, but the presence of all of them would enhance the possibilities for success.

Little additional certainty has been contributed by the regulations on technology transfer contracts of May 1985, although some points have been clarified. For example, recognition has been given to the protection of proprietary know-how and trade secrets. The Technology Import Contract Regulations specifically include "proprietary technology" among the forms of transferable technology which are covered by the Regulations and which the purchaser is bound to protect under Article 6.

At the same time, the new Regulations contain provisions which can be used to buttress the negotiating power of Chinese importers of technology. Article 9 states that the supplier "shall not force the purchaser to accept unreasonable restrictive requirements," and enumerates certain restrictions which cannot be included without special permission of the approving authority. The supplier may not:

—require the purchaser to purchase unnecessary technology or technical services, raw materials, products or equipment unrelated to the transferred technology;

—restrict the purchaser from buying from other parties;

—prevent the purchaser from developing or improving the imported technology;

—prevent the purchaser from obtaining from other sources similar or competitive technology of the same type;
—impose "unequal terms" of technical exchange or improvements between two parties;
—restrict the categories, types or sales price of products manufactured using the imported technology;
—"unreasonably restrict" the purchaser's sales channels or export markets;
—prevent the purchaser from continuing to use the imported technology after the expiration of the terms of the contract; or
—request the purchaser to make payments for, or accept responsibility for, technology which is unusable or on which the patents have expired.

The implications for the future of these requirements should be discussed in the context of certain general standards which the Regulations require imported technology to meet. Article 3 states that the imported technology must be "advanced and reliable" and must be capable of:

—Developing new products;
—Improving product performance, reducing the cost of products and conserving energy of raw materials;
—Facilitating the effective use of Chinese resources;
—Enhancing export earnings of foreign exchange, and facilitating environmental protection, production safety, economic management, and the raising of the "level of science and technology."

It is readily evident that these last-enumerated requirements could be mutually inconsistent in many cases. Plainly too, interpretations of what may be "unreasonable" restrictions under Article 9 could vary extensively. Both of these sets of standards are so general that they will be given meaning only through interpretation, often couched in terms of exceptions to the standards. As is so often the case with the making and enforcement of Chinese laws, tentativeness and flexibility promise to mark the evolution of these regulations. Tentativeness is not inconsistent with the eventual appearance of clear tendencies—so long as basic policies do not change. At the time the regulations were promulgated no policy changes seemed in the offing that pointed to an intent to have the regulations alter the established contract practices which have been discussed previously here.

The legal framework will evolve only gradually, however. Interpretive regulations are slow to follow the general laws they supplement, and practice usually moves faster. Regardless of the precise course of legal development we can be sure that technology transfer to China, like other areas of trade and investment in that country, will continue to reflect the nuances of endlessly changing encounters among law, policy and practice.

VIII. FOREIGN TRADE RELATIONS

OVERVIEW

By Leonard Woodcock*

The eight papers in the Foreign Trade Relations section provide a necessary informational background to those interested in a practical involvement in U.S.-China trade.

The American relationship, of course, can only be understood in the context of China's total international trade and the financial arrangements developing on a global scale. This is well covered in the Central Intelligence Agency's submission with particular reference to the most recent past. Put in perspective is China's attempt to diversify its international trade, including increase in bilateral trade with the USSR and Eastern Europe. That this also might include political steps looking to more normal state-to-state relations is in no way, in my opinion, a negative step.

The Central Intelligence Agency's other paper on US-China trade notes the shift in the composition of that trade. At the time of normalization of relations, United States exports were predominantly raw materials: agricultural products, particularly grains, synthetic fibers, lumber and chemicals. The spectacular success of China's agricultural reforms has severely limited her need of grain imports and opened the way to American exports of industrial machinery, other manufactures, technologies, and services. Machinery sales have approximated 30 percent of such exports in 1984.

One major American advantage in the early 1980's appeared to be superior technology in oil extraction. In my last months as U.S. Ambassador, I stated repeatedly that if oil was as abundant in the South China Sea as the geologic formations promised, then the major turning point for Chinese development would be at the end of this decade. As the mid-point of the decade approaches, the verdict has yet to be made. The Chinese general effort, never-the-less, is going full-speed ahead. As the Noyes paper indicates the future of Sino-American trade will be strongly tied-in with American investments in China and by projects using U.S. technologies.

That this is a wise strategy is underscored by the Nanto-Kim paper on Sino-Japanese Economic and Trade Relations. Japan has both natural and man-made advantages in economic relations with China. Geographical proximity and, to a much lesser extent, cultural affinity are among these, together with a greater use for Chinese exports than other developed countries. Building on these natural

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advantages the Japanese government has extended concessional grants and loans, preferential tariff rates under Generalized System of Preferences (GSP), and coordinated development. Exploiting these opportunities are the intelligently aggressive Japanese trading companies and businessmen.

Limiting the Japanese advantages, however, is the Chinese policy never again to put all its eggs in one economic basket as it did, to its sorrow, with the Soviet Union in the 1950s.

The Sutter paper on the future of Hong Kong emphasizes the importance of that future to the United States and the limited American influence in the forming of that future. The paper also notes the obvious implications for the reunification of Taiwan with China. Much international skepticism was expressed at China's determination to force the pace of negotiations and to set a deadline for settlement of September, 1984. In the event, the outcome appears successful and the innovative concept of "one flag, two systems' seems accepted. The day after the initialling of the agreement, the Hong Kong money and equity markets advanced. Since the signing of the agreement by the Chinese and British principals, the visa lines at the American consulate have substantially shortened.

Textiles continue to be the major component of China's exports. One of the Joseph Pelzman papers fully analyzes the textile problem and draws the supportable conclusion that this necessary reliant will continue to be manageable during China's developing industrial transition. The other Pelzman paper deals with GSP, if continued by the United States beyond 1985, and outlines the advantage to the Sino-American relationship of Chinese access to the system. This would need to be prefaced by China's adherence to the General Agreement on Tariffs and Trade (GATT).

The extension of special autonomy in foreign investment to fourteen more coastal cities is reviewed by Victor Falkenheim. The nature of the autonomy granted is somewhat different than that of the original economic zones, but I was informed in Beijing in June 1984, the extension had been proposed by Chairman Deng Xiaoping after his tour of the original zones. Personal discussions with officials of one of the zones, Yantai, revealed a considerable excitement about the prospects made possible.

John Copper's paper contains an interesting analysis of China's foreign aid program over 35 years and brings the current policy into focus. Today more than ever the program is guided by nationalist considerations and much less by ideological convictions. The aid program is carried out with a light hand and supports China's effort to be deemed a leader of the Third World.

The Stanley Lubman paper is a sympathetic treatment of the legal problems facing equity joint ventures in China, but it also faces the difficult problems remaining. Since the Sino-American normalization concluded in December, 1978, Chinese foreign trade relations have been affected by many administrative changes, some with apparent contradictions. The changes, in my opinion, although sometimes contradictory do have a common thread: discard what does not work and be willing assayers of things pragmatic. The growing self-confidence of the Chinese people is both a product of, and a support to, this approach. This review of the Chinese economy could not come at a better time.

CHINA'S INTERNATIONAL TRADE AND FINANCE

By John L. Davie*

CONTENTS

I. OVERVIEW

In late 1983 China began to emerge from a three-year hiatus in its capital-import program and since then foreign purchases have picked up sharply. Although Beijing virtually halted new orders for Western equipment and technology during the "readjustment," it continued to lay the groundwork for even closer trading relations with the West. It enacted legislation on foreign investments and patents, signed bilateral tax and investment treaties with several countries, and joined the Multi-Fiber Arrangement under the GATT and the International Atomic Energy Agency.

Export expansion and import restraint have given the Chinese three consecutive years of record trade and current account surpluses. The surpluses boosted China's total international reserve holdings to nearly $20 billion by the end of 1983, tenth largest in the world. While this helped to improve China's already excellent international credit rating, China undoubtedly would have derived greater economic benefits from investing these funds at home.

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*Office of East Asian Analysis, Central Intelligence Agency.

In 1983 China began to put its foreign exchange earnings to more productive use, spending not only on domestic infrastructural projects such as energy, transportation, and communications, where lack of investment in the past had severely constrained economic growth, but also in light industry and agriculture. This has significantly boosted the opportunities for sales to and cooperative ventures with China.

All signs point to a resurgence of trade over the next few years. Imports overall probably will grow on the order of 20 percent per year. Capital goods will experience the largest gains. Transport equipment purchases, in particular, have surged ahead, boding well for the United States in such areas as jet aircraft, helicopters, and locomotives. Agricultural imports, however, will continue to decline, reflecting China's great success in boosting agricultural production.

Although exports jumped almost 30 percent in the first quarter of 1984 compared with the first quarter of 1983, this trend is unlikely to continue. For the next few years, exports probably will rise only 10 to 15 percent per year. Developments at home and abroad are causing concern in Beijing over the long-term prospects. Externally, recession and protectionism have reduced the developed countries' demand for China's exports. Internally, the country's domestic budgetary problems—partly caused by skyrocketing subsidies to foreign trade—have occupied the immediate attention of Chinese leaders.

The Chinese have attempted to increase export earnings by moving into higher-valued manufactures. Volume quotas and other quantitative restrictions on imports from China in the West are forcing the Chinese to export better quality, higher priced goods than they otherwise would. Beijing also has tried to open up new markets in the Middle East, Eastern Europe, the Soviet Union, and Latin America in order to compensate for increasing barriers to their exports, and to build better political relations as well. These markets, however, will not provide a long-term solution for China's foreign exchange needs.

Over the past two years domestic financial losses from foreign trade have ballooned. Because domestic prices are not in line with world prices, Beijing has had to subsidize both exports and imports of different products. Moreover, as the foreign trade system became more decentralized, China's irrational domestic price structure tended to distort commodity trade patterns.

In March 1984 the Ministry of Foreign Economic Relations and Trade announced that trade would be recentralized under its aegis, ostensibly to counteract these problems. There appear to be disagreements in Beijing over the needed solutions, however, with many in power favoring price reforms, not recentralization. Even if the recentralization order is carried out, it probably will not curtail trade at the local and provincial level, nor ease the need for subsidies.

Beijing's past progress in attracting foreign investment has been slow, in part, because of differences among Chinese leaders and planners on the extent of incentives that should be offered to foreign companies. In 1984, however, Beijing renewed its commitment to push forward with the open door policy, most prominently, by opening additional port cities to foreign investment and giving them greater decisionmaking authority. Foreign investment in China, which at year-end 1983 totaled $1.5 billion, probably will double several times in the next few years, lead by the search for offshore oil.

China's change in status from net debtor to creditor stems both from Beijing's readjustment policy and from stringent foreign exchange control measures established in early 1981. The Chinese have used very little of the $27 billion in commercial and government-supported credit lines they arranged in 1979. Indeed, in 1983 they prepaid most of their long-term commercial debt as well as the entirety of their first credit tranche from the IMF. Beijing is restructuring the small foreign debt that remains by reducing interbank borrowings and taking on long-term low interest loans from the World Bank, Japan's Overseas Economic Cooperation Fund (OECF), and other official sources. Nevertheless, over the longer term, China will need to tap the commercial markets in a big way if it is to complete its ambitious development plans.

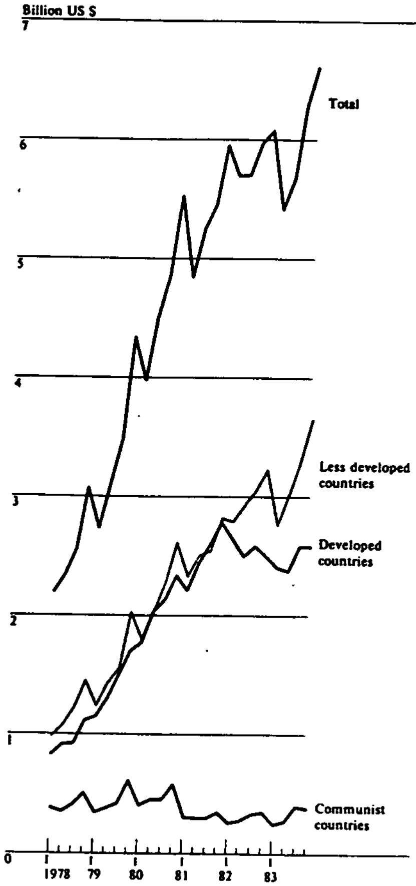
II. Background

The three-year hiatus in China's capital-import program that began in early 1981 has ended. China is again in the market for Western equipment and technology. Beijing has reordered its priorities, has erected an institutional framework to attract foreign investment, and has intensified the search for foreign partners. This paper analyzes these trends and makes projections for China's international trade, finances, and economic relations over the next few years.

Reductions in domestic investment stemming from the readjustment policies announced in 1979 were largely responsible for the past decline in foreign purchases. Under the readjustment investment was cut in order to stimulate consumption, and heavy industry was deemphasized in favor of light. As a result, imports of capital goods and industrial supplies plummeted. Contrary to speculation in the Western press, the dropoff in purchases did not reflect foreign exchange difficulties. Chinese exports were growing rapidly and Beijing had access to virtually unlimited credit in the West

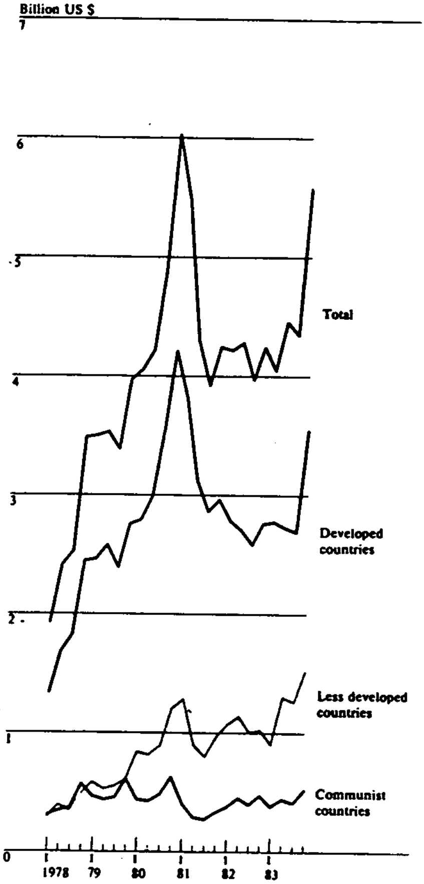
The decline in capital imports came mainly at the expense of the developed countries—trade with the LDCs continued to increase (see figures 1, 2, and 3). Imports from Japan and Western Europe were particularly hard-hit as a result of cutbacks in steel and machinery purchases. Exports to the developed countries also slumped, but for a different reason—recession in the West explains most of the decline. China's exports to the LDCs continued to grow, despite the economic troubles experienced by many of them. (See Appendix tables 1 and 2).

Figure 1
China: Exports, f.o.b.



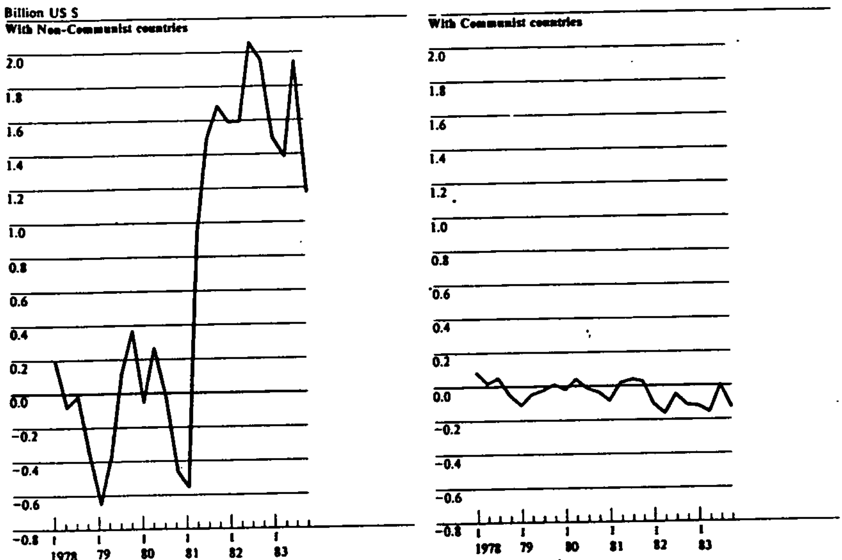
Note: First-quarter 1978 through fourth-quarter 1983.

Figure 2
China: Imports, f.o.b.



Note: First-quarter 1978 through fourth-quarter 1983.

Figure 3
China: Trade Balances, f.o.b.



Note: First-quarter 1978 through fourth-quarter 1983.

Note: First-quarter 1978 through fourth-quarter 1983.

The resulting trade surpluses boosted China's international reserve holdings to nearly $20 billion by the end of 1983, tenth largest total reserves in the world and seventh largest in terms of foreign exchange alone. (See tabulation). This level of reserves—more than 12 months worth of imports—was much larger than needed to cover any exigencies.

HOLDINGS OF INTERNATIONAL RESERVES DECEMBER 31, 1983

[Billions of U.S. dollars]

Rank	Country	Total reserves	Gold [1]	Foreign exchange	SDR's [2]
1	United States	124.9	102.3	6.3	16.3
2	West Germany	79.7	37.0	37.3	5.4
3	France	51.6	31.8	18.1	1.7
4	Switzerland	46.7	32.3	14.4	0
5	Italy	46.0	25.9	18.5	1.6
6	USSR	39.3	29.8	9.5	0
7	Japan	34.0	9.4	20.4	4.2
8	Saudi Arabia	29.2	1.9	17.5	9.8
9	Netherlands	27.3	17.1	8.7	1.5
10	China	19.8	4.9	14.3	.5
11	United Kingdom	18.2	7.4	8.7	2.1
12	Belgium	18.0	13.3	3.8	.9
13	Spain	13.1	5.7	7.0	.4
14	Taiwan	12.8	1.4	11.4	0
15	Austria	12.7	8.2	3.9	.6
16	Venezuela	12.1	4.5	6.3	1.3
17	Australia	12.0	3.1	8.7	.2
18	Singapore	9.2	0	9.1	.1
19	India	8.2	3.3	4.3	.6
20	Norway	7.1	.5	5.9	.7

[1] Valued at year-end market rate.
[2] Includes reserve position in IMF.

For a capital poor country such as China, the change in status from capital importer to capital exporter made little economic sense. Interest earnings on China's deposits in foreign banks were far less than the potential return on capital invested domestically. Foreign exchange deposits abroad did nothing to build China's ageing infrastructure or to upgrade its inefficient industrial base. Moreover, maintaining a trade surplus created inflationary pressures in the economy—state procurement of goods for export injected more currency into circulation than was absorbed by domestic sales of imports, with the result that more money chased fewer goods. The large buildup of foreign exchange reserves was politically unwise as well, raising the question of whether China deserved access to low-cost funds from the World Bank and other international lending agencies.

In 1983 China began to put its foreign exchange earnings to more productive use, investing them not only in domestic infrastructural projects such as energy, transportation, and communications, where lack of investment in the past had severely constrained economic growth, but also in light industry and agriculture. By fourth quarter 1983 China's capital equipment imports approached the record level of 1980, yet one of the biggest categories of capital goods—payments for industrial know-how, production licenses, technical services, and various froms of consultancy—probably does not show up in the trade returns at all. Payments for such invisibles may have exceeded $1 billion in 1983.

Although imports slumped from 1981 to 1983, Beijing continued to lay the foundation for even closer trading relations with the West. It joined both the Multi-Fiber Arrangement under the auspices of the GATT and the International Atomic Energy Agency. It enacted the implementing regulations for the Joint Venture law and completed work on a patent law in order to make investing in China more attractive to foreign entrepreneurs. It has signed bilateral tax and investment treaties with Japan and several countries, establishing the rights of foreign investors. And it has established sizable lines-of-credit with Japan, the World Bank, and with Western commercial banks which will allow it to proceed rapidly with major infrastructural projects once technical negotiations are concluded.

More than any other move, however, Beijing's decision this past April to open 14 additional port cities and Hainan Island to foreign investment reflects China's commitment to push forward with the open door policy. Under the new policies, local authorities will be given greater freedom to accept foreign investments without Beijing's approval, similar in many respects to the powers granted the authorities in the Special Economic Zones. Foreign investors in the new "Economic Development Zones" will be given preferential tax rates, a waiver of import duties on goods that will be re-exported, and greater access to domestic markets.

This policy decision represents a major departure from the past. Under Deng Xiaoping Beijing has now assigned a leading role to the port cities in China's modernization process, contradicting Mao Zendong's long-standing policy of balanced growth between coast and interior. In large part this probably reflects a pragmatic attempt to deal with an economic reality—China's transportation system is so overburdened that in real terms it often costs less for the port cities to trade with foreign countries than with the hinterlands. The decision, however, also reflects the growing influence of localities on policies emanating from Beijing. Local and provincial authorities have warmly embraced their new prerogatives—indeed, many inland cities are now claiming to possess the same rights as those granted to the coastal cities. The ability to attract foreign funds for their investment projects gives them an alternative to using central government funds and a means of circumventing Beijing's controls. Under the financial "responsibility" system currently being instituted, the ability to find new sources of funds may be critical to economic survival.

These actions will begin to bear fruit in 1984, significantly boosting the opportunities for sales to and cooperative ventures with China. All signs point to a resurgence of trade. By the first quarter of 1984 China's imports already had started to take off, running more than 20 percent ahead of the same time in 1983. Imports of capital goods and industrial supplies—particularly steel, nonferrous metals, lumber, and plastics—are leading the list; imports of agricultural commodities, however, have dropped following three consecutive years of excellent harvests. Over the next few years imports probably will grow more than 20 percent per year.

Although exports jumped almost 30 percent in the first quarter of 1984, producing the highest quarterly trade surplus ever, this trend is unlikely to continue. The foreign trade ministry's announcement in mid-March 1984 that trade would be recentralized may have caused a temporary surge and could lead to cutbacks in subsequent quarters. Export growth over the next few years will be limited to about 10–15 percent per year.

Whether China's reserves will continue to grow will depend in part on complex equity and debt considerations. Based on past precedents reserves probably will follow the trend of the trade balance. While Beijing would like to reduce the level of its reserves, much of the capital equipment China will be getting will be obtained through direct foreign investment or on buyer's credits. Therefore, in the near term, reserves might not decline and could even increase.

III. The Uncertainties Ahead

In his 1984 economic plan report to the National People's Congress in May, Song Ping, Minister-in-charge of the State Planning Commission, announced that China's total trade volume in 1984 would decline 5 percent from the 1983 level. From 1981 to 1983 Chinese officials consistently made inaccurate predictions of China's foreign trade prospects. The Chinese projections probably underestimate trade growth in 1984 as well. Lack of up-to-date trade data and the volatility of the international economy are the primary reasons for Beijing's conservative forecasts, but growing uncertainty over the prospects for exports, caused both by external and internal developments, has added to Beijing's cautiousness.

Externally, recession and protectionism have reduced the developed countries' demand for China's exports. Over the past two years lower commodity prices have hurt China's agricultural, mineral, and crude oil exports. At the same time, Chinese attempts to gain substantially greater access to the US and EC textile markets have been repeatedly rebuffed.

In response China has attempted to boost sales to the Soviet Union, Eastern Europe, the Middle East, and other untapped markets. Arms sales shot up from virtually nothing in 1980 to $1.5 billion in 1983—6 percent of total exports. In an attempt to earn foreign exchange China has even offered to store nuclear waste materials for several West European nations. All of these markets, however, involve some long-term risks and will only provide short-term help for China's hard currency earnings. Until Beijing is more certain of its future earnings prospects, it will be reluctant to move ahead with major development projects.

Internally, the country's domestic budgetary problems are occupying the immediate attention of Chinese leaders. The central budget remained in deficit in 1983. In particular, subsidies to agriculture and foreign trade took an unanticipated jump. Chinese efforts to trim these subsidies could restrict the growth of both exports and imports.

The trade subsidies are a result of China's irrational domestic price structure—prices are fixed arbitrarily and are not in line with world market prices. At the internal settlement rate of 2.8

yuan per dollar—the exchange rate at which Chinese entities are permitted to convert foreign exchange into yuan—the domestic prices of primary products generally appear to be lower than world prices, while those of manufactures appear to be higher.[1] Hence, it is generally profitable for Chinese traders to export primary products and to import manufactures. The reverse—exporting manufactures and importing primary products—tends to produce losses.

At the official exchange rate in use prior to 1981, exports produced losses, on balance, while imports made profits, a sure sign of the overvaluation of a currency.[2] Because foreign trade corporations (FTCs) under the Ministry of Foreign Trade handled all trade (at least before 1979), the FTCs could offset the losses on trade in one commodity with the gains made on another and such losses or gains did not affect the decision to trade.

As China's foreign trade system became more decentralized, however, the domestic price structure led to a trade pattern that was clearly contrary to China's comparative advantage. The price system encouraged exports of capital-and land-intensive commodities that were in short supply (e.g., oil, steel, and tobacco) and encouraged imports of labor-intensive manufactures that could have been produced for a lower real cost at home (e.g., cameras, televisions, radios, and wristwatches).

Since early 1981 Beijing has taken several steps to counteract these distortions. First, Beijing—in effect—devalued the yuan by introducing the internal settlement rate. Although this reduced the need for subsidies to exports, it resulted in increased subsidies for many imports. Moreover, with a decline in some highly-profitable imports that resulted from the readjustment of the economy, and with a decline in world prices for many of China's exports, net financial losses from trade increased sharply.

In 1982 Beijing introduced a trade licensing system and considerably revised its tariff system in order to prevent local enterprises from exporting goods in short supply or from importing goods that competed with domestic products. The licensing system gave the Ministry of Foreign Economic Relations and Trade (MFERT) new regulatory and oversight capabilities, while the new tariffs—on exports as well as imports—helped to shield the domestic price structure from the effects of international trade.[3]

Finally, in March 1984 MFERT announced that trade would be recentralized under its aegis. Pricing and supply problems created by the decentralization were offered as reasons for reasserting MFERT control. Subsequent press criticism of the "stifling overcentralization" of trade suggests that there may be some differences in Beijing over whether recentralization or price reform is the solution to China's foreign trade problems. Even if the recentralization order is carried out, it probably will not have major consequences for the trade of local and provincial enterprises. Instead, its pri-

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[1] It is difficult to generalize about Chinese prices. The present generalization only applies to major commodities at the wholesale level that would enter into world trade, not to retail prices.

[2] During most of the 1970's, the official exchange rate, published by the Bank of China, floated between 1.5 and 2.0 yuan per dollar.

[3] Export tariffs prevented Chinese traders from price-cutting and thereby passing windfall profits on to foreign buyers, while import tariffs raised the domestic prices of foreign goods in order to protect local industries.

mary effect would be to shuffle lines of responsibility for trade within the central government itself. In recent years other ministries of the central government such as the Ministry of Coal Industry and Ministry of Petroleum Industry have garnered an increasing share of foreign trade. Under the recentralization order, MFERT probably will recoup most of the trade conducted previously by other ministries. In light of the lengthy treatment given to the recentralization announcement in the Chinese press, Beijing probably intends to make MFERT an example of how government administration and enterprise management functions can be separated. Thus, many of the local producers, end users, and trading firms will continue to make economic decisions, while MFERT will administer the plan, regulating provincial trade through the use of licenses, tariffs, and other indirect controls. Although MFERT will exercise greater oversight, the national-level FTCs probably will not supplant the trade of provincial corporations.

In anticipation of the recentralization announcement, many trade organizations in China may have rushed to fullfill standing export contracts in advance, one possible explanation for the strong upturn in exports in the first quarter of 1984. According to business reports on the Spring Canton trade fair, prices were up 10 to 15 percent, perhaps an indication of MFERT's new effectiveness in coordinating foreign trade negotiations. Whatever the reasons for the recent surge in Chinese exports, if Beijing maintains a disproportionate incentive to export and tight controls on imports, China's current account surpluses are unlikely to evaporate.

IV. Balance of Payments—Flush With Reserves

China's central planners have attempted to prevent domestic economic pressures from causing excess demand for foreign goods. Nevertheless, domestic economic developments are transmitted, at least partially, to the foreign sector after some lag. Hence, China's balance of payments has reflected Beijing's shifting national economic policies. Current account surpluses during 1976–1978 gave way to deficits in 1979 and 1980, as deliveries began on the $10 billion worth of complete plants and equipment China ordered in 1978. Readjustment policies favoring light industry and agriculture—announced in early 1979—did not affect China's current account until 1981, when deliveries of capital equipment and industrial supplies began to subside. While the domestic economic recovery has been underway since 1982, imports only began to pick up in late 1983. Continuing export expansion and restraints on imports have given the Chinese three consecutive years of record trade and current account surpluses. (See Appendix table 5).

Although the rate of growth of trade in services has outpaced that of merchandise trade, service expenditures probably have exceeded earnings. The Chinese are making a major effort to turn the deficit on services into a surplus by expanding their international merchant fleet, improving tourist facilities, and boosting foreign sales of construction labor services. China now has 29,000 workers abroad, double the number of 1980, and Beijing plans to have 100,000 workers in LDCs by 1990. In addition, interest earnings on China's foreign exchange holdings have climbed sharply.

In recent years China's net receipts from unrequited transfers have declined, primarily as a result of a slowdown in remittances from overseas Chinese. A decline in monetary remittances from Hong Kong probably reflects the opening up of the Crown Colony's border with China—relatives now bring gifts instead of sending money—and the declining value of the Hong Kong dollar. Between 1980 and 1983 China received $71 million in funds the UN, including $23 million from the United Nation's Development Program, $8 million from the Fund for Population Activities, $25 million from the World Food Programme, $5 million from the High Commissioner for Refugees, and $8 million from UNICEF. Since 1977 China's own foreign aid to the third world has been pared back substantially in order to conserve resources for its own economic development. Nevertheless, it still exceeds the amount of aid China gets from international organizations.

Proceeds from the current account surplus have been used to lift foreign exchange reserves to record levels, to reduce foreign commercial debt, and to increase investments abroad. China's international reserves, excluding gold,[4] totalled $14.9 billion at yearend 1983 and by midyear 1984 amounted to more than $16.8 billion, while China's total foreign debt stood at only $5.7 billion. For the past three years Beijing has restructured its foreign debt by reducing interbank borrowings and taking on long-term low interest loans from the World Bank, Japan's Overseas Economic Cooperation Fund (OECF), and other official sources. In 1983 China prepaid its first credit tranche drawing from the IMF one year ahead of schedule, as well as almost $1 billion in commerical debt. In 1984 debt servicing probably amounted to less than 5 percent of China's export earnings. In 1983 foreign investment in China almost quadrupled the level of 1980, the first year any significant amount came in. This probably was not enough, however, to offset the heavy outflow of Chinese investment funds, particularly to Hong Kong.

China's change in status from net debtor to creditor stems both from Beijing's readjustment policy and from stringent foreign exchange control measures established in early 1981. The decline in imports of capital goods mainly reflects reductions in investment in heavy industry. State budget deficits have reinforced the cutbacks in capital imports: in some cases domestic funds have not been sufficient to pay for the local costs of imported plants.

Central regulations controlling foreign exchange have added to the growing reserves. Beginning in March 1981 Beijing required all domestic enterprises to deposit their foreign earnings with the Bank of China rather than in foreign banks. China's regulations further required enterprises to repay hard currency loans in hard currency. Imports by Chinese firms are thus largely limited by the value of their own exports; surplus foreign exchange can be sold to other enterprises, but in the absence of developed capital or foreign exchange markets the regulations help assure a trade surplus. Although the Chinese began to relax their capital controls in 1983, particularly on remittances of foreign partners in joint ventures, they still have far to go. Chinese economists are aware of the irra-

[4] Declared gold reserves amount to 12.7 million ounces, worth $4.9 billion at year-end 1983 market prices.

tionality of holding such a large amount of reserves and have recommended bringing them down to a level commensurate with the level of current account expenditures. One Chinese economist has recommended reducing reserves to about 2 months worth of imports, or roughly $4 billion.[5]

V. The Search for New Export Markets

In 1983, for the second consecutive year, recession and protectionism in the developed West slowed the growth of China's exports. Exports totaled $24 billion, up only 2 percent from the year before. This is far below the 25–30 percent annual growth rates achieved from 1978 to 1981.

Over the next few years China's exports probably will grow at an average annual rate of 10–15 percent, as recovery of the industrialized countries gathers momentum. Agricultural commodities will achieve mixed results, caught between higher world prices and increased domestic demand. Although the long-term outlook for exports from the extractive sector—including minerals, metalliferous ores, coal, and oil—appears to be promising, the near-term prospects are for slow growth. Exports of manufacturers will make the largest gains, as the Chinese continue to substitute exports of processed goods for raw materials wherever possible.

During 1982 and 1983 domestic supply shortages and weak foreign demand hampered Chinese exports to the developed countries. Exports of agricultural commodities, petroleum, and other raw materials have stagnated or declined, due to increasing demands in China and decreasing prices abroad. (See Appendix table 3). Petroleum exports dropped to $4.2 billion in 1983, reflecting price cuts of almost 15 percent. The volume of crude oil exports, however, increased almost 2 percent to 14.8 million tons, an indication that Beijing continues to give high priority to exports despite increased shortages at home.

Inadequate rail and port capacity continues to constrain coal exports. Nevertheless, in 1984 the volume of exports should increase to nearly 7 million metric tons—1 percent of total output. Japanese, European, and US firms are actively negotiating future joint development projects with the Chinese. A major agreement was signed in early 1984 with a US firm concerning the development of China's potentially largest open pit mine—the Pingshuo Mine in Shanxi. Exports from the Chinese mines, however, will not come on stream until 1986 or 1987.

The Chinese have attempted to increase export earnings from their manufactures by moving into higher value added lines. Partly this has been in response to volume quotas and other quantitative restrictions on imports from China in the West, which force the Chinese to export better quality, higher priced goods than they otherwise would. But the Chinese are also trying to increase their gains from trade by moving into exports that reflect their comparative advantage in labor-intensive products. By branching into industries that require large inputs of manual labor, they hope to absorb some of the large number of unemployed into the work-

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[5] Ding Ning Zhong Guo Jin Rong (China's Banking), Beijing, 4 January 1984, pp. 55–56.

force. Disguised unemployment among the urban labor force of 114 million people probably is much larger than the offical unemployment figure of 2.6 percent reported at the end of June 1983.

To compensate for declining exports to the developed West, Beijing has tried to open up new markets in the Middle East, the Soviet Union, Eastern Europe, and Latin America. In Eastern Europe and the USSR the Chinese have found trade partners that are eager to obtain cheap textiles and consumer goods that have been restricted in the West. Trade with the U.S.S.R. increased 110 percent in 1983 and was scheduled to double again in 1984. Nevertheless this trade is only one-seventh as large as Sino-US trade.

Brazil catapulted into the ranks of China's top ten trading partners in 1983 as Chinese exports—primarily crude oil—soared to nearly $600 million. (See tabulation.) In 1984 several trade missions exchanged visits and trade for the year probably will have exceeded $1 billion. In August 1984 China and Brazil initialed a nuclear cooperation agreement.

CHINA: TOP TEN TRADE PARTNERS, 1983

[Millions of U.S. dollars, FOB]

Rank	Country	Value
1	Japan	9,764
2	Hong Kong	8,341
3	United States	4,425
4	West Germany	1,743
5	Jordan	1,527
6	Canada	1,389
7	Singapore	1,001
8	Brazil	856
9	France	827
10	USSR	648

VI. A Resumption of Foreign Purchases

In 1983 imports rose 10 percent to $18.4 billion, after bottoming-out in 1982. In contrast to 1982, when foodstuffs—chiefly grain and sugar—were the only major category of imports to increase, China significantly stepped up imports of industrial supplies and capital goods. Imports will undoubtedly accelerate in the next few years, with growth on the order of 20–25 percent per year. Capital goods will experience the largest gains, industrial supplies will show growth in selective areas, but agricultureal imports will continue to decline.

Favorable weather patterns and agricultural reforms have led to three consecutive years of bumper harvests, reducing the overall need for imports of agricultural commodities. Furthermore, the Chinese are reducing acreage sown to food-grains in order to increase the output of commercial crops such as cotton and oilseeds. These adjustments are having a major impact on China's agricultural trade. In 1983, for example, China cut back substantially on cotton imports and actually began exporting for the first time. (See Appendix table 4). Within the next few years China probably will emerge as an important cotton exporter, a development which could hurt U.S. exports, especially to major Far Eastern markets.

Grain imports dropped from 15.4 million tons in 1982 to 13.5 million in 1983, in part because of increasing supplies at home.[6] Of those totals, U.S. sales fell from 8.5 million tons to 3.8 million—a loss of 4.7-million tons worth more than $700 million—as China stopped purchasing from the U.S. and switched to Argentina and Canada during the dispute over U.S. quotas on imports of Chinese textiles. Thus, in 1983 shipments fell 2.2 million tons short of the 6 million ton minimum required under the U.S.-China long-term grain agreement.

Three factors explain the fall in U.S. shipments: lower, import demand, the textile dispute, and price cutting by France and Argentina, trying to move their large stocks of wheat.[7] If the United States had held its market share, exports would have dropped by about 1 million tons, or $150 million, because of the fall in total Chinese imports of grain. But the U.S. share of China's grain imports also fell, from 55 percent in 1982 to only 28 percent in 1983. The fall in exports associated with this lower share—about $550 million or 3.7 million tons—represents the combined effects of price cutting and the textile dispute. The largest part of this $550 million drop—roughly $300 to $400 millon—is the result of the dispute, because without the dispute China probably would have bought at least the 6-million ton minimum.

Imports of most industrial supplies picked up substantially in 1983, reflecting increases in domestic economic activity and growing domestic shortages. Steel imports nearly doubled to 9.9 million metric tons as China surpassed the United States as Japan's number one customer. Imports of copper, aluminum, nickel, and zinc also made impressive gains. Record imports of logs and plywood, two-thirds of which came from the United States, reflected the speed-up in Chinese construction activities. Aside from its lumber sales, however, overall the United States was one of the few countries that did not benefit from China's increased purchases of industrial supplies, perhaps the result of an exceptionally strong U.S. dollar.

Recovery of investment in China has resulted in a resurgence of capital equipment imports, which increased to $5.2 billion in 1983, up 36 percent over 1982. Transportation equipment, especially, had a banner year, and this resulted in an upturn in U.S. sales of aircraft and trucks. U.S. exports of computers, telecommunications equipment, machine tools, medical electronic apparatus, and heavy construction equipment also benefitted. Associated with the jump in capital equipment purchases has been a Chinese push to obtain pure technology. Recently the Chinese have purchased know-how in such diverse areas as: tree cultivating, insecticide chemistry, water control, food preservation, coal excavating and gasification, building materials research, iron ore dressing, large-scale integrat-

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[6] China's domestic crop reached a record 387 million tons—a 34 million ton increase over 1982.

[7] The ideas expressed in this paragraph are from U.S., Department of Agriculture, Economic Research Service, *China: Outlook and Situation Report,* June 1984, p. 14. Data have been revised and updated, however.

ed circuits, cargo handing, birth control, disease treatment, environmental protection, and energy conservation.

China's capital equipment imports probably will climb 50 to 70 percent in 1984. Transport equipment purchases, in particular, have surged ahead, boding well for the United States in such areas as jet aircraft, helicopters, locomotives, marine radar, and support vessels. Imports of mining and constuction equipment, fueled by the offshore drilling activity, have also taken a leap forward. Imports of oil industry equipment, such as production platforms for the Bohai Bay and South China Sea, are increasingly being paid for by for foreign joint venture firms and thus do not represent a major drain on China's foreign exchange reserves.

Imports of military equipment and weapons may also increase, depending in large part on United States and other Western countries' willingness to sell. Although China's long-term commitment to military self-sufficiency remains firm, in the short run the Chinese now appear more willing to buy some items outright.

VII. Foreign Investment

Beijing's past progress in attracting foreign investment has been slow, in part, because of an uncertain commitment among Chinese leaders and planners on the extent of incentives that should be offered to foreign companies. Other obstacles to success included China's inexperience, its need to develop credibility in relationships with foreign businessmen, its lack of adequate infrastructure, problems with labor productivity and wages, and the lack of detailed regulations on taxes and remittances of profits.

Beginning in 1983, however, Beijing made a range of concessions in a bid to gain more foreign participation in modernizing the economy. Scores of new laws have been released to attract or protect the foreign investor. In September, China issued regulations to clarify its 1979 Joint Venture law. The rules offered longer tax holidays, increased opportunities to sell the output of the venture in the domestic Chinese market, and more decision-making autonomy for the venture. Early in 1984 China introduced new tax rules that exempt joint ventures from import duties and abolish certain industrial taxes on ventures that import advanced machinery and technology. In April 1984 the National People's Congress (NPC) formally ratified Deng's decision to open fourteen additional port cities and Hainan island to foreign investment, giving entrepreneurs many of the advantages available in the Special Economic Zones. The NPC also endorsed laws clarifying the legal status of totally foreign owned companies in China.

At the end of 1983 there were 188 "equity" and 1,047 "contractual" joint ventures in China.[8] In addition there were 18 coopera-

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[8] From a Western viewpoint, both forms of joint ventures, as well as joint oil exploration agreements and wholly-owned foreign subsidiaries, are considered direct foreign investment. Other forms of business arrangements, such as licensing, processing, and compensation trade agreements, are not treated as foreign investment since no foreign claims on real assets located in China exists. The Chinese, however, use the term "foreign investment" loosely to refer to all forms of foreign participation, even including loans to Chinese enterprises. The Chinese appear to use the term "cooperative production agreement" synonymously with contractual joint ven-

Continued

tive projects for prospecting and exploitation of offshore oil. Total paid-in foreign investment on these three forms of direct investment amounted to approximately $1.5 billion (for the most part, this was consistent with standard Western definitions of direct foreign investment; see footnote 8 above). Of that total about $380 million is located in the four Special Economic Zones, with the bulk in Shenzhen, on the Hong Kong border. If licensing agreements, processing and compensation trade, and wholly-owned foreign subsidiaries are included in the totals, in accord with Chinese practice (as shown in the tabulation below), total paid-in foreign investment amounted to $2.3 billion through the end of December 1983.

CHINESE DATA ON DIRECT FOREIGN INVESTMENT

[Millions of U.S. dollars; yearend]

Type	Pledged			Paid-in	
	1981	1982	1983	1982	1983
Total	2,846	4,958	6,600	1,769	2,345
Equity joint ventures	88	141	340	103	166
Contractual joint ventures	1,800	2,726	2,900	530	730
Joint oil exploration	498	999	2,000	486	651
Compensation trade	460	725	930	413	542
Other businesses [1]		367	420	237	254

[1] Including wholly owned foreign enterprises and licensing agreements.

As of November 1983, American investors had spent $406 million on 23 joint projects in China. There were 16 equity joint ventures involving $91 million, one $10 million cooperative management project, and eight agreements for joint exploitation of offshore oil worth $305 million. The three largest non-oil Sino-American joint ventures are the Great Wall Hotel with U.S. participation of $35 million, the Jianguo Hotel with U.S. assets of $11 million, and American Motors' Beijing Jeep Corporation with $16 million in U.S. assets.

China's competitive offshore leasing program got underway in 1983 with signings of exploration and development contracts by 27 foreign oil companies, including ten U.S. firms. Drilling began in 1984 on most of the blocks, which are located in the Yellow and South China Seas. China expects to sink as much as $20 billion into offshore-oil exploration and development by 1990.

Exploration work continued in 1983 in offshore areas previously leased to Japanese, French, and U.S. firms. The Japanese have had success exploring in the Bohai and will soon begin development of at least one field. Atlantic Richfield found a commercially viable natural gas field in its concession south of Hainan, but the discovery was marred by the subsequent loss of the drill ship—and its 80

ture. From a Chinese legal viewpoint there are three chief distinctions between contractual and equity joint ventures. Equity joint ventures:

(a) fall under the Joint Venture Tax law (a flat 33 percent tax), whereas contractual ventures are taxed on a graduated basis under the Foreign Enterprise Income Tax;

(b) share profits in proportion to equity participation, whereas contractual joint ventures share profits according to a ratio agreed to in the contract;

(c) form new legal entities with their own boards of directors, whereas contractual joint ventures are managed directly by their parent corporations.

member American-Chinese crew—in an October typhoon. ARCO has urged China to use the gas from this field to produce fertilizer on Hainan island. If approved, the fertilizer plant would be the largest in the world.

The Chinese have also signed preliminary agreements with foreign investors for the Guangdong nuclear power plant and for development of the Pingshuo and Jungar open pit coal mines. In mid-1984 they were in the process of arranging financing for these projects and work could begin by early 1985.

Despite the obstacles to foreign investment posed by differences in economic environments and investment philosophies between China and the West, China's efforts to attract foreign investment have been relatively successful. Foreign investment in China at year-end 1983 was on a par with that of South Korea, just slightly below that of Taiwan, and about one-quarter the level of the other Asian NICs—Hong Kong and Singapore—and Indonesia. (See tabulation). By mid-year 1984, however, foreign investment in China—led by exploration for offshore oil—probably surpassed that of South Korea or Taiwan.

DIRECT FOREIGN INVESTMENT, PAID-IN, FOR SELECTED EAST ASIAN COUNTRIES

[Billions of U.S. dollars, year-end 1983]

China	1.5
South Korea	1.5
Taiwan [1]	1.5-2.0
Indonesia [2]	5.1
Hong Kong [3]	6.0-8.0
Singapore [3]	5.0-7.0

[1] Estimated from data on commitments.
[2] Excluding offshore oil.
[3] Estimated from official data on investment in the manufacturing sector and from other indicators.

VIII. Foreign Debt

The Chinese have used very little of the $27 billion in commercial and government-supported credit lines they arranged in 1979. Fiscal conservatism and cutbacks in capital expenditures, rather than the previous ideological aversion to foreign debt, have left little need for these loans.

At the end of 1983 China's total debt stood at $5.7 billion. This was a mixture of commercial and official loans, with a wide range of maturities. From 1981 to 1983 commercial borrowing was cut back sharply and in early 1984 it accounted for less than one-fourth of total debt. China was seeking only concessionary loans and avoided incurring commercial debt for all but short-term trade financing.

During 1983 Beijing and Tokyo concluded an agreement extending an addtional $2 billion in Overseas Economic Cooperation Fund loans to cover seven major development projects in China, including three ports, two railroads, a hydroelectric power station, and the Tianjin-Shanghai-Guangzhou telephone network. The loans can be drawn over the next five years, carry a 3.5 percent interest rate, and allow repayments over 20 years, following a 10 year grace period. This surpasses the $1.5 billion in OECF funding that Tokyo provided to China under an agreement signed in 1980, covering the electrification of the Beijing-Qinhuangdao Railroad, construction of coal terminals at Qinhuangdao and Shijiu, and completion of the Yanzhou-Shijiusuo Railroad.[9]

In March 1984 China also asked the Export-Import Bank of Japan to extend a second five-year untied loan totaling $3 billion to help develop three onshore oilfields—Dakong, Liaohe and Daqing—and the Jungar coal project in Inner Mongolia. An agreement on these loans was expected by the end of 1984. China's long term oil development plans envisage an increase in oil production from 106 million metric tons in 1983 to 150 million tons by 1990 and further to 200 million by the year 2000. Under the first five-year agreement with the Bank of China, signed in May 1979, the Ex-Im Bank pledged to extend a loan totaling 420 billion Yen ($2 billion at the exchange rate at the time of signing), carrying an interest rate of 6.25 percent and repayable in 15 years after completion of the projects involved. The loan was intended to help finance seven coal and three oil development projects. By March 1984 Beijing had drawn down the balance of the loan.

The Chinese have also obtained commitments for over $1.9 billion from the World Bank. The loans will cover 18 projects, including four for energy, two for communications development, four for agriculture, and the rest for education and medicine. Loans for energy account for 27 percent of the total, those for communications account for 18 percent, and those for educational projects account for 22 percent. Of the total, the IBRD has contributed $1,178 million and the IDA has contributed $734 million. Only a small fraction of the loans have been drawn. While these loans might appear, at first glance, to "crowd out" commercial lending, this probably is not the case, since most of them are for infrastructural projects that do not provide high or immediate returns and thus would not be attractive to commercial lenders.

In 1984 Hua Guofeng created headlines with his announcement in Tokyo that China intended to obtain about $50 billion in foreign funds over the course of the Seventh five-year plan. His estimate, however, was based on China's capacity to repay the loans from current account earnings during the plan period, not on a summation of China's import needs. While the Chinese continue to put primary emphasis on not becomming overindebted to foreign countries, Hua's statement, nevertheless, is an indication of the magnitudes under consideration. Once China has exhausted all available concessionary financing, it will need to tap the commercial markets in a big way—or accept much larger levels of foreign investment—if it is to complete its ambitious development plans.

[9] Under the original OECF package two other projects had been included—the Mount Dayao tunnel on the Henyang-Guangzhou Railroad and the Wuqiangxi hydroelectric power station. These projects were postponed in order to provide $430 million in commodity loans to fund the local costs of the first stage of the Daqing Petrochemical and Baoshan Steel plants.

APPENDIX

TABLE 1.—CHINA: EXPORTS, F.O.B., BY AREA AND COUNTRY[1]

[Millions of U.S. dollars]

	1970	1978	1979	1980	1981	1982	1983
World	2,156	10,086	13,718	18,875	21,495	23,467	23,983
Non-Communist countries	1,676	8,522	12,018	16,987	20,252	22,228	22,691
Developed countries	658	3,776	5,643	8,268	10,043	10,225	9,943
East Asia and Pacific	282	2,107	2,993	4,422	5,406	5,443	5,108
Australia	35	140	166	244	340	319	230
Japan	242	1,948	2,793	4,139	5,032	5,082	4,846
North American	18	406	737	1,188	2,058	2,440	2,451
Canada	18	83	143	132	183	165	200
United States	0	324	594	1,056	1,875	2,275	2,252
Western Europe	358	1,262	1,912	2,654	2,579	2,342	2,383
Belgium	9	39	67	165	150	121	100
France	61	196	284	406	443	380	377
West Germany	73	319	464	703	669	610	668
Italy	55	174	344	380	349	372	360
Netherlands	23	109	136	237	214	168	156
Spain	1	59	115	102	96	87	73
Sweden	16	48	68	93	86	76	67
Switzerland	16	44	48	67	68	63	65
United Kingdom	70	186	255	316	317	295	306
Less developed countries	1,018	4,747	6,375	8,719	10,209	12,003	12,748
Southeast Asia	715	3,197	4,271	6,262	7,348	7,901	8,100
Hong Kong	467	2,249	3,021	4,401	5,264	5,430	5,846
Indonesia	31	116	125	189	242	227	230
Malaysia	71	211	212	241	261	264	253
Philipines	NA	112	121	210	200	212	91
Singapore	120	326	392	599	736	839	788
Thailand	NA	80	230	396	306	278	216
South Asia	73	158	263	340	360	331	295
Bangladesh	NA	42	65	95	108	103	68
Pakistan	26	79	117	160	172	142	140
Sri Lanka	46	28	64	49	37	40	40
Middle East	77	565	762	1,054	1,173	2,422	2,675
Kuwait	19	92	125	140	132	120	124
Saudi Arabia	NA	90	128	238	229	223	224
Syria	8	47	47	50	71	65	105
United Arab Emirates	6	74	106	129	141	79	82
North Africa	43	157	174	126	185	287	415
Egypt	13	52	30	27	54	49	50
Sub-Sahara Africa	102	533	619	449	519	526	545
Nigeria	18	187	260	51	41	44	455
Sudan	11	47	44	47	50	40	41
Zambia	3	8	2	16	2	2	3
Latin America	7	126	286	437	624	536	718
Argentina	1	2	11	30	20	9	3
Brazil	0	4	86	239	360	333	577
Chile	0	11	24	19	32	20	8
Mexico	0	27	40	60	105	59	12
Communist countries	480	1,563	1,700	1,888	1,243	1,209	1,292
USSR	22	257	241	230	132	143	308
Eastern Europe	255	982	1,076	1,180	746	659	602
Czechoslovakia	25	136	117	119	82	72	79
East Germany	36	138	190	169	101	69	61
Hungary	11	66	53	53	44	26	26
Poland	24	91	105	129	63	178	144

TABLE 1.—CHINA: EXPORTS, F.O.B., BY AREA AND COUNTRY [1]—Continued

[Millions of U.S. dollars]

	1970	1978	1979	1980	1981	1982	1983
Romania	62	415	524	626	398	275	253
Yugoslavia	2	70	48	49	31	18	16
Other	203	324	384	478	365	407	382

[1] Data are reconstructed from various issues of Central Intelligence Agency, "China: International Trade". Data are rounded to the nearest $1,000,000. Components may not add to total because of rounding. Only major trade partners are shown within any trade region.

TABLE 2.—CHINA: IMPORTS, FOB, BY AREA AND COUNTRY [1]

[Millions of U.S. dollars]

	1970	1978	1979	1980	1981	1982	1983
World	2,044	10,321	14,283	19,180	17,941	16,689	18,399
Non-Communist countries	1,655	8,784	12,442	17,236	16,669	15,021	16,678
Developed countries	1,372	7,268	10,168	13,514	12,739	10,804	11,712
East Asia and Pacific	702	3,622	4,539	6,066	5,838	4,446	5,409
Australia	129	484	776	796	639	838	393
Japan	569	3,074	3,674	5,109	5,076	3,500	4,918
North America	135	1,307	2,230	4,497	4,379	3,917	3,362
Canada	135	442	507	742	776	1,005	1,189
United States	0	865	1,724	3,755	3,603	2,912	2,173
Western Europe	534	2,338	3,398	2,951	2,523	2,441	2,941
Belgium	23	205	129	104	116	203	220
France	81	199	339	303	274	336	450
West Germany	167	995	1,492	1,145	1,017	853	1,075
Italy	57	188	278	254	331	210	264
Netherlands	22	135	159	147	98	66	133
Spain	1	66	128	64	74	112	109
Sweden	22	83	114	83	68	60	113
Switzerland	21	95	119	139	123	128	124
United Kingdom	107	176	453	394	252	178	244
Less developed countries	283	1,516	2,274	3,722	3,930	4,217	4,966
South East Asia	55	387	883	1,975	2,526	3,087	3,200
Hong Kong	10	63	382	1,249	1,956	1,954	2,495
Indonesia	0	0	0	0	8	15	18
Malaysia	22	110	182	217	88	110	163
Philippines	0	47	51	45	778	105	26
Singapore	23	58	170	308	479	240	213
Thailand	0	77	77	124	186	397	94
South Asia	82	132	123	368	410	245	257
Bangladesh	0	24	19	31	19	26	20
Pakistan	39	31	25	221	272	145	146
Sri Lanka	42	61	55	50	45	8	16
Middle East	26	156	191	432	159	187	132
Kuwait	0	23	27	133	43	0	0
Saudi Arabia	0	0	1	7	0	0	0
Syria	16	33	30	50	25	11	44
United Arab Emirates	0	0	0	0	0	0	0
North Africa	33	109	78	75	93	76	98
Egypt	18	65	31	56	68	35	40
Sub-Sahara Africa	82	173	235	244	187	151	174
Nigeria	1	7	11	4	0	0	0
Sudan	18	40	92	50	34	43	0
Zambia	48	25	44	82	13	12	14
Latin America	4	559	765	629	555	471	1,104
Argentina	2	62	193	189	92	137	616
Brazil	1	129	118	72	104	86	279
Chile	0	30	97	105	61	62	40

TABLE 2.—CHINA: IMPORTS, FOB, BY AREA AND COUNTRY [1]—Continued

[Millions of U.S. dollars]

	1970	1978	1979	1980	1981	1982	1983
Mexico	0	124	114	93	170	87	54
Communist countries	389	1,537	1,841	1,943	1,272	1,668	1,721
USSR	25	242	268	294	116	165	340
Eastern Europe	225	968	1,210	1,216	701	927	865
Czechoslovakia	31	126	117	85	70	185	94
East Germany	42	182	190	259	113	134	173
Hungary	8	58	68	54	34	34	45
Poland	26	98	148	109	40	98	52
Romania	72	374	580	574	396	382	378
Yugoslavia	4	35	41	104	22	49	72
Other	139	327	363	435	455	576	516

[1] Data are reconstructed from various issues of Central Intelligence Agency, "China: International Trade." Data are rounded to the nearest $1,000,000. Components may not add to total because of rounding. Only major trade partners are shown within any trade figure.

TABLE 3.—CHINA: COMMODITY COMPOSITION OF EXPORTS, F.O.B. BY SECTOR OF ORIGIN [1]

[Millions of U.S. dollars]

	1970	1978	1979	1980	1981	1982	1983
Total	2,155	10,085	13,720	18,875	21,495	23,436	23,983
Agriculture	1,005	3,205	3,865	4,664	5,126	5,068	5,170
Of which:							
Live animals	65	255	250	340	376	383	339
Meat & fish	155	525	635	532	796	740	733
Grain	115	350	335	483	511	495	559
Fruit & vegetables	175	580	720	935	1,047	1,038	1,032
Tea & spices	NA	230	315	282	304	393	342
Oilseeds	65	95	200	186	523	247	330
Natural textile fibers	105	400	510	544	510	562	618
Crude animal materials	120	375	445	538	456	464	475
Extractive	115	1,325	2,055	3,592	3,966	4,052	3,916
Of which:							
Crude minerals	NA	140	185	267	258	290	288
Coal	NA	100	175	249	267	325	582
Crude Oil	0	1,015	1,575	2,858	3,130	3,300	2,920
Manufacturing	1,035	5,555	7,795	10,619	12,403	14,316	14,897
Of which:							
Petroleum products	0	235	605	1,261	1,366	1,627	1,431
Chemicals	110	475	800	1,181	1,330	1,304	1,313
Textile yarn and fibrics	350	1,685	2,225	2,756	3,083	2,940	3,332
Nonmetallic mineral products	NA	255	305	416	473	466	434
Iron and steel	40	165	210	251	445	473	277
Nonferrous metals	25	125	140	203	234	221	172
Machinery	60	275	380	529	675	678	729
Transport equipment	30	50	70	78	135	108	105
Clothing	160	730	1,115	1,653	2,093	2,440	2,787
Handicrafts	NA	425	575	774	826	872	901
Military firearms	NA	NA	NA	0	4	1,290	1,429

[1] Data are reconstructed from various issues of Central Intelligence Agency, "China: International Trade" (Quarterly Reviews and annual handbooks). Data for 1970–1979 are rounded to the nearest $5 million. All other data are rounded to the nearest $1 million.

TABLE 4.—CHINA: COMMODITY COMPOSITION OF IMPORTS, F.O.B. BY END USE [1]

[Millions of U.S. dollars]

	1970	1978	1979	1980	1981	1982	1983
Total	2,045	10,320	14,285	19,180	17,941	16,689	18,399
Foodstuffs	360	1,365	1,885	3,033	3,234	3,573	2,502
Of which:							
Grain	255	965	1,430	2,225	2,341	2,447	1,607
Sugar	75	265	200	300	472	609	399
Oilseeds	5	35	115	181	157	80	45
Consumer durables	15	110	310	620	852	656	640
Of which:							
Watches	5	40	135	86	175	115	120
TVs, radios	0	5	145	287	394	132	150
Industrial supplies	1,330	6,845	8,395	9,887	8,900	8,865	10,313
Of which:							
Natural textile fibers	85	695	995	153	169	174	176
Synthetic textile fibers	15	175	155	1,625	1,515	1,089	922
Synthetic textile fabrics	40	210	310	508	778	341	251
Paper and paperboard	15	95	160	354	244	165	175
Rubber	75	190	310	423	217	237	249
Petroleum and products	NA	55	40	31	56	28	46
Fertilizer, manufactured	130	430	615	969	759	594	554
Plastic materials	25	130	150	369	478	617	572
Metalliferous ores	NA	160	140	127	74	93	104
Iron and steel	370	2,870	3,310	2,215	1,321	1,880	3,065
Nonferrous metals	190	410	490	411	165	434	717
Metal products	NA	115	175	363	354	172	233
Capital goods	340	2,000	3,695	5,640	4,955	3,595	4,944
Of which:							
Machinery	180	955	2,300	3,862	3,893	2,226	2,908
Transport equipment	145	945	1,245	1,490	703	1,054	1,513
Precision instruments	15	85	150	288	360	315	523

[1] Data are reconstructed from various issues of Central Intelligence Agency, "China: International Trade" (Quarterly Reviews and annual handbooks). Data for 1970–1979 are rounded to the nearest $5 million. All other data are rounded to the nearest $1 million.

TABLE 5.—CHINA: BALANCE OF PAYMENTS [1]

[Billions of U.S. dollars]

	1978	1979	1980	1981	1982	1983
Current account	0	−1.1	−1.0	3.3	7.7	5.4
Trade balance	−0.2	−0.9	−0.3	3.6	6.7	5.6
Exports, f.o.b.	10.1	13.7	18.9	21.5	23.4	24.0
Imports, f.o.b.	−10.3	−14.3	−19.2	−17.9	−16.7	−18.4
Service, net	−0.4	−0.8	−1.3	−0.9	0.4	−0.7
Earnings, total	1.0	1.7	2.5	3.2	3.6	3.9
Freight and insurance	.2	.4	.7	1.1	1.0	1.0
Port dues, ship chandler- ing, etc.	.2	.3	.4	.4	.4	.4
Passenger services	Negl	Negl	.1	.1	.1	.2
Travel receipts	.2	.4	.5	.7	.7	.8
Interest	.2	.3	.5	.7	1.0	1.3
Other	.2	.3	.3	.2	.4	.2

TABLE 5.—CHINA: BALANCE OF PAYMENTS [1]—Continued

[Billions of U.S. dollars]

	1978	1979	1980	1981	1982	1983
Expenditures, total	−1.4	−2.6	−3.7	−4.1	−3.1	−4.6
Freight and insurance	−.6	−.9	−1.3	−1.4	−1.1	−1.4
Port dues, ship chandlering, etc.	−.2	−.4	−.6	−.7	−.6	−.7
Passenger services and travel abroad	Negl	Negl	Negl	−.1	−.1	−.1
Interest	−.2	−.4	−.6	−.8	−.6	−.5
Technology payments	−.2	−.6	−1.0	−.7	−.2	−1.2
Other	−.2	−.4	−.2	−.4	−.5	−.6
Unrequited transfers, net	.5	.6	.6	.6	.5	.4
Credits, total	.6	.7	6.7	.7	.6	.5
Private	.6	.7	.7	.5	.5	.5
Public	0	0	Negl	.2	.1	.1
Debits, total	−.1	−.1	−.1	−.1	−.2	−.2
Private	0	0	Negl	Negl	Negl	Negl
Public	−.1	−.1	−.1	−.1	−.2	−.2
Capital account, excluding reserves	−1.1	2.3	1.6	−.9	−.4	−1.1
Long-term capital, net	−.9	.7	1.5	.1	−.3	−1.0
Direct investment	−.1	−.1	0	.2	.1	−.4
Abroad	−.1	−.1	−.1	−.1	−.4	−.8
At home	0	0	.1	.3	.5	.4
Portfolio investment	0	0	0	Negl	Negl	−.3
Drawings on loans received	.1	1.4	2.5	1.6	2.4	1.5
Official loans	0	0	Negl	Negl	.3	.3
Energy loans from Japan Ex-Im	0	0	.4	.5	.2	.2
Buyers credits	0	Negl	.1	.2	.3	.3
Supplier credits	0	0	.2	.4	1.4	.5
Interbank loans	0	1.3	.3	Negl	Negl	Negl
Non-bank borrowing	0	0	.2	.1	.1	.1
Payments due for processing arrangements	0	0	.3	.1	.1	.1
Other	.1	.1	1.0	.3	0	0
Repayment of loans received	−.9	−.6	−1.0	−1.7	−2.8	−1.8
Buyers credits	0	0	0	Negl	Negl	Negl
Supplier credits	0	0	−.4	−.4	−1.0	−1.0
Interbank loans	0	0	−.2	−.8	−1.1	−.5
Non-bank borrowing	0	0	0	−.1	−.1	−.1
Payments due for processing arrangements	0	0	−.1	−.1	−.1	−.1
Other	−.9	−.6	−.3	−.3	−.5	−.1
Short-term capital, net	−.2	1.6	.1	−1.0	Negl	−.1
Supplier credits received	Negl	.4	.2	.1	.2	NA
Supplier credits extended	Negl	Negl	−.2	−.7	−.3	NA
Bilateral payment agreements assets	−.4	−.1	−.1	−.1	−.1	−.1
Short-term bank borrowing	.2	1.2	.1	−.5	.1	NA
Reserves [2]	.7	−.6	−.2	−1.8	−6.3	−4.0

TABLE 5.—CHINA: BALANCE OF PAYMENTS [1]—Continued

[Billions of U.S. dollars]

	1978	1979	1980	1981	1982	1983
Monetary gold	Negl	Negl	Negl	.1	Negl	Negl
Special drawing rights	0	0	.1	Negl	.1	−.1
Reserve position in IMF	0	0	−.2	.2	0	−.2
Use of IMF credit	0	0	0	.5	Negl	−.5
Foreign exchange assets	.8	−.6	−.1	−2.5	−6.4	−3.2
Net errors and omissions	.4	−.6	−.4	−.6	−1.2	−.3

[1] Data are from Central Intelligence Agency "China: International Trade," various quarters; Wharton Econometric Forecasting Associates, Centrally Planned Economies Balance of Payments and Debt Report, People's Republic of China, 25 April 1984, Section 3, pp. 2–6, and for 1983, author's own estimates.

[2] Negative indicates an increase.

UNITED STATES–CHINA TRADE

By Helen Louise Noyes*

CONTENTS

I. SUMMARY

US-China trade ties have expanded fairly steadily since 1971 to the point that the US is now China's third largest trade partner and a major source of the technology, investment, and services needed for Chinese economic development.

Textile products traditionally have dominated Chinese exports to the United States; through mid-year 1984, they have accounted for nearly half of total sales. Because of tightening world restrictions on textile trade, China is trying to diversify its export product lines, but has not yet been very successful. Exports of oil, oil products, and pharmaceuticals have increased substantially, but growth in sales of most other goods have been less dramatic. However, Chinese purchases of US goods have changed character. Once predominantly raw materials—textile fibers, grain, wood, chemicals—an in-

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creasing share of US exports to China is industrial machinery and other finished manufactures, technologies, and services.

Over the next several years, Sino-US trade will probably be bolstered by the imports and exports that are generated by American investments in China and by projects using US technologies. However, although China will continue to try to expand its variety of exportable commodities and to find alternative markets, sales of textile products will probably still be China's principal source of foreign exchange, and the US and other OECD countries its principal markets.

Problems with trade barriers will therefore continue to plague the US-China relationship, and market access will be the preeminent issue to be faced over the next few years. Chinese exports will continue to test trade barriers and additional US restrictions may spark selective embargoes of US products. Beijing will also press Washington to eliminate other obstacles to closer economic ties, including agreement on or implementation of bilateral pacts regarding taxation, investment, and nuclear and other technology controls. In addition, China will continue to emphasize the present inability of the US to provide concessional loans competitive with those available from Japan, Belgium and others.

II. United States-China Trade Patterns

China and the United States established trade relations in 1972. Initially, two-way trade soared due to China's large purchases of grains and cotton, but then it slumped during the uncertainties of the mid-1970s (see Table 1). Trade accelerated rapidly after 1977, peaking in 1981 at nearly $5.5 billion. The US share of China's total trade reached about 14 percent in 1981, but fell to 10.4 percent in 1983. Only Hong Kong and Japan enjoy larger shares of China's trade.

CHINA'S EXPORTS TO THE UNITED STATES

The United States absorbs about 10 percent of China's total exports, ranking third behind Hong Kong (24 percent) and Japan (20 percent). US purchases of Chinese goods increased steadily from 1972 to 1982 and contracted slightly in 1983. Planning Minister Song Ping told the National People's Congress in May 1984 that total trade that year would fall 5.1 percent. Exports probably would bear the brunt of any trade decrease. Increased domestic demand and China's $16 billion in foreign exchange reserves have combined to relax the pressure to export. Beijing's attempts to reassert some central guidance over trade could also cause a contraction in exports.

TABLE 1.—SINO-UNITED STATES TRADE BALANCES, 1972–83

[Million US dollars, FOB]

	Two-way total	Chinese exports	Chinese imports	Chinese surplus or deficit	Chinese cumulative deficit
1972	92	32	60	−28	−28
1973	802	61	741	−680	−708
1974	931	112	819	−707	−1,415

TABLE 1.—SINO-UNITED STATES TRADE BALANCES, 1972-83—Continued

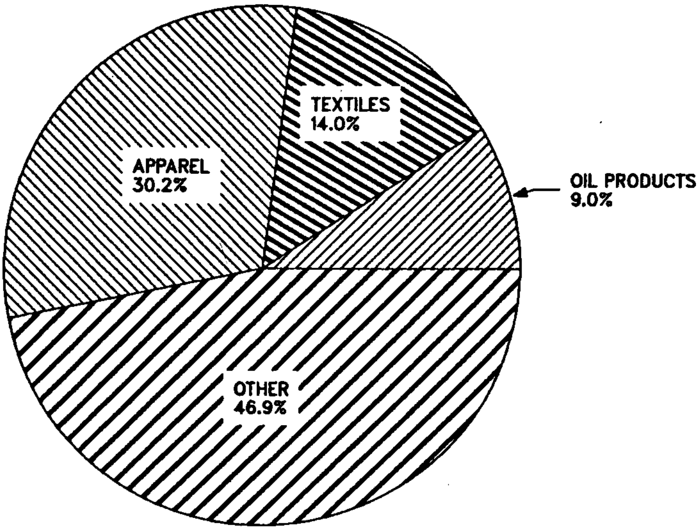
[Million US dollars, FOB]

	Two-way total	Chinese exports	Chinese imports	Chinese surplus or deficit	Chinese cumulative deficit
1975	460	156	304	−148	−1,563
1976	337	202	135	67	−1,496
1977	374	203	171	32	−1,464
1978	1,189	324	865	−541	−2,005
1979	2,318	594	1,724	−1,130	−3,135
1980	4,814	1,059	3,755	−2,696	−5,831
1981	5,478	1,875	3,603	−1,728	−7,559
1982	5,187	2,275	2,912	−637	−8,196
1983	4,425	2,252	2,173	79	−7,797
1984 January-June	2,644	1,482	1,162	320	−7,805

Note: US Customs Bureau statistics. Chinese customs statistics do not agree with US data. For example, Chinese customs for 1983 show exports of $1.718 billion and imports of $2.763 billion, for a deficit of $1.045 billion. Chinese data probably include some services and fees that are not counted in US merchandise trade data. In addition, China lists imports CIF, thus including insurance and freight fees that are not included in analogous US FOB export data.

Mid-year 1984 statistics indicate unexpectedly strong growth in sales to American markets, however. The value of Chinese exports in the first six months of 1984 was nearly 40 percent higher than in the same period of 1983. Textile products, including yarns, fabrics and apparel, still dominate China's sales to the U.S. (see the Figure). They averaged 37 percent of total sales in 1978-82, jumped to 45 percent in 1983, and hit 46 percent in the first half of 1984. Beijing has tried to diversify its exports in response to world restrictions on trade in textile products. But so far, diversification of exports to the U.S. has been largely within the textile and apparel sectors—from sensitive categories to those not yet restricted—rather than into other industries. Plans to increase textile export value by selling higher-value products have not yet been successful; the average price per unit has fallen steadily from 1981 through mid-1984.

United States Imports from China
1983



Among other Chinese exports, oil and oil products have gained most significantly in recent years, reaching 19 percent of U.S. imports in 1983 (see Table 2). Also gaining ground are canned vegetables, pharmaceuticals, hand tools, industrial fasteners, furniture, handbags, and housewares. Because China is trying to expand sales of non-oil, non-textile goods and enter new product markets, Chinese exports are becoming more heterogeneous. Its exports to the U.S. are generally more diversified than those of India, Argentina, Yugoslavia and other countries at roughly comparable stages of development. In 1983, the variety of Chinese sales to the U.S. approximated that of South Korea.

Even so, because of the dominance of textile and oil products, U.S. purchases are still more concentrated overall than those of China's major European trading partners. Germany, France and England buy fewer textile and oil products and more foodstuffs, tools and traditional Chinese products than the U.S.

TABLE 2.—HIGHLIGHTS OF CHINA'S EXPORTS TO THE UNITED STATES

[Million U.S. dollars, FAS]

Category	1983		First half, 1984	
	Value	Share (percent)	Value	Share (percent)
Total	2,244	100.0	1,482	100.0
Manufactures	1,026	45.7	689	46.5
Apparel and accessories	774	34.5	499	33.7
Wicker, basketware	58	2.6	35	2.4
Footwear	34	1.5	24	1.6
Fuels	430	19.2	263	17.7
Gasoline	309	13.8	149	10.1
Crude oil	79	3.5	62	4.2
Intermediate manufactures	390	17.4	272	18.4
Textile yarn and fabrics	241	10.7	184	12.4
Chemicals, related products	131	5.8	79	5.3
Fireworks	29	1.3	19	1.3
Pharmaceuticals	25	1.1	13	0.9
Food	112	5.0	78	5.3
Canned vegetables	34	1.5	30	2.0
Tea	10	0.4	8	0.5
Crude materials	97	4.3	55	3.7
Barium sulfate and carbonate	26	1.2	14	0.9
Down and feathers	8	0.3	6	0.4
Machinery, transport equipment	42	1.9	29	2.0
Miscellaneous	10	0.5	12	0.8
Beverages and tobacco	4	0.2	2	0.1
Beer	2	0.1	1	0.1
Animal/vegetable fats, oils	2	0.1	2	0.1

Source: U.S. Customs Bureau.

CHINA'S IMPORTS FROM THE UNITED STATES

Chinese purchases from the US have fluctuated more than sales. They peaked at $3.8 billion in 1980, or 20 percent of China's total imports. By last year, US sales had dropped to $2.2 billion, or 12 percent of China's total. Major trade items over the past decade have been grains, textile fibers (cotton and synthetic), fertilizers, wood and plastics. In recent years, China increased purchases of US industrial machinery, office equipment, and commercial aircraft (see Table 3).

China's imports of US goods have diversified considerably through early 1984, but still are much more concentrated than those of comparably developed countries—only East European imports are less varied. Because of the strong influence of agricultural products in Sino-US trade, China's imports of US goods also tend to be more concentrated than imports from Western Europe or Japan, which feature wide varieties of metallurgical products and manufactured goods.

TABLE 3.—HIGHLIGHTS OF CHINA'S IMPORTS FROM THE UNITED STATES

[Million U.S. dollars, FOB]

Category	1983		First half, 1984	
	Value	Share (percent)	Value	Share (percent)
Total	2,173	100.0	1,162	100.0
Machinery, transport eqpt	586	27.0	284	24.4
Aircraft and parts	235	10.8	49	4.2
Construction, mining eqpt	52	2.4	45	3.9
Office eqpt	52	2.4	34	2.9
Food	541	24.9	284	24.4
Grain	536	24.7	283	24.4
Chemicals	354	16.3	265	22.8
Fertilizers	168	7.7	119	10.2
Plastics	92	4.2	73	6.3
Crude materials	300	13.8	173	14.9
Conifer logs	228	10.5	129	11.1
Manufactures	220	10.1	61	5.2
Aluminum	87	4.0	3	0.3
Paper	41	1.9	22	1.9
Miscellaneous	172	7.9	94	8.1
Electrical meters, controls	92	4.2	46	4.0

Source: US Customs Bureau.

III. Evolving International Trade Ties

China is becoming more active in the world economic scene, expanding its trade and investment linkages and participating more in international economic organizations. Its higher profile has attracted the interest of foreign firms, facilitated trade, and forced, albeit slowly, Chinese accommodations to standard international business practices. A prime area of potential trade growth over the next decade will be that evolving from direct ties between foreign and Chinese firms, such as joint ventures, co-production, and cooperative project development. These arrangements generate both imports—technology, materials, and equipment—and exports.

The Chinese have undertaken several steps to increase foreign participation in their economy through trade and investment. For example, over the past five years, China has:

—opened 19 coastal sites to foreign investment, offering as inducements more liberal business terms than offered elsewhere in China;

—passed laws governing taxation, liability, patent protection, trademarks and investment procedures for foreign firms;

—expanded the array of products of joint Chinese-foreign firms that may be marketed within China;

—held many investment conferences to publicize hundreds of projects for which the Chinese are seeking Western technology, equipment, capital, management, and marketing;

—negotiated tax, investment and other cooperation accords with several countries to clarify such issues as expropriation policy, arbitration procedures, repatriation of profits and labor compensation.

UNITED STATES INVESTMENT IN CHINA

According to *Xinhua* (19 March 1984), by the end of 1983 US firms had signed 20 joint ventures with Chinese firms, worth $85 million, and countless cooperative arrangements (compensation trade, assembly or processing accords, buyback deals). In addition, US firms are involved extensively in China's search for offshore oil, with contracts costing American companies perhaps $250 to $300 million.

Some firms are wary of entering business in China, discouraged by stories of poor business and residential facilities, bureaucratic confusion, and high Chinese fees for labor and services. Over time, operating conditions will improve as China gains experience with Western business practices and refines its legal and bureaucratic structures and as Western businessmen adjust their expectations. More than half of all of China's equity joint venture contracts were signed in 1983, suggesting that investor confidence had increased. An active campaign by the Chinese leadership to encourage foreign investment appears to have helped. The exchange of visits by Premier Zhao Ziyang and President Reagan early this year underscored the positive bilateral relationship and reassured the American business community.

SEEKING TO DIVERSIFY EXPORTS

China's early forays into export expansion have focussed on improving packaging and marketing traditional light industrial products. Early 1984 trade statistics suggest a growing export capability in such product groups as toys, collectibles (coins, antiques), housewares (wicker, china, plasticware), and chemicals. The Chinese, especially through joint foreign-Chinese firms, are actively searching for additional marketing opportunities.

Long-term ambitions.—China has ambitious long-term goals for exports. Vice-Premier Tian Jiyun announced in July 1984 that China gradually will become an exporter of grains, cotton and edible oils.[1] Although China has been able to boost productivity, it is likely that a return to less favorable weather conditions and increases in domestic demand will work against large-scale exports of unprocessed agricultural products.

China's long-term economic plans apparently include substantial growth in machinery and equipment exports as well. Beijing already exports such machinery as basic machine tools and small hydropower generators. Various ministries, corporations, factories, and provinces have developed at least tentative plans to upgrade their manufacturing facilities and to improve quality in order to become competitive in world markets within the next five to fifteen years. Products include machine tools, diesel engines, elevators, and process controls. China is pushing electronics development in particular, driving to double by 1990 the output of semiconductors, communications equipment, computers, and consumer electronics for both domestic use and export.

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[1] Presumably, this means exports in addition to China's normal aid to LDCs.

Coping with trade barriers.—By expanding exports, China will no doubt continue to encounter trade barriers. US, Japanese, and European authorities already have imposed extra import duties or other limitations on some Chinese exports (see Table 4). China's economic reforms stimulated some of these problems. Decentralization of trade responsibilities and emphasis on profitability thrust factories and local trade organizations into international trade activities with which they were unfamiliar. Consequent underpricing of some goods in world markets resulted in antidumping investigations and duties.

TABLE 4.—ITC INVESTIGATIONS OF CHINESE EXPORTS THROUGH MID-1984

Product	Date of ruling	Antidumping duty (percent)
Greige Polyester Printcloth	6 September 1983	22.40
Cotton shop towels	4 October 1983	30.10–37.20
Canned mushrooms	5 October 1983	None
Potassium permanganate	31 January 1984	39.63
Chloropicrin	22 March 1984	58.00
Barium chloride	Pending	
Barium carbonate	6 April 1984	None

Source: Federal Register.

A tightening of trade authority in early 1984 will help eliminate some of the confusion. Nonetheless, China will continue to push into world markets whenever possible, and an expansion of exports on China's part coupled with protectionism among major importing countries promises to produce additional frictions. Beijing will remain highly sensitive about trade restrictions and probably will work with other developing exporters, particularly within the GATT framework, to press for less constrained world trade.

Seeking alternative markets.—As Chinese exports trigger the protection mechanisms of importing countries, China will try not only to diversify its product array but also to diversify its markets. These attempts to expand exports to alternative markets will not relieve trade pressures with the US and other developed importers, however. Many potential cash customers are developing countries that compete with China to export sensitive categories of goods—such as textiles or footwear—to OECD markets and so clearly would not import those goods from China. Consequently, the US and other OECD countries will continue to be China's main buyers, with all the potential for friction that entails.

DIVERSIFYING IMPORTS

China's interests in industrial advancement, export development, and self-reliance will stimulate new import patterns. For example, during the next few years, capital goods and software—designs, blueprints, training—will probably capture a greater share of Chinese imports, while the share taken by agricultural products ebbs.

Import expansion.—China has more than 300,000 industrial enterprises that need at least some capital improvements and massive infrastructural development. More than $16 billion in foreign exchange reserves and additional billions in untapped foreign loans have long suggested an imminent groundswell in capital imports. However, Beijing is wary of another massive surge in plant and equipment purchases like the 1977–78 binge that led to contract cancellations and embarrassment. Thus many of the factory upgrading projects are being undertaken with foreign investment and advice or under the auspices of Western assistance programs. Cumbersome decision-making processes, extensive negotiations, unrealistic demands on foreign firms and time-consuming feasibility studies are slowing the expected pace of equipment purchases.

Import substitution.—Many of China's more massive development projects are ultimately aimed at cutting imports. Over the past decade, China has imported plants, equipment, and technology in order to boost domestic production of many products, led by fertilizers, synthetic fibers, and steels. Agricultural reforms also were designed to bolster production and decrease dependence on imports. China also has opened domestic markets to products of joint ventures in order to reduce imports.

Partly because of the agricultural reforms and also because of good crop conditions, China has enjoyed successive years of record harvests that allowed lower imports of cotton, wheat and soybeans. For most industrial products, however, Beijing's hopes of reducing imports by adding domestic production capacity have been frustrated by rapidly expanding consumption or by unexpectedly slow completion of new facilities. Nonetheless, the import substitution policy has effectively slashed the growth rate of purchases of foreign industrial materials.

Seeking alternative suppliers.—Chinese traders play world markets astutely. Although some orders are placed in the name of friendship or international goodwill, most are based on favorable price, quality, and financing arrangements. In spite of this rationale, Beijing is anxious not to be dependent on any supplier for a particular product.

Concessional financing and transfer of know-how are important criteria in China's selection of suppliers of capital equipment and industrial processes. The Chinese want the latest technologies and, as senior policy advisor Huan Xiang indicated in August 1984, they believe the US will be the world leader in high technology for a long time. Nonetheless, the Chinese also buy older, less technologically advanced plants when they are available. For example, China has purchased a steel products mill, a semiconductor line, and textile mills shut down during the recession of 1982.

IV. Outlook for United States-China Trade

PROSPECTS FOR UNITED STATES FIRMS

Prospects are mixed for long-term involvement in China by US firms. The Chinese generally prefer US technology and industrial equipment, but US firms are handicapped somewhat by the lack of concessional financing and by delays in agreement on or implementation of bilateral pacts regarding taxes, investment, technology controls, and other pertinent business facilitation accords.

The investment outlook.—So far, Chinese officials are disappointed by the reluctance of American companies to invest in China, but the pace should pick up, especially once a bilateral investment treaty is concluded.[2] Beijing is authorizing more jurisdictions to directly negotiate foreign investments, and US firms will doubtless be involved. Most such projects will likely be relatively small, however, and may prove to be only moderately profitable to the average investor.

In contrast, such large-scale Sino-US projects as the Ping-shuo coal contract are likely to be few in number. Because of the size and complexity of this type of project, China can overestimate its ability to meet contractual obligations for infrastructure and other support; financing acceptable to the Chinese can be difficult to arrange; and unfavorable market changes during the prolonged development period can undermine plans to export the product. Other events, though not necessarily directly related, will strongly influence the prospects for future large projects. For instance, if oil companies do not find major offshore deposits within the next few years, their financial losses will dampen the investment environment.

Sales opportunities.—China has a continuing need for foreign guidance, technology and equipment to modernize old industries and develop new ones. In the wake of last year's liberalization of technology controls, some observers speculated that US technology sales could reach $2 billion in 1984 alone. Such estimates must be kept in perspective, however, since these sales would not be reflected in US trade statistics until hardware passes through Customs, and shipments could be drawn out over several years.

China would like to have foreign—especially US—assistance or involvement in nearly every economic sector (see Table 5). In addition to outright, one-time purchases, an increasing share of Sino-US trade stems from long-term or recurrent supply relationships. For example, joint ventures and other investments generate protracted sales of equipment and raw materials to China.

China also will continue to need certain industrial raw materials in spite of plans to replace imports by expanding domestic capacity. For instance, American firms are likely to be a major source of imported fertilizers, as well as other chemical raw materials, especially when world market prices are depressed. The US probably will continue to account for a large share of China's timber imports. Chinese imports of US grains will continue, too, though not at the 6 million ton per year level of the grain trade agreement that expires this year.

TABLE 5.—*Sectors with High Potential for US-PRC Commercial Links*

Oil (Off- & On-shore)	Aircraft & traffic controls
Coal mining	Rail equipment and controls
Hydropower	Trucks and road-building
Nuclear power	Computers/electronics
Power transmission & conservation	Pollution control systems
Communications	Agricultural equipment & chemicals
Packaging	Food processing
Chemicals	Weapons systems

[2] Negotiations for the treaty stalled in early 1984 and were then scheduled to resume in the Fall of 1984. The treaty would address arbitration, repatriation of profits, and other vital international business facilitation issues.

Services also will be an important growth sector in China during the next decade and American firms will contribute to that growth. Tourism, engineering and project design already are expanding rapidly. China will probably contract with foreign firms to assist its own factories and government entities in these and such other fields as finance, insurance, and market research. Sales of defense equipment and technologies should also gain importance now that China is eligible for foreign military sales.

Facing Chinese competition.—Chinese products will no doubt pose competitive threats to the exports of some US firms to third markets. Generally, the Chinese will not be able to muster either the volume or the quality of product to undercut healthy Western businesses, but selected products could be a problem. For example, cotton growers are watching China's consistently record-breaking crops with concern. The Chinese should be able to export cotton competitively if they can conform to international standards in terms of quality and bale size. On the other hand, China is likely to remain a relatively minor exporter of coal, although exports from its joint ventures may displace others in the Japanese market. The major threat to US coal exports is more likely to come from Australia.

China is likely to increase its competitiveness in some manufactured goods, but has not been able to absorb advanced Western technologies fast enough to quickly develop export capabilities in highly sophisticated products. Chinese tools, fasteners, and spare parts will probably compete more with exports from Pakistan, South Korea, or Taiwan than with US firms. Other fast-growing exports are likely to be products of joint ventures or component assembly operations under the aspices of Western firms, and therefore should not be unexpected.

CHINESE EXPORTS TO THE US

It is unlikely that the variety of China's future exports to the United States will differ significantly from that of the present. Textile sales will continue to be China's principal source of foreign exchange. If oil production declines, exports may have to be diverted to fill domestic requirements. Many fast-growing export items will be from those industries now being expanded, especially foodstuffs, chemicals, consumer electronics, and other industries developing with Western cooperation.

Much of recent sustained export expansion can indeed be traced to ties with foreign firms, particularly compensation trade links established in the late 1970s. US imports of Chinese-made pharmaceuticals, for example, have gone from $4.7 million in 1979 to $25 million in 1983, an average annual increase of more than 50 percent. Similarly, sales of toiletries were $6.6 million in 1979 and averaged 23 percent annual growth to reach $15 million in 1983. These product lines are still being expanded with additional Western investment in everything from traditional herbal medicines to genetic engineering, all promising continued strong growth.

V. Trade Policy Issues

MARKET ACCESS

China will complain about any real or perceived barriers to trade with the United States. However, unless bilateral relations deteriorate considerably, Beijing will not elevate trade disputes to a level that could affect overall relations. Still, the Chinese could repeat the 1983 embargo [3] in reaction to particularly offensive US actions in order to underscore their concern about US trade limitations. Nonetheless, Chinese exports will persistently test those barriers.

Legal obstacles.—China has pressed the US to review its trade laws to eliminate legislative obstacles to closer economic ties. US restrictions on imports of Chinese textiles have caused considerable diplomatic tension and US limitations on technologies available to the Chinese, although liberalized, have sent the Chinese to other countries for some purchases. In fact, one concern of Zhao Ziyang during his 1984 trip to Europe was to encourage technology trade with the European Community.

In addition to restrictions on textile and technology trade, China regards with displeasure Export-Import Bank provisions restricting loans to Communist countries (a Presidential waiver is required for credit to a Communist nation and for any loan exceeding $50 million) and exclusion from duty-free treatment of trade under the Generalized System of Preferences. Changes in US Customs procedures, such as the recategorization of gasoline into a higher-tariff classification, also irritate the Chinese and reinforce their feeling that the US does not value the bilateral relationship.

Textiles.—Textiles will probably remain a particular irritant. Refinements in US methods to determine market penetration and identify country-of-origin have driven the textile exporting nations, including China, to press in international venues for more liberal textile trade. As of this writing, China has protested strongly the country-of-origin rule change proposal and has implied that US persistence may result in trade disruptions. China, among others, believes that the rule change violates both international and bilateral textile trade agreements, and that such a unilateral move is evidence that the US looks upon China as a less-than-equal power.

China in January 1984 joined the Multifiber Arrangement, GATT's textile trade monitoring body, hoping to pressure US and European policymakers to relax textile trade restraints. In July 1984, China and several other textile exporting nations formed the International Textile and Clothing Bureau to coordinate their lobbying within MFA. Exporters (China) and importers (US) will clash on textile issues without mutually satisfactory resolution for many years.

GATT.—China also will seek GATT membership, with expanded market access as one goal. While China may only accept accession terms that already conform to its trade plans, it may be possible to negotiate terms that help the Chinese develop trade practices that

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[3] Declared in retaliation for unilateral US controls on Chinese textile trade, the 1983 embargo affected US sales of cotton, synthetic fibers, soybeans and wheat. It appears that Beijing selected these commodities carefully, since the Chinese had ample stockpiles or could fill their needs from other suppliers.

better conform to the standards of other GATT member-nations. By acceding to GATT, China would meet the final legal requirement for US Generalized System of Preferences (GSP) status. With GSP, China would qualify for lower import tariffs, thus reducing costs and enhancing their competitiveness in the US market. But first, careful and possibly prolonged negotiations for accession to GATT must be completed.

FINANCING

US firms seeking entree into the China market will face strong competition from European and Japanese firms which can more readily arrange financing at concessional rates. OPIC has financed feasibility studies and insured several projects, but OPIC does not provide large-scale financing. Although Ex-Im loans can be obtained for US-PRC transactions, their rates are not competitive with government-backed loans available from Japan, Belgium and other countries.

GRAIN AND MARITIME AGREEMENTS

The long-term grain trade agreement, under which China agreed to buy at least 6 million tons of grain yearly, expires at the end of 1984. After four successive years of record crops, China no longer feels a need to assure the availability of so much grain for imports. Consequently, if a new long-term agreement is negotiated, its terms will no doubt be less rigid than the old agreement.

The US-China maritime agreement expired at the end of 1983 and has not yet been renegotiated. Problems in enforcement of cargo-sharing were a major stumbling-block to a new agreement. At present, there appears to be no urgency on either side to reach a new agreement.

CHINA'S SPECIAL ECONOMIC ZONES

By Victor C. Falkenheim*

CONTENTS

I. Introduction

In China's dramatic post-Mao opening to the west, no single initiative appeared more radical or problematic than the 1979 decision to establish four foreign investment enclaves in China's southern provinces of Guangdong and Fujian. Avowedly capitalist, uncomfortably reminiscent of their treaty port precursors, the "Special Economic Zones" (SEZs) symbolized the boldness of China's break with the autarchic policies of the past. Equally, however, the controversial nature of the program made its success an acid test both of leadership's political resolve and of its ability to surmount substantial economic and bureaucratic obstacles to create an investment setting conducive to significant foreign participation.

With Deng Xiaoping's celebratory tour of the SEZs in early 1984, a major political milestone if nothing else, was reached. Proclaiming the 5-year experiment a success, Deng and the Party leadership called upon the nation to "learn from Shenzhen", the largest of the

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SEZs, and authorized both the expansion in size of the smaller existing zones and the opening of 14 additional coastal cities as preferred sites for foreign investment.[1] Further, Gu Mu, China's senior SEZ policy spokesman, described the new 14 city decision as the second stage of a planned three phase territorial broadening of zone-type policies from "south to north, east to west and coast to interior" with the upcoming third stage to be marked by the opening of entire coastal regions to relatively unrestricted foreign economic interaction.[2] A major spurt in foreign investment in the SEZs in 1984, in response to these and other legal and policy changes, suggested that the foreign business community was ready to concede some substance to Deng's pronouncements.

Yet many analysts remained skeptical about these claims of success, viewing the 1984 coastal city expansion more as a response to the limitations and shortcomings of the initial stage of enclave development than a measure of its successes.[3] In particular, questions were raised concerning the cost effectiveness of the zone option, given the high costs of zone capital construction, the relatively modest level of foreign investment through 1984 and the absence of significant linkage effects. Further, the virtual universalization of zone privileges independent of location for largescale, technologically advanced joint ventures provoked fears that the effect would be to blur the boundaries between zone and non-zone jurisdictions, undercutting the appeal of zone-based industrial development. Finally, the authorization of separate "Economic and Technical Development Zones" in the 14 coastal cities, threatened the possibility of damaging inter-zone competition for limited investment funds, resulting potentially in uneconomic concessions to foreign investors or investment shortfalls in the weaker zones.[4]

Assessing the achievements and future prospects of the SEZs in light of these questions however, is by no means easy. Data and methodological problems aside, the SEZs are still in their infancy and it is too early to arrive at any firm judgment about their success. Moreover, the multiple nature of the goals embodied in the zone strategy make the development of appropriate success criteria difficult. Zone policy makers deliberately adopted the term "Special Economic Zone" in preference to the more conventional designation of Export Processing Zone (EPZ) to convey the more encompassing character of zone objectives. As described by Xu Dixin, these include not only such standard EPZ goals as generating foreign exchange, creating employment, attracting foreign investment, and facilitating technology transfer, but in addition serving as "laboratories" for reform of the economy.[5] And beyond these economic goals were a set of implicit political objectives related to the future of Hong Kong and Taiwan.

Any full evaluation even of the economic importance of the SEZs would thus have to include consideration of their impact on local industrial growth, employment, and export earnings as well as

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[1] Kawai Hiroko, "China's Open Door Policy in High Gear," *China Newsletter*, No. 53 (November-December, 1984) pp. 11-17; *Ta Kung Pao* (Hong Kong) 7 April 1984, p. 1.

[2] *Xinhua*, 17 January 1985 [*FBIS*, 23 January 1985, K6].

[3] "SEZs 'Not Faring Well'," *South China Morning Post*, 23 September 1984.

[4] *Far Eastern Economic Review*, 20 December 1984, pp. 99-104.

[5] Xu Dixin, "China's SEZs," *Beijing Review*, Vol. 24, No. 12 (23 March 1984) pp. 14-21.

evaluations of their importance as a laboratory for economic reform and their contribution to the diffusion of foreign technology and management methods to the domestic economy. No effort at such comprehensiveness will be attempted here. A substantial body of commercial and legal literature has already accumulated dealing with zone related legislation and the concessionary policies adopted by each zone and needs no recapitulation. Nor will this essay examine in any detail the pilot economic reform programs undertaken in the zone. Instead, the essay will attempt to gauge the achievements of the SEZs by comparing the initial investment and growth objectives of zone planners to actual performance, where possible in relation also to the costs incurred by Chinese national or regional authorities.

II. SEZ Goals

Despite the political boldness of the zone initiative, the scope of the new program at the outset was limited by design. Zone advocates were aware, on the basis of a careful survey of extant zones, of the economic risks inherent in such export promotion vehicles. Thus while they were attracted by the successes of the Korean and Taiwan EPZs, they were determined to limit their own risks. Hence, despite widespread pressures from numerous aspirant coastal cities, the decision was taken to restrict the experiment to four zones, in areas where suitable pre-conditions gave a reasonable assurance of success. A combination of economic and political logic and forceful local advocacy made the case for siting the zones in Guangdong and Fujian provinces a plausible one.[6] Already beneficiaries of a decentralization reform which gave them added trade and financial flexibility, these two provinces were natural candidates for an enclave type experiment by virtue of physical location, access to funds, expertise and markets, previous experience with foreign investment joint stock companies and close ties to overseas Chinese investors. To be sure, two of the zones, Zhuhai and Shenzhen, on opposite banks of the Pearl River estuary, were economicially underdeveloped and infrastructurally weak, but they were powerfully compensated for this deficiency by their proximity, respectively to Macao and Hong Kong. Shantou, on the north Guangdong coast, and Xiamen in southern Fujian as medium size cities, offered the potential advantage of an existing commercial, industrial and educational foundation on which to base an export promotion program, and more important, large and loyal constituencies of overseas Chinese to tap for investment and expertise.

While this cautious selectivity reduced the risk of failure, it offered little guarantee that local authorities would proceed equally prudently, hence central policy guidelines set sharp limits on the permissible scope of zone development. Only Shenzhen was mandated to establish a largescale 'comprehensive' zone involving across-the-board development of industrial, commercial, property and tourist related undertakings. The other zones were to varying degrees sharply hedged in by policy directives which called for limiting zone size and for gearing zone objectives to local resources.

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[6] Liaowang, No. 24 (June 11, 1984), p. 15.

The May, 1980 Central Committee guidelines (Document #41) on the planning of the Shantou and Xiamen zones, directed zone authorities to lay primary emphasis on utilizing their existing industrial foundation and capital stock to accelerate export production of light industrial goods, particularly machinery. Zone authorities particularly were charged with the task of securing the use of foreign capital for renovation of old factories for this purpose. The Central Committee specified further in July, 1981 in Document 17 (1981) that the two cities should accord priority to export processing while simultaneously developing tourism. Overall development strategy was to be dictated by each city's "fundamental character".[7] The result was a series of localized plans that called for quite limited and concentrated development programs as the following zone by zone review will show.

III. Shantou SEZ

Shantou in 1980 was a medium sized city, its greater metroplitan area containing 720,000 people on 245.5 square kilometers and its urban core, (Shantou proper) containing 416,000 people on 7.25 square kilometers. With a modest old port area, Shantou had been involved in international trade for over 100 years and 120 of its 352 factories and enterprises (1983) were engaged in production for export. Shantou's labor force in 1983 totalled 132,000 of whom the bulk (over 100,000) were employed in 251 collective sector enterprises (total fixed assests 68 million yuan) and 30,600 worked for the remaining 101 larger state-sector factories (total fixed assets 180 million yuan). Total industrial output in 1981 was valued at over 800 million yuan.[8]

In the initial stage of zone planning three proposals were brought forward. The first advocated developing an industrial zone on the southern tip of Dahao Island at Guangao, across the Rongjian River, later proposed as a site for a major petrochemical development. The main advantage of this location was the availability of a stretch of deepwater shoreline at Chiwang Bay which following harbour development could be constructed to accommodate 10,000-ton ships. The disadvantages were the lack of wind-shelter and the lack of adequate water supplies which would have to be piped from neighboring Chaoyang county. The minimum projected costs of constructing adequate water facilities was 5 million yuan and the estimated costs of wharf and harbor development were put at 200 million yuan, expenditures deemed well beyond the financial resources of the locality. A second proposed site was in the eastern suburbs of Shantou at Zhuchidu, a 10 square kilometer underdeveloped parcel of low-lying land near Maiyudao. The estimated costs of landfill work however was put at 40 million yuan and the problematic weightbearing capacity and drainage properties of the finished site ultimately ruled out any significant industrial development on this site. The final choice was a small parcel of land near Longhu village in the northeast section of the city. Though the land available for development was more limited, ease of port access (7 kilometers

[7] *Zhongguo Jingji Tequ Nianjian* (1983) (Almanac of China' SEZs), Hong Kong, 1983, p. 272.
[8] *Beijing Review*, No 50 (14 December 1981), p. 8; *China's Foreign Trade* (April, 1982), p. 9.

from the old wharf, 17 kilometers from the fishing port and 2 kilometers from the planned new wharf) proved decisive. While critics pointed to constraints imposed by poor longterm potential of the new port because of unresolvable drainage and silting problems, a 1.6 square kilometer site at Longhu was chosen by the Provincial CCP committee in late 1980. A Planning Office of the SEZ Administrative Committee was established in September 1981 and in October it decided to expand the scope of the zone by developing an additional 1.7 square kilometer site of sandy, uncultivated land near the fishing port, to meet the projected transport requirements of the zone. The Committee also acquired control of an adjacent 10 square kilometer parcel of farmland for future development as an agricultural processing base. Over the three months from September to December, 1981 the Administrative Committee of the Zone, with the assistance of a staff of surveyors and planners from the Beijing Iron and Steel Survery Institute (Beijing Gangtie Sheji Yuan) produced a provisional "General Plan". The plan was amended in early 1983 and given provincial assent in June 1983 at which time Zone plans were incorporated into the broader city development plan.[9]

As specified in the plan, Shantou was not to build a "comprehensive" zone as was being undertaken in Shenzhen and in particular was to avoid any focus on property development.[10] Rather, its main emphasis was to center on developing a processing industry in conjunction with the development of its agricultural site to the southeast. The key to the zone's further development was the industrial processing area at Longhu village where, on a core industrial site of 1.6 square kilometers and an adjacent warehousing and residential area of 1.2 square kilometers, it was proposed to build 200,000 square meters of multi-purpose, multi-story industrial buildings (4–6 stories high), expected to accommodate a total of 250 light industrial enterprises, employing 50,000 staff and workers and producing an annual output valued at 380 million yuan upon completion. The site was to be developed in two stages, with the first phase involving the development by 1986 of a .55 square kilometer site with 100,000 square meters of administrative, residential and factory floor space at which time 50 factories were expected to be under construction or in operation, with up to 25,000 employees. In this first stage, the emphasis was to be on labor intensive industries, particularly electronics and textiles. In the second stage of development after 1986, the remaining 1.05 square kilometer site was to be developed, with a simultaneous emphasis on the 1.7 square kilometer port zone south of Longhu and the gradual but non-priority development of the agricultural zone as well. In this later stage, some appropriate development of scenic spots for tourism was mandated as well as attention to the broader renovation of old enterprises in the city proper, financed with foreign funds. These goals were given a sharp boost in March, 1984 with the formal designation of Shantou as China's 33rd comprehensive

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[9] Chen Chuankeng, "Problems in the Development and Construction of the Shantou SEZ," *Ridai Dili* (Tropical Geography), Vol. 4, No. 1 (March, 1984), pp. 49–56, in *China Report: Economic Affairs* (CREA) 1984: 092, pp. 97–106; *Jingji Tequ Nianjian* (1983), pp. 272–273.

[10] *Wen Wei Po* (Hong Kong) 1 February 1983, p. 1; 20 March 1984; *Shantou Ribao*, 16 June 1983, *CREA:* 388, p. 59.

export commodity base. In November, 1984 for reasons to be discussed below, the Shantou SEZ was dramatically expanded in size to 52.6 square kilometers, initiating a process of plan revision just now underway.

IV. Xiamen SEZ

Xiamen was one of two sites in Fujian province initially considered for export zone development. The second, Langqi Island in the mouth of the Min River near Mawei, the port city of Fuzhou, was the subject of an elaborate planning exercise in cooperation with consultants from Millie's Group (Hong Kong) focusing on the development of a petrochemical complex. However, high infrastructural costs associated with the development of adequate port facilities at Mawei led to the decision in October, 1980, to limit authorization to the Xiamen site.[11] Ground breaking began in October, 1981 following a year of planning and preparation. The assets of Xiamen were clear. It was an old trading port, with a good natural harbor, rail links to the interior and a modest light industrial base consisting of 770 factories and an industrial work force of 100,000. The region's solid educational and technical foundation and its location in a productive agricultural region, offered solid support for an export development effort as well as a market for the products of zone based enterprise.[12] From the outset, there was a twofold thrust to development plans for the zone—first to develop a small 2.5 square kilometer industrial zone at Huli (in northwest Xiamen) adjacent to the new port at Dongdu. The second aim was to oversee the technological renovation of Amoy's older export oriented industries on the basis of foreign investment.

The 1982 master plan for the development of the industrial district called for construction in two phases.[13] The first phase to be completed by the end of 1984 called for ground levelling on a 1.1 square kilometer site and the completion of power, water, roads, communication infrastructure and all-purpose factory space sufficient for between 100–120 factories, creating employment for 15,000 workers. In the second stage, projected for 1988 completion, an additional 100 factories were to be built employing another 20,000 workers. On flanking sites in the eastern and southern sections of the zone totalling 4.55 square kilometers, facilities for schools, hospitals, post and telecommunications centers, restaurants and cultural facilities and workers' dormitories, foreign residences etc. were to be built. Ultimately a "new town" of 70,000 was envisioned, growing to a population of 140,000 by the turn of the century. The plan also anticipated rapid growth in industrial output (GVIO) from the 1982 level of 1.2 billion yuan to over 6 billion yuan by the year 2000.

The Huli industrial district planners sought periodically though unsuccessfully to extend the industrial zone to encompass neighboring Yuangdang and similar proposals were mooted to develop a

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[11] Edith Terry," Fujian's Special Economic Zones," *China Business Review*, Vol. 7, No. 5 (September-October, 1980).

[12] *Beijing Review*, No. 50 (14 December 1981); *Zhongguo Jingji Nianjian* (1983) (Almanac of China's Economy) Section V, pp. 91–93.

[13] *Asian Wall Street Journal*, 13 April 1982; *Liaowang*, No. 24 (11 June 1984), pp. 14–15.

non-contiguous district on the mainland, Xinglin, across the Jimei viaduct. But if zone development plans were confined to Huli, the Zone Management Committee's authority for the technological renovation program was city-wide and in 1983 because of resulting jurisdictional problems the Zone Management Committee was given co-equal status with Xiamen Municipality, reporting directly to the province. Ultimately, local pressure and the logic of city-wide development led to the decision in March, 1984 to formalize and rationalize the situation by making the entire 123.5 square kilometer city proper (Xiamen Island) a Special Economic Zone.[14] This decision led to a significant shift in zone objectives. A new set of plans drafted in mid-1984 called for—in addition to the completion of Huli industrial district—a new 15 square kilometer urban banking and trade center to be built in Yuandang district, and an additional 20 square kilometer industrial zone, the Jiangtou-Lianban Industrial District, specifically for the development of technology-intensive industries. In addition, a major port expansion was slated for future development. The 1982 master plan had provided for an additional four berths at Dongdu Port which would increase the capacity of Xiamen Harbor from its 1981 level of 2.03 million tons per annum capacity to over 4 million tons. The goals enunciated in 1984 called for making Xiamen a major international trade center and projected a total of 23 deepwater berths with the capacity to handle up to 20 million tons a year.[15]

V. Zhuhai SEZ

In comparison to the older port cities, Zhuhai on the western bank of the mouth of the Pearl River, was far less well developed, with a modest industrial base of approximately 190 enterprises concentrated in Xiangzhou (the capital of Zhuhai since 1961) employing a workforce of approximately 40,000 workers and staff. In March 1979 Zhuhai was placed under direct administration of the province and authorized to establish a "pilot economic zone" by the State Council.[16] The city itself was expanded in size to enclose an area of 364 square kilometers, with a population of 138,000 (including 20,000 transients) and in August 1979, the formal creation of the Zhuhai SEZ was announced with a 6.7 square kilometer plot approved for industrial development.[17] The initial plans called for the division of the zone into 4 separate areas with 45% of the land to be devoted to industrial enterprises. The 1982 plan projected 3 districts: The Gongbei district bordering on Macao which would house the industrial park development and central administration area; the Jida district to the east, slated for tourism; and the Wanzi district allocated principally for residential and office uses. In June 1983 in response to local pressure the State Council approved doubling the size of the zone to 15.6 square kilometers of which 10.8

[14] "Changes in Xiamen's Zone," *Business China*, November 14, 1984, p. 163.

[15] *Xiamen Jingji Tequ Touzi Zhi Nan* (Guide to Investment in Xiamen SEZ) Xiamen, November 15, 1984. Xiamen's new status was formally ratified by the State Council in July, 1985. See *Xiamen Ribao* July 31, 1985, p. 1.

[16] *Zhuhai Jingji Tequ Touzi Zhi Nan* (Guide to Investment in Zhuhai SEZ), Zhuhai SEZ Development Co., 1983.

[17] *Asian Wall Street Journal*, July 8, 1982, pp. 1, 5; *Nanfang Ribao*, July 27, 1983, p. 1.; *An Open Coastal City-Zhuhai*, Office of Administration of Zhuhai SEZ, (comp.), October 1984.

were designated for industrial development. At the same time the adjacent Doumen county (population 240,000) was placed within the SEZ jurisdiction.

The master plan for the 15.6 square kilometer site drawn up in early 1984 and submitted to the province for approval called for 350 factories to be built on a 15 square kilometer site, with an aim of creating an industrial city of 100,000 by the year 2000, ten times the 1984 zone population of 10,000.[18] In the course of development it was expected that local industrial output would grow from its 1983 level of US 70 million to US 1 billion by 2,000. The focus of industrial development was to be on electronics and building materials, particularly glass and ceramics, but long term zone development plans hinged on the development of the Macao economy, and the success of the Pearl River oil development and the South China Sea oil development more generally. Reportedly, Zhuhai leaders were pressing Beijing for expansion of the SEZ to encompass the entire 364 square kilometer municipality of Zhuhai, an issue that was taken up with Deng Xiaoping in January 1984 during his visit to Zhuhai and which is apparently still under review.[19]

VI. Shenzhen

The most ambitious program of all was the proposed development from scratch of a "new type city" on the site of the small rural and fishing town of Shenzhen. In 1979, Shenzhen was a sleepy township of 23,000 in largely rural Baoan county.[20] The scope of Shenzhen goals were ambitious not only relative to the lack of prior infrastructural development, but in terms of absolute magnitude. The new zone would be the largest such zone in the world, 327.5 square kilometers in area, stretching 49 miles along the border of HK's New Terroritories, incorporating fully one third of the area of the newly designated Shenzhen municipality. The population of the zone in 1981 was 98,000, out of a total municipal population of 300,000. In the draft 20 year development plan released in 1982,[21] the main objective of zone leaders was to establish a comprehensive, integrated zone, whose prime focus would be on industrial development, preferably technology intensive in character, but simultaneously promoting agriculture, tourism, and trade. Of the 98 square kilometers available for urban development, 15 square kilometers were designated for industrial development. The Zone was divided into 18 districts to be developed serially on a self-financing basis. The average targeted annual growth rate for the 6th Five Year Plan period (1981-1985) was 88%, with per annum growth slowing to 25% during the 7th Five Year Plan (1986-1990). The average annual projected growth rate of the SEZ through 2000 was 31%. Shenzhen's industrial output (GVIO) of 51 million yuan in 1980 was to reach 1.2 billion yuan by 1985, by which time 200 new enterprises were to be in production with approximately

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[18] *Asian Wall Street Journal,* March 27, 1984.

[19] Interview, Hong Kong, Dec. 6, 1984; see also Tim Williams, "Focus on Zhuhai," *China Business Review,* Vol. 11, No. 6 (November-December 1984), pp. 57-59.

[20] Shenzhen SEZ Economic Development Corp. (ed.), *Investment Guide for Shenzhen SEZ,* Hong Kong, Wen Wei Po, 1982.

[21] *Guoji Maoyi,* No. 9 (27 September 1983), p. 5; *Wen Wei Po* (Hong Kong) 11 September 1983, p. 2; *Business China,* September 29, 1982, pp. 39-40.

50,000 workers on the job. Industrial output would top 12 billion yuan by the year 2000, by which time the Zone's population was expected to reach 800,000. A total of 1,500 new zone enterprises creating over 200,000 industrial jobs was to underpin that growth. An amended 5-year development plan set forth in mid-1984 covering the 7th Five Year Plan period envisaged a 100% increase in the size of Shenzhen city proper (then 30 square kilometers) through the gradual absorption of the newly rising industrial and commercial districts of Luohu, Shangbu, Futian and Shekou, with the zone's population estimated to rise from the 1984 level of 250,000 to 450,000 by 1990 at which industrial output would top 4.78 billion yuan.[22]

The initial goals as summarized in table form by Professor David Chu in 1982 (Table 1)[23] were limited, prudent, and well in line with the broad goals set for the national economy, though as this brief review indicates, they were subject to sharp and ultimately successful pressures for upward revision by local leaders.

TABLE 1.—CHINA'S SPECIAL ECONOMIC ZONE PROGRAMME UP TO YEAR 2000

	Shenzhen SEZ	Zhuhai SEZ	Longhu in Shantou	Huli in Xiamen	Total
Projected urban population:					
1981	[1] 30,000	25,000	[2]	[2]	
1985	250,000				
1990	400,000		28,000	35,000	
1995		87,900			
2000	1,000,000	175,000	52,000	65,000	1,292,000
Area designated (in sq. kms)	327.6	6.8		2.5	
Planned built up area	98	4.37		2.5	
Net industrial area	15	2.27	1.6	2.0	20.87
Basic employment	87,000	25,000	24,000	30,000	166,000
Nonbasic employment	58,000	16,700	5,200	6,500	86,400
Investment (in millions of renminbi):					
In urban facilities	1,670	272.5	88.4	110.5	2,141.4
In infrastructural construction	2,000	400.0	45.0	70.0	2,515.0
Total Chinese construction	3,670	672.5	133.4	180.5	4,656.4
Overseas investment required (in millions of U.S. dollars)	1,500	227	280	350	2,357
Target number of factories	1,500	227	160	200	2,087
Expected export value (in millions of U.S. dollars)	3,750	568	400	500	5,218

[1] Out of a total of 84,000.
[2] Negligible.

VII. Infrastructural Development

Despite central efforts to limit the scope and risks of the zone initiative, the relative backwardness of the four SEZS meant that an enormous initial infrastructural investment was required, a daunting obstacle to the realization of zone plans. Even the more developed cities, Xiamen and Shantou were impoverished in comparison to the economically more advanced east China coastal

[22] *China Market*, August 1984, pp. 20-22; *Zhongguo Xinwen She*, 15 August 1984 [FBIS August 16, 1984, p. 2].
[23] David K.Y. Chu, "The Costs of the Four SEZs to China," Part II, *Economic Reporter* (English) June 1982, p. 9.

cities because of their long time "front line" status. The result, as one commentary on the Shantou zone noted, was that "greater priority and much larger amounts of investment" was necessary to bring their 'special traits' "fully into play".[24] In the case of Shantou, for example, the estimated initial 5 year capital construction costs (including roads, land preparation, electricity, water supply and administrative and support facilities), ranged from 151.3 million to 200 million yuan, covering such items as 15.5 kilometers of roads, five bridges and culverts, four kilometers of coastal revetments, 42 kilometers of underground water mains, a water purification plant with a daily capacity of 26,000 tons, a modern telephone exchange, a new post and telegraph facility, 200,000 square meters of all purpose industrial floor space, foreign residences, and 3 additional berths to augment existing harbor facilities, this last item requiring an estimated 22 miliion yuan.[25] Expenditures simply for developing the first .2 square kilometer parcel alone were put at 35.7 million yuan, with 15 million yuan of that amount allocated for 'basic infrastructure', 10 million yuan for support facilities, 5 million for the construction of 20,000 square meters of factory space and the remainder for administration.[26]

Xiamen's capital requirements were even greater, running at well over .7 billion yuan for the first three years. Of course much of this investment was intended to serve wider regional development goals and is not all properly assignable to zone development costs, narrowly defined. A *Far Eastern Economic Review* estimate of the total costs of building the Huli industrial park put the figure at 120 million yuan,[27] but this appears to be a small fraction of total Zone-related capital construction. Some indication of the magnitude of the latter may be inferred from a partial list of construction projects which include four new deep water berths at Dongdu port, (including a container terminal), the expansion of Gaoqi airport to accommodate Tridents and Boeing 737s; the development of feeder rail links to the Yingtan-Xiamen main line, a water supply system with 110,000 tons daily capacity, a 110 KVA transformer station; telephone and telecommunications modernization not to speak of land preparation costs for one million square meters of industrial land and the building of conventional factory space.

1982 actual capital construction expenditures were 100.25 million yuan, a figure which covered initial costs of the first 2 berths at Dongdu port including revetments for additional berths, the extension of runway and parking apron areas of Gaoqi airport, 19.3 kilometers of water mains; two pumping stations, cold storage facilities at Dongdu fishing port and 460,000 square meters of ground preparations.[28] 1983 expenditures for the completion of dockwork, underground conduits and an additional 500,000 square meters of land preparation were put at 210 million yuan.[29] 1984 capital con-

[24] Chen Guangkeng, "Problems in the Development and Construction of the Shantou SEZ," *op. cit.*, p. 98.
[25] *Zhongguo Jingji Tequ Nianjian* (1983) *op. cit.*, p. 273.
[26] Ibid.
[27] *Far Eastern Economic Review*, October 1, 1982, p. 63.
[28] *Fujian Ribao*, 1 April 1983.
[29] *Ibid.*

struction expenditures involved total costs of 420 million yuan of which 190 million were alloted for the completion of the dock and warehouse zone and auxilliary housing.[30] Total zone related capital construction costs over the first 3 years appear to exceed 700 million yuan, four times the anticipated development costs of the Shantou SEZ, with direct in-zone costs incurred in 1982 and 1983 running about 10–15% of full zone related capital construction costs. Projected capital construction investment for 1985 was 850 million yuan.[31]

Zhuhai's construction requirements were equally massive. The zone itself required an additional 110 KVA transformer substation for its power needs and another 200,000 KVA station was necessary to meet anticipated city-wide power demands. Harbor development plans called for the addition of 6 deep water berths. In terms of transportation, an internal and peripheral highway net was slated for construction, the existing heliport was to be expanded to accommodate 30 copters, a medium sized airport was put on the drawing boards. Further, plans called for more than doubling the water supply capacity from the existing level of 30,000 tons per day to between 60–80,000 tons per day along with 2 sewage treatment centers. While the total costs of these projects are not known and indeed many of them are only barely underway, available data on actual construction expenses indicate a level of spending around 700 million yuan over the initial 5 year period. Moreover, Mayor Yao Guang in a visit to Hong Kong in mid-1984 indicated that the pace of capital construction was to be stepped up in 1985 and 1986 with investment over the two years to top 1 billion yuan.[32]

The construction of the new Shenzhen zone involved the most massive costs of all, the 1982 master plan calling for infrastructure investment of US $2.4 billion between 1980 and 1990.[33] In fact, actual capital construction expenditures virtually doubled each year, from 1979 through year-end 1984 totalling 3.59 billion yuan over the six year period, and the 1984 revised plan covering 1985–1990, projected capital construction expenditures of 7.5 billion yuan.[34]

TABLE 2.—ZONE-RELATED CAPITAL CONSTRUCTION INVESTMENT

[Million yuan] [35]

	1979	1980	1981	1982	1983	1984	Total
Zhuhai SEZ		30+ (1979–1980)	65	105	(136)	340	676
Xiamen SEZ				100.25	210*	420	730.25
Huli Industrial Park (excluding transport)				15.5	36.55		
Shenzhen SEZ	49.88	124.87	270.39	632.65	885.93	1,636	3,599

[35] See footnotes 25–34.

Note: All figures are for actual expenditures except those asterisked which are for planned expenditures. Figures in parentheses are derived as percentages of the succeeding year.

[30] *China Daily,* 5 June 1984; January 21, 1985)
[31] *China Daily,* 21 January 1985, p. 3.
[32] *Nanfang Ribao,* 1 February 1983; *Hsin Wan Pao* (Hong Kong) 2 September 1984, p. 1.
[33] *Asian Wall Street Journal,* 8 July 1982, pp. 1, 5.
[34] *Renmin Ribao,* 29 March 1984; 29 December, 1984. Hong Kong Standard, July 21, 1985, p. 2.

As the volume of actual investment indicates (Table 2), a major achievement of the SEZs has been their successful generation of very substantial capital construction funds which has contributed to an equally creditable pace of construction. In Xiamen the completion of the airport, the port expansion program and the completion of water supply, power generation and telecommunications facilities has laid the foundation for both zone and municipal economic and trade development. The pace of growth in Zhuhai has been slower but changes have nonetheless been significant. Most of the infrastructural work on the 10 square kilometer industrial portion of the zone has been completed. The target date for final completion is August, 1985. A 400 square kilometer sea channel in Jiuzhou harbor is nearing completion as well and major strides have been made in the development of a tourism industry. The most marked successes of course have been registered in Shenzhen where a major urban and industrial development program have virtually created a new city. The following construction data suggests the scope of this achievement.

TABLE 3.—SHENZHEN CONSTRUCTION: 1979-84 [36]

	1979	1980	1981	1982	1983	1984	Total
Area constructed (square meters)	130,113	346,303	545,944	926,662	1,464,000	2,600,000	6,013,022
Residential dwelling area (square meters)	52,617	178,546	234,687	624,000	1,544,917	1,500,000	3,044,917

[36] "Remin Ribao," 29 March 1984; "Zhongguo Xinwen She," 17 January 1985 ("CEA" 85: 008, 98).

To be sure, the pace of development has not been even across the zones and many of the major projects have been plagued by delays, particularly affecting efforts to improve transport links between Hong Kong and the zones. Questions have also been raised about the utility of some of the infrastructure put into place, writers pointing to the low occupancy rate of under-roof industrial facilities created by Shenzhen. But these problems notwithstanding, the zone experiment has clearly led to major strides in local capital construction.

Moreover, one of the distinctive achievements of zone development policy has been the striking degree of foreign participation in basic infrastructure development. Despite the initial zone legislation which provided that all preparatory work including "levelling, land preparation, construction work for water supply, drainage, electric power, roads, docks, communications, warehouses and other public facilities" was to be the responsibility of the Chinese administration, an even more significant proviso mandated that "if necessary, foreign capital may be used in the aforementioned construction work.[37] The importance of this provision was acknowledged by Gu Mu in early 1985 in his praise for efforts in Guangdong and Fujian to dramatically increase capital construction despite local budgetary limitations, on the basis of foreign investment.[38] As one analyst pridefully acknowledged, "China has not,

[37] *Xinhua*, 26 August 1980 [FBIS, 28 August 1980, L10].
[38] *Xinhua*, 17 January 1985 [FBIS, 23 January 1985, K6].

as other countries in similar situations, made large investments of state money . . . in developing the infrastructure of her SEZs."[39]

Ascertaining the precise proportions of foreign and domestic contributions to infrastructural development however is not easy, in part because of the difficulty of separating infrastructural projects from overall investment totals. The 1982 Shenzhen master plan anticipated that U.S. $7.2 billion, 58% of the total zone investment costs through the year 2000 would come from foreign sources.[40] The 1984 Zhuhai master plan calling for U.S. 2.1 billion in investment by 2,000 estimated that one-third would come from foreign sources.[41] In the Xiamen zone where development costs for the ten major projects including the airport and harbor development were estimated to exceed half a billion yuan, foreign funds played a major role. In the four-year period 1980–1983 the province raised 145 million U.S. dollars in foreign funds, including a Kuwaiti loan for airport development, a loan from First Chicago Bank for the purchase of a provincial fleet, etc.[42]

Much of this money has been funnelled through infrastructural joint ventures of which the most distinctive form has been large scale tract development contracts. The advantage of this option has been that it simultaneously addresses the problems of capital shortages, the lack of managerial expertise, and more importantly, the lack of international business and financial contacts. In the Shenzhen SEZ for example, four major tract development programs are underway. Hopewell Holdings (Hong Kong) has taken on the responsibility for overseeing the development of 30 square kilometers in Futian district, at an estimated cost of 10 billion Hong Kong dollars. Lian Cheng Enterprise is currently developing an area of 6 square kilometers on two tracts, one near Mankamto and the other on Deep Bay. Millie's Group is involved in construction of industrial buildings for rental on a 2.8 square kilometer site at Nanao and Guangdong Enterprises is developing three parcels of land for industrial and commercial purposes.[43] In the Zhuhai SEZ, Wang Guangying's Everbright Corporation has two major projects underway, a 240 million yuan agricultural development program at Modaomen, and an industrial park at Beiling, while B.N. Wong's Gladhover Corporation envisages a multi-site development of residences, businesses and industrial parks at Silverbay and Xiawan.[44]

Many of these omnibus joint venture projects include key infrastructural components in addition to industrial and commercial development plans. Hopewell's master plan for Shenzhen for example includes expansion of the Luohu railway station, and the construction of a 7–8 kilometer light railway line running from Luohu to Futian. in 1984, following three years of negotiation, Hopewell signed a cooperative agreement to develop a major toll road from

[39] *China Reconstructs*, July, 1983, p. 10.
[40] *Asian Wall Street Journal*, 20 September 1982, p.1
[41] *Asian Wall Street Journal*, 27 March 1984.
[42] *China Economic News*, 24 October 1983, p.4
[43] *Asian Wall Street Journal*, 18 January 1982; *Hong Kong Standard*, 3 July, 1982; Tim Williams and Robert Brilliant, "Shenzhen Status Report," *China Business Review*, March-April, 1984, pp. 10–14.
[44] *Xinhua*, 19 September 1984 [*FBIS*, 25 September 1984,K6]; Madelyn C. Ross, "Zhuhai's Hong Kong Connection," *China Business Review*, Volume 11, No. 6 (November-December, 1984), pp. 39–40.

Kowloon through Shenzhen to Guangzhou connecting to Zhuhai. Most recently, Hopewell and the state owned Nanhai-Shenzhen Joint Service Corporation signed an agreement to develop a major deep water port at Mawan with a projected annual capacity when completed of 10 million tons. Similarly in Zhuhai, the crucial U.S. 37.2 million dollar port modernization at Jiuzhou harbor where four new berths are to be added will be funded out of a U.S. 63 million dollar loan syndication for Gladhover's Zhuhai development program. Other examples of more limited infrastructural joint ventures including for example a joint venture with the Yokohama-based shipping firm Suzue Gumi to build two 60 meter piers with warehousing, and an agreement with Hong Kong Cable and Wireless to modernize the phone system.

Chinese claims that a major part of the capital costs of zone construction have been financed by foreign investors, may partially overstate the case given that much of this investment is in all likelihood recycled Chinese funds through Hong Kong. While some of the financing for these projects has come from outside Hong Kong, Gladhover's partial reliance on Australian financing being a case in point, much of the investment has been financed by the Bank of China Group in Hong Kong. Between 1979 and 1983 Hong Kong Macao investments by the Bank of China Group in the four zones totalled 1.1 billion dollars (Hong Kong) in 363 projects, 347 of which were in the Guangdong SEZs.[45]

On the domestic side, construction investment has been funded out of three sources: intra-zone enterprise net profits, including processing fees; property development and tourism profit taxes, and; domestic (extra-zone) direct investment in the form of capital, material and manpower by central government ministries, provincial government agencies and enterprises across China. The proportions from each source have varied from zone to zone. The 1982 Shenzhen plan projected 75% of domestic investment from SEZ generated net profits, 15% from domestic direct investment and just under 15% from bank loans and credit.[46] Direct domestic investment has in fact run at about 20% of the total over the past 5 years. In Zhuhai, in 1982 about 45% of the domestic capital investment came from SEZ profits, mainly from tourism, and about 55% from domestic investment.[47]

VIII. Foreign Investment in the SEZs

It is undoubtedly premature to offer any long term assessment of the attractiveness of the zones as magnets for foreign investment, given the lack until quite recently of completed physical, administrative and legal infrastructure. According to Gu Mu's Report to the 9th meeting of the 6th N.P.C. Standing Committee in early 1985, a total of U.S. $2 billion of investment had been pledged to the zones through some 4,700 economic cooperation agreements, an amount constituting over 40% of the total pledged foreign direct investment in China.[48] While the SEZs incentive policies clearly

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[45] Fu Wen, "Zhongyin Jituan Cuijin Gangao yu Neidi Jingji Guanxi de Qiaoliang," *Economic Reporter*, 2 April 1984.

[46] *Asian Wall Street Journal*, 20 September 1982; *Business China*, 29 September 1982, p. 140.

[47] *Liaowang*, No. 16 (16 April 1984), p. 25.

[48] *Xinhua*, 17 January 1985 [*FBIS*, 23 January 1985] K8.

enabled them to garner the lion's share of total investment, the figures are less than impressive when compared to total infrastructural costs of close to 6 billion yuan and even less so when actual investment is considered. The latter figure across the four economic zones according to the same report, totals an estimated U.S. 840 million dollars over the past five years.

The most successful of the SEZs has been Shenzhen which accounted for U.S. 580 million dollars or 67.5% of total actual investment through 1984 and over 75% of the total number of economic cooperation agreements.[49] As Table 4 below shows, there has been a steady annual increase in the number of project agreements signed with foreign businessmen, with a slight levelling-off in 1981–1982 as consequence of political uncertainties in Hong Kong and the resulting collapse of the Hong Kong property market. The dollar volume of pledged foreign investment also rose steeply from 1979 to its peak in 1981, declining sharply in 1982 and resuming an upwards trend in 1983 reaching peak levels again in 1984. Because of the lag between initialled agreements and actual utilization of investment funds, the pattern of actual investment has experienced steady growth. Based on 1979-1983 totals below, actual investment has run at just over ⅕ of total pledged investment.

TABLE 4.[50]—FOREIGN INVESTMENT IN SHENZHEN SEZ

	1979	1980	1981	1982	1983	1984	Total
No. of agreements signed	170	303	578	583	878	983	3,495
Pledged investment ($HK million)	235	2,136	6,800	1,419	2,634	(6000)	*19,224
Actual investment ($HK million)	120	250	590	880	1,130	1,650	4,620

[50] Renmin Ribao, 29 March 1984, p. 5; China Daily, 27 December, 1984, p. 2. Hong Kong Standard, July 21, 1985, p. 2.
*1979–Oct. 30, 1984.

A partial breakdown of the agreements by type reveals a strong predominance of small processing and assembly agreements, with the more elaborate and more desired contractual or equity joint ventures running on average at about 18% of the total number of agreements.

TABLE 5.[51]—FOREIGN INVESTMENT IN SHENZHEN SEZ: BY AGREEMENT TYPE

	1979	1980	1981	1982	1983	Total
Contractual joint ventures	30	24	39	47	149	289
Equity joint ventures	7	4	13	11	92	127
Foreign wholly owned		5	18	8	13	44
Total	37	33	70	66	254	460
As percent of total number of agreements (table 4)	21.8	10.9	12.1	11.3	28.9	18.3

[51] Renmin Ribao, 29 March 1984, p. 5.

While this must be reckoned somewhat disappointing, the sharp increase in the number of equity and contractual joint ventures in 1983 marks a significant change and probably reflects the growing confidence of the foreign investing community in the legal and administrative reforms put into place. Shenzhen has dominated the

[49] *Ibid.*, p. K9.

equity joint venture scene nationally, with its total of 127 joint ventures between 1979 and 1983 amounting to 67.6% of the total number of equity joint ventures signed nationwide.[52]

Breaking down the Shenzhen's investment total by sector reveals both in terms of number of agreements and in terms of actual investment that the largest single category was manufacturing, with 43.6% of the total, followed by real estate development with just over a quarter of total actual investment.

TABLE 6.[53]—SHENZHEN SEZ: COMPOSITION OF INVESTMENT

[1979-83 totals]

	Number of agreements	Percent of total	Actual investment (1,000 H.K.)	Percent of total
Industry	1,847	73.7	1,299,010	43.6
Real estate	59	2.4	789.35	26.5
Commerce, food, service	132	5.3	224.65	7.5
Tourism and recreation	16	.6	150,800	5.1
Agriculture, husbandry and others	423	16.9	*44,790	1.5
			**435,170	14.6
Communication and transport	28	1.1	37,040	1.2
	2,505	100	2,980,810	100

[53] Renmin Ribao, 29 March 1984, p. 5.
*Agriculture and husbandry.
**Others.

A breakdown by year reveals the growing dominance of industrial projects over time.

TABLE 7.[54]—SHENZHEN INVESTMENT PROJECTS

[By type]

Type of project	1979	1980	1981	1982	1983	Total
Industry	112	243	321	457	714	1,847
Commerce, food, service	5	10	5	25	87	132
Communications and transportation	3	4	5	1	15	28
Real estate	2	9	25	6	17	59
Tourism and recreation	2	5	3	2	4	16
Agriculture, animal husbandry, acquatic products, others	46	32	218	86	41	423

[54] Ibid.

Zhuhai SEZ ranked second among the zones in terms of the number of projects (839), the volume of pledged investment committed to zone projects (U.S. $1.31 billion) of which U.S. $80 million was in actual use by year end 1983.[55] The Zhuhai investment guide issued in midyear 1984 listed 50 joint ventures, (including both contractual and equity joint ventures) with a total investment of U.S. $1.2 billion, with the following sectoral breakdown.

[52] *Renmin Ribao*, 29 March 1984, p. 5; *Economic Reporter*, 20 February 1984, p. 20.
[55] Beijing Review, No. 13 (1 April 1985), p. 24.

TABLE 8.[56]—ZHUHAI SEZ: JOINT VENTURES (MIDYEAR 1984)

[Dollars in millions]

Sector	Number of projects	Pledged Invest-ment
Industrial	24	$910
Tourism	7	230
Real Estate	2	39
Communications	8	19
Commercial	8	7
Cultural	1	1
Total	50	1,206

[56] An Open Coastal City-Zhuhai, op. cit., p. 33.

While much of this pledged investment came in the form of large tract development projects whose full realization will be dependent on the future economic climate, Zhuhai investment commitments on paper were running well ahead of the assumptions of the Zone master plan which anticipated a total of $700 million U.S. in investment through the year 2,000. As in the case of Shenzhen, there was a significant reported upsurge in the investment in 1984 with 111 projects signed in the first quarter alone and pledged investment of $198 million U.S. Among the new projects were a U.S. $22 million brewery, Zhuhai's largest single joint venture enterprise to date.[57]

Data on Xiamen SEZ investment is much more difficult to assemble. The available figures suggest that serious investment began in the zone only in 1983 and that during the first 2 years there may have been no more than a dozen or so projects with a value of U.S. $40 million. This rose to a total of 36 joint venture projects by year end 1983, involving approximately U.S. $200 million in pledged foreign investment. A major spurt of investment occurred in 1984 with the signing of 37 new agreements at a reported value of U.S. $254 million, a breakthrough which followed years of negotiations and the successful completion in 1984 of many key infrastructural projects.

TABLE 9.[58]—XIAMEN SEZ: JOINT VENTURE PROJECTS

[Cumulated totals; dollars in U.S. millions]

	1982	July 1983	September 1983	Dec. 31, 1983	Dec. 29, 1983
Number of agreements/projects	18	23	29	36	73
Pledged foreign investment	$40	$150	$150	$200	$454

[58] Zhongguo Tequ Nianjian (1983), op. cit., p. 335.; China's Foreign Trade, April, 1984, p. 20; Fujian Luntan, No. 23 (15 June 1984), p. 7; Renmin Ribao, 29 December 1984.

In Shantou where infrastructural work began only in 1982, foreign investment is only now beginning to develop. The *1983 SEZ Yearbook* reported a total of 360 agreements for Shantou, of which 352 were for processing and assembly while only 8 were classified as some form of joint-venture agreements. Of this eight, six of the

[57] China Daily, 17 April 1984, p. 1.

larger projects were reported in operation in early 1984.[59] There are no overall figures on the magnitude of foreign investment, though an interview in Hong Kong in December 1984 with a zone businessman elicited the unconfirmed report that 13 enterprises (3 equity joint ventures; 10 contractual joint ventures) were either in operation or under construction and involved a total pledged investment of about U.S. $250 million.

IX. Economic Impact

However modest these investment totals from a national perspective, their regional impact has been substantial in three areas. First, the rising pace of capital construction and overall domestic and foreign investment has stimulated a rapid rise in the value of industrial output (GVIO). The trend was most marked in Shenzhen which experienced an average annual increase in industrial output of 56.4% between 1979 and 1983, and 100% between 1983 and 1984 with foreign enterprises and sino-foreign joint-ventures accounting for 53% of total output value in 1983.[60] Though no complete breakdown is available for Zhuhai's industrial output the total of agricultural and industrial output (GVAIO) manifested substantial growth.

TABLE 10.[61]—INDUSTRIAL AND AGRICULTURAL OUTPUT (BY VALUE) IN SHENZHEN AND ZHUHAI

[Million yuan]

	1979	1980	1981	1982	1983	1984
Shenzhen SEZ (GVIO)	60.61	84.44	242.82	362.12	720	1,817
Zhuhai SEZ (GVAIO)			128.75		(197)	408

[61] Renmin Ribao, 29 March 1984, p.5; Renmin Ribao, 29 December 1984; Yangcheng Wanbao, 2 June 1982; 16 February 1983; Beijing Review, No. 13 (1 April 1985), p. 24. Hong Kong Standard, July 21, 1985, p. 2.

A secondary result was the steady rise in local financial revenues which in turn were fed back into local development programs.

TABLE 11.[62]—LOCAL FINANCIAL REVENUE

[Million yuan]

	1979	1980	1981	1982	1983	1984
Shenzhen SEZ	35	55	118	163	296	512
Zhuhai SEZ			38.38		63	148

[62] Beijing Review, No. 13, (1 April 1985), p. 24; Yangcheng Wanbao, 2 June, 1982; Caizherng Wenti Yanjiu, 1984, No. 2, p. 17; Zhongguo Tequ Nianjian (1983), op. cit. pp. 670–671. Hong Kong Standard, July 21, 1985, p. 2.

Finally, the rapidly expanding zone economies generated increased employment, rising wages and a general pattern of commercial expansion. While little comparative employment data is available, the figures for Shenzhen indicate 80,000 new jobs were created by the fall of 1984, not including the over 100,000 transient workers involved in the construction of the SEZ.[63] Of the 80,000

[59] Radio Guangzhou, 17 January 1984(*CREA*:84:010:p.83); *Xinhua*, 25 April 1984 (*FBIS 4* May 1984).

[60] *China Economic News*, 20 Febraury 1984, p. 7.

[63] *China Reconstructs*, Vol. 33, No. 9 (September, 1984), p. 15.

new jobs, 10,000 were directly created by the 96 wholly owned foreign enterprises and the 202 joint ventures in the SEZ.[64] The rising average monthly wages in the SEZ and steadily increasing volume of the total retail sales give concrete evidence of a vibrant local economy.

TABLE 12.[65]—SELECTED COMMERCIAL INDICATORS FOR SHENZHEN

	1978	1979	1980	1981	1982	1983	1984
Average monthly wages	47	66	87	96	113	131	175
Total retail sales (million yuan)	106.7	126.8	205.1	348.0	553.9	1,250.9	1,500.0

[65] Beijing Review, No. 1, (7 January 1985), p. 37.

While quantitatively impressive, these figures conceal a number of qualitative problems. Much of the rapid rise for example in industrial output value has come from the construction industry, construction output in 1983 accounting for over 600 million of the total GVIO of 720 million in that year.[66] Similarly though manufacturing investment has grown as a proportion of the total foreign investment, much of it has been in low end assembly and processing, largely using 1960s technology. Both of these problems reflect yet a third source of concern, the fact that over 91% of foreign investment in the Guangdong zones has originated in Hong Kong and Macao, shaping the pattern of investment according to the regional division of labor.[67]

These problems have attracted attention of China's leaders because of their impact on two of the principal goals of the SEZs'—technology transfer and export expansion. As a *People's Daily* report put it, the "true strength of the SEZs lies in developing industries and products" completely geared to "international market needs". They should not, the article continued be built merely "to give the appearance of prosperity." SEZs must therefore avoid "taking over outdated technologies and equipment" producing goods "competitive only on the domestic market"; a problem in the SEZs of Shenzhen, Xiamen and Shantou where there is "a lack of new industries and of newly developed technologies".[68] Zhao Ziyang similarly noted with some asperity following his visit in early 1984 to Xiamen SEZ that "Special Economic Zones are not being developed for the purpose of providing jobs, nor should they go solely after increases in their output value".[69] Rather, as Ji Chongwei described the proper "guiding ideology" of the zones, they should develop "export oriented industrial structures . . ." based on advanced technology, which is the key both to export competitiveness and technology transfer.[70]

Substantial concern has been voiced over the lagging export performance of the Zones, particular Shenzhen. Not only have total imports substantially outrun exports (in 1983 on an order of 5 to 1),

[64] Beijing Review, No. 50 (17 December 1984).
[66] *Guoji Maoyi Wenti*, No. 5 (September-October, 1984)/(CEA:85:005, p. 94)
[67] *Ibid.*, p. 91; *Zhongguo Xinwen She*, 1 April 1984 (*FBIS*, 3 April 1984) p. 21.
[68] *Renmin Ribao*, 29 December 1984 (CEA:85:007: p. 81)
[69] *Xinhua*, 20 January 1984 (*FBIS*, 1 February 1984), p. K13.
[70] Ji Chongwei, "Theory and Practice of China's Policy of Opening to the Outside World," *Jingji Yanjiu*, No. 11 (20 November 1984), in (*CEA*: 85:009, p. 47)

but even local exports (those products handled by Zone trade agencies) ran well behind imports from 1979–1981, turning the corner only in 1982. Equally worrisome, the overall volume of exports has grown far more slowly than the economy (Shenzhen's 1983 export total of $21 million a disappointing 1% of the total Guangdong exports in the same year). Moreover, exports have continued to be dominated by fruit and foodstuffs with "very few industrial products."[71]

TABLE 13.[72]—SHENZHEN SEZ EXPORTS (LOCAL)

[Millions of U.S. dollars]

	1979	1980	1981	1982	1983	1984
Value of exports	9.42	11.24	n.a.	16.00	21.10	n.a.

[72] Shenzhen Tequ Nianjiana (1983), p. 428; Guoji Maoyi Wenti, No. 5 (September-October, 1984) in (CEA: 85:005), p. 83.

To be sure foreign exchange revenue from zone development and processing fees have redressed this disappointing picture somewhat, and the development of Zone industries is still in the embryonic phase, but the long term problem of export competitiveness remains a crucial issue for Zone planners, particularly with the imminent completion of the interior border control line, and the planned shift to convertible zone currency, at which time as one commentator observed "the flow of Shenzhen commodities into the interior will experience restrictions" and "the export problem will indeed become an acute one." [73]

Another troublesome area centers on the extent and character of linkages between the domestic and zone economies. The frequently cited slogan, "wai yin nei lian", emphasizing import of foreign funds and technology and their linkage with domestic resources posits significant ties between zone and nonzone economies, a pattern described both as a "new pattern of production exchange" and a major "accelerator" of economic growth.[74]

But it remains unclear precisely what forms these new ties will take and whom they will benefit. Most accounts have stressed the reciprocal nature of the exchange, one such report noting that "in the economic interchange between the SEZs and interior the SEZs will gain considerable economic benefit," while the interior will "share from the preferential policy", and "utilize advanced technologies imported into the SEZ." [75] One discussion of the likely pattern of cooperation in the Pearl River delta region described a division of labor in which the hinterland would supply raw materials and intermediate processed goods to the Zone which would assemble finished products for export. Foreign exchange generated in this way would enable the SEZ to purchase more advanced technology some of which would be sold to the hinterland to gradually upgrade its production.[76] This form of sub-contracting from the Zones

[71] *Shenzhen Tequbao,* 13 September 1984, p. 2; *Nanfang Ribao,* 14 July 1984 p. 1 (*CEA:* 84: 101), p. 109; *Guoji Maoyi Wenti,* No. 5 (September–October, 1984) in (*CEA:* 85:005), p. 94.

[73] *Ibid.* p. 94.

[74] *Nanfang Ribao,* 6 February 1984, p. 4.

[75] *Guoji Maoyi Wenti,* No. 5 (September–October, 1984), in (*CEA*:85:005), p. 88.

[76] *Wen Wei Po* (Hong Kong), 8 January 1985, (*FBIS,* 14 January 1985), W6.

to the hinterland has in fact been a very important stimulus to local economic growth, and is quite visible in sections of former Baoan county that now constitutes the periphery of the Shenzhen SEZ. Similar putting-out arrangements have been built into a number of joint venture contracts signed by the Xiamen SEZ.

Unfortunately for the development of zone-interior ties, the primacy of Zone growth goals has meant that the procurement of needed raw materials and manufactured goods from the domestic economy has been limited. Bureaucratic delays and supply and transport bottlenecks have meant that even for goods manufactured in China, sourcing has tended to be external. This has been particularly true for key construction goods such as rolled steel, cement and timber, but applies to many finished products as well.

TABLE 14.—SHENZHEN SEZ: CONSTRUCTION MATERIAL PROCUREMENT (1983)[77]

Product	Total consumed	Procured domestically		Percent produced in-zone	Percent imported
		Under plan (at state prices)	Market (negotiated prices)		
Rolled steel (tons)	150,000	2.38	31.6		66.00
Cement (tons)	700,000	14.29	34.37	4.20	47.14
Timber (cubic meters)	47,000	8.50	4.50		87.00
Coal	91,700	45.80	54.20		

[77] Beijing Review, No. 1 (7 January 1985), p. 36.

For the most part the SEZs and particularly Shenzhen have been major beneficiaries of these new forms of economic cooperation. In Shenzhen for example, in 1983, some 456 domestic joint ventures were in operation, with a total investment of 649 million yuan, ⅓ of the total investment up to that point, with a 1982 output of over 100 million yuan (27.7% of 1982 GVIO).[78] These ties involved linkages with firms attached to 17 ministries and bureaus at the Central level, 20 provinces and cities and 80 prefectures and counties. The contribution of domestic enterprises to the SEZs in some areas such as electronics has been particularly marked. Starting virtually from scratch, Shenzhen has built a substantial electronics industry, with 60 enterprises, 13,000 staff and workers, a total investment of 180 million yuan, and output value in 1983 of 320 million yuan. Of the 60 factories, 15 were set up with foreign participation, 15 were set up by the SEZ using its own resources, but 30 were set up as domestic joint-ventures in cooperation with other provinces and central agencies.[79] Whatever the exact distribution of benefits to domestic and Zone partners in these cooperative ventures, it is clear that domestic investment is being encouraged by the central government as a means for building up the zone industrial base under principles that are not entirely evenhanded. As one recent article acknowledged, the "primary" purpose of the SEZs is to attract foreign capital and "domestic integration" consequently was "supplemental" in importance.[80] On the other hand, domestic

[78] *Shenzhen Tequ Bao*, 2 May 1983 (*CREA*, 363), p. 45–46. *Zhongguo Xinwen She*, 29 June 1983 (*CREA*, 367), pp. 114–115.

[79] Radio Guangzhou, 24 August 1984 (*CREA:* 84:077), p. 56.

[80] *Nanfang Ribao*, 6 February 1984, p. 4.

firms have real incentives to establish cooperative links through investment in the SEZs, including access to advanced technology and world market information, an opportunity to generate additional foreign exchange revenue, and a chance to achieve higher levels of profitability than would be possible through investment in their own locales. Whatever the relative payoffs to the SEZs or their domestic partners, from the national perspective, the shift of investment to the Zones represents fulfillment of part of a broader restructuring reform, centering on enhancing the economic role of cities as focal points for commercial and industrial development. To the extent that the resulting redeployment of manpower and funds results in more efficient production, and new more rational economic linkages independent of ministry-based or territorially-based administrative units, then the outcome is seen as desirable.

The decision in 1984 to open 14 coastal cities to foreign investment, and the creation of "Economic and Technical Development Zones" in those cities represents a logical extension of these principles which are at the heart of the enclave development strategy. Undoubtedly, political pressures from the coastal cities played a part in the broadening of the zone experiment, and no doubt cost considerations were influential in shifting its emphasis to a number of more developed coastal cities. But equally, the size of the Chinese economy, and the recognition that each of the newly designated 'open' cities will play a catalytic role in the regional development of its own zone-hinterland was the key to the decision to move beyond the limited 4-zone enclave experiment. It equally explains the decision to enlarge the existing zones so that they could more adequately fulfill this strategic function. Gu Mu's acclamation of Dalian's role as the center of Northeast China, and Lianyungang's stimulative impact on the cities along the Longhai Railroad seems to confirm this view. In this sense, the SEZ experiment has been a success if only in helping to rethink regional strategies of growth.

To be sure the effect of the initiative has been to unleash new local aspirations for growth and the result well may be to eclipse the older SEZs. But the Center, in the initial phases of this new program is sharply hedging in city aspirations to prevent excessive competition and overbuilding.[81] In the longer term, the more crucial factors shaping the SEZs' prospects will be changes in the international economy, and success or failure of the South China oil program. But for the moment, optimism is the order of the day in China's zone planning.

In 1982, analyzing the strategic role of the SEZs, one commentator identified three perspectives on their functions. The first, opposed them as "treasonable", as "breeding grounds for social evils". The second setting advocated them up as small, sealed-off export processing zones emphasizing labor intensive industrialization. The third and preferred option, called for the "boldest use of the zones" to turn them into "hubs" of economic contact with the outside world. If modernization is the premise on which the zones are founded, the writer continued, the zones "must not merely be the

[81] Ji Chongwei, "Theory and Practice.." *op.cit.* p. 53.

backdoor of Hong Kong," nor must they be "mainly used for processing and assembly," which can be engaged in wherever there is surplus labour. Rather, they must be "backed by all of China," becoming "pivotal points for the transformation of China's ties with the world." [82] The third option has clearly become the basis of China's policy towards the zones in the wake of Deng Xiaoping's 1984 visit. Its success in the coming decade remains to be tested.

[82] Ruan Ming, "Establishment of the SEZs and Economic Strategy," *Fujian Luntan,* No. 2 (20 April 1982), in (*CREA*:259), p. 47.

HONG KONG'S FUTURE AND ITS IMPLICATIONS FOR THE UNITED STATES

By Robert G. Sutter*

CONTENTS

SUMMARY [1]

American officials, business executives and investors have had a strong interest in the negotiations between Great Britain and the People's Republic of China (PRC) regarding the future status of Hong Kong. Prompted by a legal deadline whereby 90 percent of the colony's territory will revert to PRC rule by 1997, British and Chinese representatives began secret discussions following Prime Minister Margaret Thatcher's visit to China in September 1982 in order to determine how soon and in what ways China would assert its claim to sovereignty over the territory. The start of the talks was accompanied by sharp Sino-British disagreement over Hong Kong's legal status and implied PRC warnings that China might assert control over the territory well before 1997. It also coincided with a serious decline in the territory's economy, prompted in part by worries in Hong Kong over possible future PRC rule. Subsequently, there were some signs of economic rebound, a new round of Sino-British talks on Hong Kong began in July 1983, and both London and Beijing announced in April and July 1984 their intention to reach an agreement on Hong Kong's future by the end of the year. A Sino-British joint declaration and accompanying documents were initialed in Beijing on September 26, 1984. But opinion remained divided as to whether or not the anticipated growing PRC influence over Hong Kong would jeopardize the territory's viability as a commercial center in East Asia.

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[1] Sources for this report include weekly coverage of Hong Kong issues by the Far Eastern Economic Review and the Asian Wall Street Journal Weekly. Trade and investment figures are from the U.S. Department of Commerce, Foreign Economic Trends and Their Implications for the United States. Coverage of PRC comment is seen in Foreign Broadcast Information Service (FBIS). Daily Report. China.

The American economic interest in Hong Kong is large, as the United States is the colony's largest trading partner ($8.96 billion in 1983), and its largest foreign investor (estimates range around $4 billion). Beijing leaders also have explicitly linked their policy on reunification of Hong Kong with the mainland with their policy on reunification regarding Taiwan. As a result, Americans are closely watching Hong Kong developments for clues as to possible precursors to PRC policy toward Taiwan, where the United States has important interests including legal ties under the Taiwan Relations Act. At present, British and Chinese sensitivities over the Hong Kong issue appear to compel the United States Government to adopt a low public posture. In this context, within such a low profile mode of operations, there also appear to be only a few limited options the United States Government could adopt in order indirectly to influence the situation to the advantage of American interests.

BACKGROUND

Hong Kong has a population of over 5 million, 98 percent of whom are ethnic Chinese. The colony was acquired by Britain from China in three stages: Hongkong Island (32 sq. mi.) by the Treaty of Nanking in 1842; Kowloon Peninsula and Stonecutters' Island (3.75 sq. mi.) by the First Convention of Peking in 1860; and the New Territories (365 sq. mi., consisting of a mainland area adjoining Kowloon and 235 adjacent islands) by a 99-year lease under the Second Convention of Peking in 1898. Consequently, most of the land area of Hongkong was scheduled to revert to China in 1997, while Hongkong Island and Kowloon Peninsula theoretically were British in perpetuity. However, Beijing regards Hong Kong as part of its territory, illegally under British administration—a view it announced formally to the United Nations in 1972.

Hong Kong began its rise to prominence as a preeminent commercial center in East Asia after Shanghai was taken by Communist forces in 1949 and declined as an international economic market. The large number of people from the PRC who sought refuge in Hong Kong and the subsequent cut off of much entrepot trade between China and the West as a result of the embargo during the Korean War led to the development of textile and other light manufacturing industries in Hong Kong.

At first Hong Kong purchased only limited amounts of food, building material and fuel from the PRC for local consumption, but its growing industries led to new needs, causing Hong Kong to become a major importer of PRC products including such vital supplies as water, foodstuffs and fuel. In 1982 imports from China amounted to almost one fourth of Hong Kong's total import bill. China retained a similar share of the Hong Kong market in 1983, supplying goods worth $5.88 billion. Hong Kong exports to China have been much lower in value, which has given the PRC a favorable balance of trade that, along with remittances by Hong Kong Chinese to relatives in the PRC, has recently accounted for around 30 to 40 percent of China's overall foreign exchange earnings. A well known adage in the region states that "Hong Kong is a unique machine capable of turning PRC pigs and chickens into U.S. dollars."

Once Great Britain withdrew most military forces east of the Suez Canal during the 1960s, Hong Kong's security rested even more on Chinese restraint and goodwill rather than on the very limited power of British forces in the colony. There was considerable uncertainty over the future of Hong Kong fifteen years ago when violence associated with the most radical phase of "Red Guard Diplomacy" during China's Cultural Revolution threatened to spill over and jeopardize stability in the colony. As Maoist influence faded, however, increasingly cordial, practical and extensive ties developed between the colony and the PRC. Transportation markedly improved and visits increased, encouraged by official representatives of both sides. The British Governor of Hong Kong made his first trip to the PRC in March 1979, and Chinese leader Deng Xiaoping told him that "investors in Hong Kong should put their hearts at ease" over Chinese intentions toward the colony.

Subsequently, British officials and Hong Kong business leaders repeatedly sought assurances from Chinese officials regarding the future of the territory after the scheduled lapse of the 99 year lease on the New Territories in 1997. PRC officials freely echoed Deng's instruction and pledged that Hong Kong's social and economic system would not be adversely affected; they implied that China was not anxious to push the British out and govern the territory directly.

China's cautious approach to the neighboring Portuguese territory of Macao seemed to underline Beijing's reluctance to interfere strongly in Hong Kong. After the military coup in Portugal and Lisbon's withdrawal from overseas holdings, Macao was the only Portuguese territory to retain its governor in office—this was because China refused to discuss the future of Macao with Portugal, and independence for the territory did not appear to be a viable option. When Portugal and China established diplomatic relations in 1979, the PRC made clear that it regarded Macao as Chinese territory under Portuguese administration. In Western legal terms, Macao remains a territory and Portugal is sovereign. In both interpretations, Macao has no international personality itself and its relations are subject to the de jure approval of the President of Portugal and the de facto tolerance of China, which continues to exert extensive influence in the territory's policies through a network of pro-PRC Chinese leaders there.[2] Beijing's talks with Britain over Hong Kong since 1982 were thought to have increased Chinese interest in reasserting sovereignty over Macao, but Chinese leaders in mid-1984 still called for maintaining the status quo for the time being.[3]

PRIME MINISTER THATCHER'S VISIT, 1982

The impending end of the lease governing the New Territories began to affect individual property leases, mortgages (often made for 15 years), and other financial and real estate arrangements in

[2] For background on Macao situation see Far Eastern Economic Review, May 5, 1983. p. 142.
[3] FBIS. Daily Report, China. July 18, 1984.

Hong Kong during 1982, and prompted British authorities to raise the issue again in discussions with Chinese leaders at the time of British Prime Minister Thatcher's visit to China in September 1982. The visit produced agreement between China and Britain to "enter into talks through diplomatic channels with the common aim of maintaining the stability and prosperity of Hong Kong." But the visit was also marked by pointed differences over the current legal status of the territory. In particular, the British prime minister emphasized at a press conference in Hong Kong following her China stay that the 19th century treaties governing the status of the colony remained the basis of Britain's position, although she added that London would talk with Beijing in the hope that the treaties could be varied by mutual agreement. She was sharply criticized by a Chinese statement of the Foreign Ministry's Information Department spokesman who said that Beijing's "consistent position" is that "China is not bound by the unequal treaties and that the whole Kong Kong area will be recovered when conditions are ripe." [4]

Sino-British Negotiations

After many months of secret diplomatic communication, the two sides issued a joint statement on July 1, 1983, announcing the start of formal talks on Hong Kong's future. The talks continued into 1984 and were supplemented in June 1984 by discussions of a working group of Chinese and British diplomats who were trying to come up with a draft agreement by Beijing's September 1984 deadline. Deng Xiaoping reportedly told Prime Minister Thatcher in September 1982 that a Sino-U.K. agreement on Hong Kong had to be reached in two years. Beijing subsequently announced that if the agreement were not reached by that time, China would announce its plans for the territory unilaterally. This represented an implicit threat presumably designed to keep the British from dragging their feet in the negotiations.[5]

The Chinese gradually released details of their plans for Hong Kong informally, mainly through reports from Hong Kong residents who met with senior Chinese leaders over the past two years. The highlights were:

—After China regained full sovereignty and administrative control of Hong Kong in 1997, the territory would become a special administrative region in China under Article 31 of the Chinese constitution.

—Hong Kong will enjoy a high degree of autonomy with local people administering the city. Beijing raised the possibility of local elections to select the senior local authorities.

—Hong Kong's present capitalist social-economic system will remain unchanged for at least 50 years after 1997.

—Hong Kong's legal structure will remain basically unchanged except that the highest court of appeals will be in Hong Kong instead of London.

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[4] FBIS. Daily Report, China. September 30, 1982.

[5] South China Morning Post, December 26, 1983. p. 8–9.

—Local and expatriate civil servants, including policemen and administrators, can retain their jobs.
—Hong Kong's status as a free port and international financial center will remain unchanged.
—The Hong Kong dollar will remain a separate and freely convertible currency.
—Residents will enjoy the right of free speech, assembly, press, and the freedom to travel.
—Beijing will be responsible for Hong Kong's foreign affairs, but will maintain its separate status in international organizations and in international agreements. It will be allowed to issue its own travel documents.
—The Hong Kong government will be responsible for the public security, maintained by the local police force.
—The economic interests of Britain and other countries will be respected.[6]

The British were more reluctant to disclose their intentions or the contents of the negotiations with China. British leaders emphasizd London's "moral" commitment to secure the best possible future arrangements for the people of Hong Kong, but British press comment and some political leaders claimed that London had little leverage over China. They underlined the fact that Great Britain had only a small economic interest in Hong Kong—it trailed far behind the United States, China and Japan as Hong Kong's leading trading partners. Moreover, officials in London clearly differentiated between the legal status of Hong Kong and other contested British territories (e.g., the Falkland Islands and Gibraltar), recognizing, in particular, the legality of the second convention of Beijing, 1898, which calls for the New Territories to revert to China in 1997. Without that land, Hong Kong appeared to be unviable as a British possession.

Press reports and the limited Chinese and British disclosures about progress in the talks showed that London was forced repeatedly to give way to firm Chinese demands during the course of the negotiations.[7] In particular:
—Some observers in London and Hong Kong had hoped at first that China would accept a renewal of the lease on the New Territories or would allow the status quo to continue after 1997. But they quickly ran up against strong Chinese determination to recover complete sovereignty over all of Hong Kong by 1997.
—By late 1983, it was clear that the British had been compelled to accept in principle China's sovereignty and administrative control of Hong Kong after 1997, and had agreed to negotiate on the basis of China's general plan for the territory.
—During a visit to Beijing in April 1984, British Foreign Secretary Howe agreed to a timetable in accord with China's deadline, calling for a draft agreement by September 1984, a debate in the British Parliament in autumn, and ratification by year end. Howe then went to Hong Kong where he reported that it

[6] South China Morning Post, December 26, 1983. p. 8.
[7] See in particular Far Eastern Economic Review, June 21, 1984; New York Times, July 9, 1984; Financial Times, April 25, 1984.

would be "unrealistic" to expect the British to retain an administrative role in Hong Kong.

By mid 1984, it was disclosed that London was under pressure to accept a Chinese proposal to establish a joint liaison group to oversee developments in Hong Kong prior to 1997, thereby giving China a vehicle to influence developments in the colony prior to formal takeover.

Foreign Secretary Howe again traveled to Beijing and Hong Kong in late July in an effort to bridge differences. He reported that he found the Chinese more accommodating than in the past.[8] In particular, while Britain accepted China's proposal for a joint liaison group, both sides explicitly stated that the group was not to be an "organ of power," but would serve only as a consultative body between the Chinese and the British over Hong Kong issues. Moreover, Howe indicated that the British had obtained China's agreement that the proposed Sino-British accord would contain detailed provisions governing future administration in Hong Kong and would be considered as an international agreement legally binding on both China and Great Britain. The foreign secretary revealed that London wanted such an accord because China had a strong record of strict adherance to international agreements and thus would remain bound by the proposed detailed provisions of the accord in future administration over Hong Kong, thereby reducing Beijing's ability to disrupt the status quo in the territory.

IMPLICATIONS OF THE AGREEMENT

The agreement reached on September 26, 1984 was in accord with British expectations and paved the legal path for British withdrawal. It ended any remaining doubt as to whether or not Hong Kong will become Chinese territory. It would.

Observers interested in Hong Kong's future had been worried during the previous two years that any prolonged impasse in the Sino-British talks leading to the current agreement could have resulted in serious uncertainty in Hong Kong, possibly prompting economic decline and social instability. Indeed, strong Sino-British differences in talks over Hong Kong in September 1982, and again in September 1983, had a serious, if temporary, negative effect on economic development in the territory. With the initialing of the current Sino-British agreement on Hong Kong, the danger of such a prolonged decline was reduced at least temporarily. Great Britain attempted to negotiate the best deal it could get from China regarding the future of Hong Kong. The agreement contained various specific commitments on the part of the Chinese side to preserve Hong Kong's British-style laws and institutions, and to allow Hong Kong to continue to prosper as an autonomous economic entity with its own freely convertible currency and its distinctive standing in international economic affairs. Nevertheless, British officials acknowledged that London had few contingency plans in the event China did not fully uphold the accord in the years ahead. Foreign Secretary Howe was reported to say that the agreement relied on

[8] FBIS. Daily Report, China. August 1, 1984.

trust between Britain and China, rather than on tangible guarantees of its implementation.[9]

HONG KONG CONCERNS

Many residents of Hong Kong have become concerned and even alarmed by the prospect of a Chinese takeover, and have not been reassured by pledges of British and Chinese concern. The numerous refugees from the PRC and their families living in Hong Kong are particularly suspicious of Chinese intentions. Local anxiety has been high because most residents have remained unable to emigrate from the colony. The absence of representative institutions in the colony also has limited the ability of the Hong Kong people to be heard either in London or Beijing. As a result, there have been repeated signs of decline of confidence in Hong Kong's future.

Coincident with Prime Minister Thatcher's visit to China and the publicized Sino-British differences over the status of the territory, for example, the stock market dropped and continued to fall, losing about 30 percent in the last four months of 1982. The Hong Kong dollar declined about 15 percent in the same period relative to the U.S. dollar and other major currencies. Property values in the colony continued to fall so that by late 1982 they were about 30 percent less than their level at the high point of the real estate market in mid 1981. Press reports noted alleged large scale "flight" of capital from Hong Kong to other economic centers in East Asia and elsewhere; spoke about wealthy Hong Kong entrepreneurs obtaining exit visas in case rapid escape were necessary to safe havens abroad; and reported that Hong Kong economic leaders were determined to limit their future exposure in the colony while increasing investment abroad.[10]

Over the next two years, however, analysis indicated that the decline in Hong Kong's economic fortunes was related not only to continued nervousness over the colony's future, but also to other economic difficulties stemming from an inflated real estate market and the global recession. Thus, the revival of the U.S. economy in 1983–1984 led to an export boom in the Hong Kong manufacturing sector, with exports in the first quarter of 1984 up substantially over 1983 levels. And the colony's largest financial institutions, led by the Hong Kong Shanghai Bank, signaled their confidence in the territory's future by offering 20-year mortgages for properties located in areas due to revert to Chinese control by 1997.

Nevertheless, publicized Sino-British disputes in the talks during September 1983 exacerbated a sharp decline in the value of the Hong Kong dollar, leading to a financial crisis that ended only when the government pegged the Hong Kong currency to a specific value in terms of U.S. dollars. The decision of Jardines, an old Hong Kong company, to move its corporate headquarters to Bermu-

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[9] Wall Street Journal, September 24, 1984. For the text of the Sino-British accord see "A Draft Agreement Between the Government of the United Kingdom and Northern Ireland and the Government of the People's Republic of China on the Future of Hong Kong." September 1984. London, Her Majesty's Stationery Office.

[10] For background in Hong Kong's recent economic developments, see U.S. Department of Commerce. Foreign Economic Trends and Their Implications for the United States. Hong Kong. 1983.

da was announced in early 1984, sending the Hong Kong stock market into a brief but steep tailspin.

Growing pessimism in Hong Kong by mid 1984 over the prospects of the Sino-U.K. talks led some residents to defer new investments, and prompted some younger professionals to make plans to start new careers elsewhere. These developments were seen as particularly damaging inasmuch as an estimated 90 percent of investment in Hong Kong comes from Hong Kong residents, and younger managers and technicians were seen as essential to keeping Hong Kong abreast of changes needed to compete successfully with other newly developing Asian economies like Taiwan, South Korea and Singapore.[11]

While many in Hong Kong were at least temporarily reassured by the September 1984 Sino-British agreement, Hong Kong observvers judged that several conditions were essential if Hong Kong were to preserve its status as an economic center for the region. In particular, Hong Kong was said to need:

—an internationally accepted, freely convertible currency.

—a continuation of current British style laws and institutions.

—a clear PRC agreement that China would not interfere in the territory's development policies and practices.

China's Policy

During 1983-1984, senior Chinese leaders, especially Deng Xiaoping, were firm in demanding full restoration of Chinese control, including the stationing of Chinese troops in Hong Kong. They employed a tough line in an apparent effort to intimidate Britain into accepting Chinese terms in the negotiations on Hong Kong's future and to silence potential opposition from the residents of Hong Kong. In June 1984, for example, Deng told unofficial members of Hong Kong's Executive and Legislative Councils, referred to as Umelco, that he did not believe their expressions of concern for the future were representative of opinion in Hong Kong; and he said that in any event China had already decided on its policies for the territory.[12]

A few days later, however, an authoritative Chinese journal attempted to soften the negative reaction by highlighting Deng's assurances that Hong Kong will remain autonomous.[13] And the Chinese appear to have adopted a more moderate tact during Foreign Secretary Howe's visit to Beijing in late July. Indeed, Hong Kong may well be pleased by China's willingness to sign an agreement in September 1984 that specified so much automomy for a territory it regards as Chinese, since this represents a significant compromise of Chinese nationalism that would appear to be reassuring to Hong Kong.

Some observers interested in Hong Kong's future maintained that despite China's sometimes tough line, it would be likely to sustain basic conditions needed for stability and prosperity and succeed in fostering a smooth transition for Hong Kong under formal PRC sovereignity. They judged that otherwise China would jeopard-

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[11] The Future of Hong Kong, Asia Society, Washington, D.C. June 28, 1984.

[12] FBIS. Daily Report, China. June 26, 1984.

[13] FBIS. Daily Report, China. July 2, 1984.

ize the reported important interest the PRC has in the continued economic development and peace of the territory.[14] However, a more skeptical view held that China's leaders may be prone to interfere more directly in the administration of the territory, in part because they may judge that China can effectively manage the complex social and economic system there, or because they may judge that it is in PRC interests to exert more direct control, regardless of how it might disrupt prevailing order in Hong Kong. Skeptics tend to believe that a more assertive Chinese policy toward Hong Kong could relatively quickly weaken the fragile underpinnings of the territory's prosperity and stability.[15]

At present, it is far from clear whether or not Beijing is able or willing to meet these basic conditions and thereby reassure Hong Kong residents. Chinese policy pronouncements about future intentions have provided Beijing with discretion in administration.

Beijing's basic political and economic interests in Hong Kong also seem to complicate the situation as they appear to pull PRC policy in contradictory directions. Politically, Beijing leaders reportedly are pushed by anti-imperialist ideological and political imperatives, stemming from the deep and bitter experience of China over the past century, to reassert strongly their sovereignty over the colony and to eliminate vestiges of British colonial rule. Moreover, Deng Xiaoping and other current PRC leaders can use a successful recovery of such "lost" territory as a way to build nationalistic support for their leading positions and other programs in China. A firm stand regarding sovereignty over Hong Kong is also thought to be supported in the Chinese leadership in order to clarify to foreign leaders with an interest in other territories claimed by China (e.g., Taiwan, Vietnamese-controlled islands in the South China Sea, and Soviet-controlled territory along the Sino-Soviet frontier) that China is determined to reassert its right to rule lands it regards as Chinese.

At the same time, however, Beijing appears to have important political reasons to avoid a strong reassertion of authority that could disrupt the social and economic status quo in Hong Kong. In particular, any PRC actions which promoted a serious downturn in Hong Kong's economic prosperity or its social-political order would probably undermine Beijing's repeated pledges to the people on Taiwan that reunification of Taiwan with the mainland would not involve any change in the island's social or economic life. Such a disruption might increase support in Taiwan and abroad for a future status for the island independent of mainland control. Conversely, if China were to succeed in reasserting sovereignty over Hong Kong with minimal disruption to the social-economic order there, its promises of "peaceful reunification" of Taiwan could gain greater credibility both in Taiwan and elsewhere.

Economically, Beijing would appear not to want to impair the rapid growth of free enterprise in Hong Kong because China has a large stake in the territory's economy. Thus, Hong Kong is China's third largest trading partner. The favorable balance in PRC trade with the colony, along with remittances by Hong Kong residents to

[14] See Asian Wall Street Journal, July 7, 1983.
[15] See Far Eastern Economic Review, June 21, 1984.

relatives in the PRC, provide for an estimated 30-40 percent of China's foreign exchange earnings. Hong Kong is also a major entrepot for PRC trade, handling an estimated $2.3 billion of PRC exports (10.6% of all PRC exports) and $1.5 billion of imports (6.9% of all PRC imports) during 1981.[16] It remains the major conduit for PRC trade, estimated at several hundred million dollars each year, with Taiwan, South Korea and South Africa—areas with which the PRC has difficulty in managing a formal trade relationship.[17]

Hong Kong entrepreneurs, who provide the vast bulk of investment in Hong Kong, are also the major investors in the new Chinese Special Economic Zone, which adjoins the colony in Shenzhen, and provide the major share of foreign investment for Guangdong Province. Hong Kong is a rear supply and operations base for the large scale oil exploration and development effort now underway in the South China Sea. It has excellent modern transportation facilities, including the best deep water port along the China coast, the third largest container terminal in the world, and a modern airport which handles 7 million passengers and 300,000 tons of cargo each year. Hong Kong also provides the PRC with easy access to modern financial, trade and management institutions, where PRC representatives can learn—from Chinese people in Chinese language—the intricacies of modern Western business practices. In Hong Kong, this can be done at a safe distance, without jeopardizing Beijing's strong commitment to maintaining its socialist system as free as possible from the "corrupting" influences of the "bourgeois" ideas of the West.[18]

Chinese leaders also are almost certainly aware that Western business leaders will take into account PRC handling of Hong Kong issues as they begin consideration of possible large scale investment in the PRC itself. Thus, a PRC policy toward Hong Kong that serves to undermine business confidence and leads to economic decline there could serve to make Western investors more cautious in pursuing closer ties with the PRC.

Despite these strong economic incentives encouraging a restrained PRC approach toward Hong Kong, there are economic factors that might prompt Beijing to take a more active and direct role in managing the territory's affairs. Thus, PRC leaders may judge that they now have built up sufficient expertise in working with Western business interests over the past few years that they can now effectively manage enterprises in Hong Kong more directly, just as they have recently managed Western style enterprises in the Special Economic Zones that have been set up in the PRC over the past few years. They may also judge that profits from enterprises in Hong Kong should be controlled and channeled more directly to the benefits of the Chinese state, rather than having the PRC benefit only indirectly from Hong Kong's prosperity. Meanwhile, if conditions in Hong Kong were to deteriorate—caused perhaps by a run on the Hong Kong dollar—despite Beijing's best efforts to reassure the Hong Kong people of China's future inten-

[16] U.S. Department of Commerce. Foreign Economic Trends and Their Implications for the United States. Hong Kong 1983.
[17] See Far Eastern Economic Review, March 17, 1983. p. 74.
[18] See Far Eastern Economic Review, March 17, 1983. pp. 43-74.

tions, Beijing may judge that assertion of Chinese control, perhaps before the 1997 deadline, would provide the best means to preserve the territory's prosperity and value to China.

U.S. Interests and Options

In recent years the United States has remained Hong Kong's largest foreign investor and trading partner. By mid 1983, according to official U.S. statistics, U.S. investment in Hong Kong reached $2.7 billion but the actual figure is thought to be much higher, estimated at around $4 billion. The United States is the major foreign direct investor in Hong Kong's manufacturing sector with 47 percent of total investment, followed by Japan with 30 percent. Out of Hong Kong's total two-way trade of $44.5 billion in 1982, $8.6 billion [19] of this was with the United States. The United States absorbed 38 percent of Hong Kong's total domestic exports that year. In 1983, Hong Kong's trade value jumped by over 20 percent and the U.S. absorbed 42 percent of Hong Kong's exports. As a supplier, the United States ranked third, after China and Japan; the American share of Hong Kong's import market was 11 percent in 1982 and 1983. U.S. businesses in Asia have long used Hong Kong as a base of operations and a major transportation, communications and financial support center. Hong Kong has loomed larger in U.S. considerations as American firms have used the colony as a base in exploring the China market. Meanwhile, the U.S. Government uses Hong Kong as an important base of operations for information, commercial and recreational activities.

Americans interested in Beijing's future policy toward Taiwan have also been following closely China's approach to Hong Kong for indications as to how Beijing intends to deal with Taiwan. Thus far, Chinese spokesmen have explicitly linked Beijing's approach on the two issues, though some have added that while Beijing wants British administration to be replaced by a "Chinese" one representing the "people" or Hong Kong, in the case of Taiwan, the administration is already Chinese and, therefore, would not have to be replaced.[20]

If Beijing manages to reassert its sovereignty over Hong Kong without disrupting the social and economic order there, it could add substantial credibility to its claim that China's reunification with Taiwan would have no negative effect on the way of life there and could thereby ease concerns of some Americans about how U.S. interests in Taiwan would be affected by reunification with the mainland. Of course, if Beijing is seen as mishandling the situation in Hong Kong, leading to serious economic decline and social disorder there, it would reduce, in the eyes of many Americans, the credibility of PRC claims that Taiwan's reunification would not adversely affect U.S. interests on the island. It could also prompt American business leaders to be more cautious in ventures in the PRC.

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[19] This figure included $5.1 billion in Hong Kong domestic exports to the U.S.; $0.95 billion in re-exports from Hong Kong to the U.S.; and $2.5 billion in Hong Kong imports from the U.S.

[20] See remarks of Chinese leaders Deng Xiaoping and Liao Chengzhi replayed in FBIS. Daily Report, China. November 23, 1982.

Despite strong American interest in Hong Kong's future, however, current circumstances appear to induce the United States Government to restrict its involvement to the role of an interested bystander regarding Hong Kong's future. London and Beijing have indicated little public interest in American support or involvement; both sides presumably judge that their discussions are complicated enough without injecting outside forces into the equation.

One suggested option calls for the United States to intercede with China privately in order to encourage a restrained PRC policy toward Hong Kong that appears more likely to preserve the economic and social status quo there. However, Beijing is judged to be less than receptive to such an American demarche over an issue of Chinese sovereignty at a time when PRC leaders see the United States repeatedly affronting Chinese sovereignty with arms sales to Taiwan. Moreover, American willingness to discuss Hong Kong's status with the Chinese could be used as a precedent in any possible Chinese efforts to engage the United States in talks over Taiwan's future status.

It is possible that U.S. officials could attempt to influence the course of events indirectly, especially through American leaders in business and multinational corporations that have as strong interest in Hong Kong and enjoy good ties with PRC leaders. These executives might be encouraged to underscore in conversations with PRC leaders the advantages of a very cautious and consistent Chinese policy regarding reassertion of Chinese rule that presumably would help insure continued business confidence there.

American officials might also encourage Hong Kong leaders to be more assertive in their discussions with PRC leaders in emphasizing the need for Chinese restraint. According to a view prevalent in Hong Kong, only a few of the large number of Hong Kong delegates who have visited with PRC leaders in Beijing over the past two years have forcefully asserted the need for a basically hands off PRC approach to the colony. Rather, they have tended to listen politely to PRC leaders' suggestions for the colony's future and to convey those views to the Hong Kong media.

Some observers point out that Hong Kong leaders who have traveled to Beijing for talks with top PRC officials sometimes have not been more assertive in putting forth Hong Kong's interests in part because many of them are very wealthy entrepreneurs who are prepared to flee the colony at the first signs of a serious decline in the status quo.[21] It is also noted that Hong Kong residents do not have a well developed tradition of political activism. The Government has been run by the Governor and the Cabinet which receives advisory support from the Executive and Legislative Councils representing leaders in the community. There have been few important political parties indigenous to the colony, although both the Chinese Communist Party and Chinese Nationalist Party maintain some influence there.

Middle class Hong Kong business and professional leaders, who are seen as more committed to Hong Kong's future and representing natural leaders under the current situation, have appeared

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[21] The Future of Hong Kong. Washington, D.C., The Asia Society. June 28, 1984.

only recently to organize themselves so that their views on the need for PRC noninterference in Hong Kong will be taken into account. Presumably, American officials could encourage these middle class Hong Kong representatives to organize themselves more rapidly and effectively in order to make sure that their interests—which appear compatible with American interests in the territory—are taken more fully into account by the PRC in future policy toward Hong Kong. Nevertheless, this approach could backfire if it became known to PRC leaders, who then might view such Hong Kong representatives as an American "front" less credible to the PRC.

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PRC TEXTILE TRADE AND INVESTMENT: IMPACT OF THE U.S.-PRC BILATERAL TEXTILE AGREEMENTS

By Joseph Pelzman*

CONTENTS

ABSTRACT

The textile industry has always been viewed as one of the first manufacturing industries in an economy's development process. It is therefore not surprising to find in the PRC a discussion of the benefits of expanding the textile industry. Increased output of this industry would not only increase the per capita consumption in the PRC but is also expected to increase the country's foreign exchange earnings.

Textile and apparel exports are, by far, the most important of China's exports. In 1983, total PRC textile and apparel exports equaled $6,718.6 million or 28 percent of its total exports. In terms of U.S. trade, textile and apparel exports in 1983 equalled $975.1 million or 43 percent of total PRC exports to the U.S. The importance of the textile industry to the PRC reflects both its current comparative advantage and the current Chinese economic policy of stressing the importance of light industry over heavy industry.

Any current discussion of expanding a textile industry in a developing country, however, must come to terms with the reality of today's textile trading environment. Unlike the pre-1950's, today's international trade environment for textiles is constrained for all developing country exporters under the Arrangement Regarding International Trade in Textiles or more commonly, the Multifiber

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Arrangement. The PRC as a new entrant to this exporting world signed the first textile bilateral with the U.S. in September 1980 to be followed by a more comprehensive bilateral agreement signed in August 1983. This latter agreement imposes specific quantity limits on 33 textile categories or 55 percent of total PRC textile exports to the U.S. in 1983. Clearly, any future investments by the PRC in its textile and apparel industries must take into account the limitations on market access which the current U.S.-PRC bilateral textile agreement imposes.

The intent of this paper is, therefore, to determine the impact of the first textile agreement on the export performance of the PRC and to speculate on the effect of the second agreement on the decision of the PRC to continue its expansion and modernization of the textile and apparel industries.

The first bilateral U.S.–PRC textile agreement, which by all accounts, was based on expected Chinese strengths, imposed specific limits on what was perceived as the PRC's then current comparative advantage, namely, a limited set of 8 cotton and synthetic fiber textile and apparel categories.

The experience of the PRC in utilizing the first textile bilateral was predictable. The PRC over the 1980–82 period managed to successfully shift its exports from restricted to unrestricted categories. Despite the existence of the bilateral agreement, one finds that the total volume of PRC textile exports actually increased as its exports adjusted to the quota system.

In large part, as a response to the PRC's success in utilizing the first quota agreement, the U.S. insisted in the second agreement on a more comprehensive set of specific quotas. This second agreement covers 33 items under specific quotas. Not only does the current list include the initial 8 categories but it also encompasses all the other textile and apparel items in which the PRC demonstrated an export potential in the 1980–82 period.

Based on the PRC's export performance during the first textile agreement one expects that during the second agreement it will also be able to divert its exports to uncontrolled categories. In cotton textiles, one would expect the PRC to increase its exports of sheets, pillowcases, down-filled coats, underwear and hosiery. In man-made textiles, one would expect the PRC to increase its exports of skirts, suits, nightwear and floor coverings. In wool textile and apparel categories the U.S. has already imposed controls on those items with the fastest rate of growth and highest market penetration rates. The only items showing a potential are women's wool coats and wool floor coverings. In all of these categories the PRC has demonstrated both a rapid growth of output and continued purchases of foreign textile equipment.

One can, therefore, conclude that despite the U.S.–PRC bilateral controls, the PRC will be able to continue its textile expansion program with little difficulty in accessing the U.S. market. The quantitative controls in the bilateral will only serve to force the PRC to maintain its flexibility in producing textile and apparel products. They will not limit the total volume of PRC textile and apparel exports to the United States. In fact, based on the earlier PRC export performance, one should find that the total volume of PRC textile and apparel exports to the U.S. will rise above the limits imposed by the 1983 U.S.-PRC bilateral textile agreement.

I. Introduction

With the general decentralization of the foreign trade apparatus of the People's Republic of China (PRC) in 1978 and 1979 and with the increasing normalization of relations between the PRC and the United States [1] bilateral U.S.-PRC trade has increased significantly. Chinese total exports rose from $10.1 billion in 1978 to $23.9 billion in 1983, its imports rose from $10.3 billion in 1978 to $18.4 billion in 1983. Chinese exports to the United States rose from $592.2 million in 1979 to $2,244.1 million in 1983, making the U.S. its third largest trading partner after Hong Kong and Japan.

On a commodity level, China's recent exports to the U.S. have emphasized light industrial items such as textiles, clothing, hardware and raw and semi-finished goods such as cotton fabric and crude minerals. Textile and apparel exports are, by for, the most important of China's exports. In 1983, total PRC textile and apparel exports equalled $6,718.6 million or 28 percent of its total exports. In terms of U.S. trade, textile and apparel exports in 1983 equalled $975.1 million or 43 percent of total PRC exports to the U.S. The importance of the textile industry to the PRC reflects both its current comparative advantage and the current Chinese economic policy of stressing the importance of light industry over heavy industry.[2]

The textile industry has always been viewed as one of the first manufacturing industries in an economy's development process. It is, therefore, not surprising to find in the PRC a discussion of the benefits of expanding the textile industry. Increased output of this industry would not only increase the per capita consumption in the PRC but is also expected to increase the country's foreign exchange earnings. Any current discussion of expanding a textile industry in a developing country, however, must come to terms with the reality of today's textile trading environment. Unlike the pre-1950 period, today's international trade environment for textiles is constrained for all developing country exporters under the Arrangement Regarding International Trade in Textiles or more commonly, the Multifiber Arrangement. The PRC as a new entrant to this exporting world signed the first textile bilateral with the U.S. in September 1980 to be followed by a more comprehensive bilateral agreement signed in August 1983. This latter agreement imposes specific quantity limits on 33 textile categories [3] or 55 percent of

[1] Bilateral U.S.-Chinese relations significantly improved after the July 7, 1979 signing of the U.S.-PRC framework trade agreement providing, among others, for the mutual extension of non discriminatory (i.e. MFN) tariff treatment. As of February 1, 1980 U.S. imports of PRC goods began to be dutied at MFN tariff rates. In September 1980 the two economies signed the first U.S.-China textile agreement. The second textile agreement effective as of January 1, 1983 was signed in August 19, 1983. These agreements are generally viewed as providing both the impetus for increased PRC exports to the U.S. as well as increased control of PRC exports of textile products.

[2] The shift in favor of light industries reflects the overal reforms initiated in the PRC in 1979. In fact, the textile sector is one of the few which has been spared the austerity policy introduced by China in 1981.

[3] The 1983 agreement constrained Chinese exports of 5 wool apparel categories, 10 man-made fiber apparel categories, 2 cotton fabric categories, and 16 cotton apparel categories.

total PRC textile exports to the U.S. in 1983.[4] Clearly, any future investments by the PRC in its textile and apparel industries must take into account the limitations on market access which the current U.S.-PRC bilateral textile agreement imposes.

The intent of this paper is, therefore, to determine the impact of the first textile agreement on the export performance of the PRC and to speculate on the effect of the second agreement on the decision of the PRC to continue its expansion and modernization of the textile and apparel industries. The degree to which this second quota arrangement will limit the size of investment by the PRC depends on whether or not the existing agreement is expected to impose binding limits on its current textile exports or to constrain the PRC's ability to shift across commodity groups, from restricted to unrestricted categories. An evaluation of the role of the first textile bilateral will not only shed light on the ability of the PRC to react to the second agreement but will also provide information on the ability of the United States to restrict the textile exports of a new entrant like the PRC.

The plan of the paper is as follows; Section II will outline the two bilateral U.S.-PRC textile trade agreements within the context of the global system of textile trade controls. The general characteristics of the Chinese textile industry along with a discussion of its current state of technological maturity as compared to the international norm are presented in Section III. The performance of PRC textile exports over the 1980-83 period are analyzed in Section IV. Concluding remarks are presented in Section V.

II. Bilateral U.S.-PRC Textile Agreements

International trade in textiles has been controlled by a series of Orderly Marketing Agreements (OMAs) since the late 1950s.[5] All of these agreements are umbrella agreements within which bilateral agreements are "negotiated" between an importing and an exporting country. Under the current Multifiber Agreement (MFA III), the U.S. has 24 bilateral agreements with its major suppliers, each agreement limiting imports, of a specific list of commodities as well as their growth rate.

A second major characteristic of these OMAs is that they provide for quantitative limits based on product type rather than price. Under the previous MFA agreements, the U.S. had negotiated limits on both an aggregate country basis as well as within country limits, established group limits and within those limits commodity specific limits. In the current set of agreements most developed countries have preferred to set either specific limits or consultation levels.

The third common characteristic among these OMAs is that they generally start as "selective" restrictions, applied only to a few dynamic producers as well as products. After a prolonged period of bargaining and selectivity, these OMAs begin to encompass more

[4] This import control figure is measured in square yard equivalents.

[5] A chronology of these agreements includes: 1957—Japanese voluntary export controls on cotton products; 1961-62—Short Term Cotton Arrangement (STA); 1962-73—Long Term Arrangement on Cotton Textiles (LTA); 1974-77—The Multifiber Arrangement (MFA I); 1978-81—MFA II; 1982-86—MFA III.

players and a wider net of goods. The current Multifiber Agreement must therefore be regarded as an extension of the earlier OMAs on cotton products and the initial post-war Japanese voluntary export controls. Over the past 25 years the U.S. expanded these restrictions from cotton as applied only to Japan, to cotton applied to all the major suppliers, finally to all fibers applied to all less developed country (LDC) and newly industrialized country (NIC) exporters. Currently, new entrants, like the PRC, are inclined to demand a larger share of the restricted pie, which under the present protectionist environment is most likely to come from a redistribution of quota shares from the three major suppliers—Hong Kong, Taiwan and South Korea.

In order to better understand the position of the PRC in this international environment one must first review the historical development of these OMAs leading up to the current and third MFA. In what follows we trace this history from the first post war Japanese OMA to the current MFA III agreement. The quota set for the PRC is then compared with that set for the other three major suppliers.

A. PRE-MFA PERIOD

In the early 1950's the U.S. textile industry was faced with market adjustment problems precipitated by excess capacity in cotton textiles, the shift to synthetic fibers and technological changes, and by increased imports of certain cotton textile products from Japan. As a partial solution to its problems the industry began to seek protection from import competition. The primary exporter targeted by the industry was Japan.[6] In response to "escape clause" actions and fearing legislation authorizing import restrictions, Japan in 1957 agreed to voluntarily control its exports of cotton textiles and apparel to the United States.

While this agreement was successful in limiting Japanese exports of cotton products to the U.S., it encouraged increased imports from such new entrants as Hong Kong, Portugal, Egypt and India. It soon became obvious to the U.S. that in order to adequately control imports, a more comprehensive solution was necessary. This solution, however, should avoid legislated import restrictions and should be designed to consider both the long-term problems of expanding textile industries in the developing countries and the contracting textile and apparel industries in the developed countries. Such an agreement known as the Short Term Cotton Textile Arrangement (STA) was negotiated in 1960 and came into effect for one year beginning on October 1, 1961. This was followed by a more comprehensive agreement, known as the Long Term Arrangement on Cotton Textiles (LTA), which went into effect for five years on October 1, 1962, and was extended twice through 1973.

The key feature of the LTA and its predecessor the STA was the so-called "market disruption" provision. Under the GATT safeguard clause (Article XIX), emergency protective action such as the imposition of quantitative restrictions or the increase in tariff rates

[6] For a more detailed description of the development of the textile quotas see Keesing and Wolf (1980) and USITC (1978).

is permitted when imports enter "in such increased quantities as to cause or threaten serious injury to domestic producers". "Market disruption" as defined in the LTA differs from the "serious injury" referred to in Article XIX in that market disruption is attributed specifically to the threat to an industry from low-priced imports from particular sources. Furthermore, under the LTA, relief was permanent, whereas under Article XIX it is constrained to a specific time period. Compensation and non-discrimination (Article I) were also eliminated with the LTA.

Imports of man-made fiber textiles and apparel, unlike cotton textiles, which were bilaterally controlled, increased more then ten fold over the life of the LTA. In response to the LDC success in expanding exports of man-made apparel, the U.S. attempted to widen the scope of the LTA. In 1971, the U.S. reached bilateral agreements with its principal suppliers, Japan, Hong Kong, Taiwan and Korea, designed to control the flow of wool and man-made textile and apparel products. These restrictions, however, were not justified under the LTA framework and subsequently the U.S. focused on amending the LTA such that it would cover textile and apparel products of all three fibers.

B. THE MULTIFIBER ARRANGEMENT

A comprehensive agreement to cover all fibers was reached on December 20, 1973. This multilateral agreement known as the Arrangement Regarding International Trade in Textiles, or more commonly the Multifiber Arrangement (MFA), became the "statement of principle and policy" regarding international textile trade. While the PRC is not a signatory of this Arrangement, the U.S. nevertheless has negotiated bilateral agreements with the PRC as if it was. The MFA, which initially covered the period January 1, 1974 to December 31, 1977, and was later extended, with some major modifications, first through December 31, 1981 and later through July 31, 1986, took as its primary goal the fulfillment of two mutually exclusive objectives. That is, to foster the expansion of world trade in textiles with particular emphasis on LDC exports while, at the same time, preventing disruption of developed country markets.

While the MFA sets out an annual 6% growth in the quantity limits agreed to in the bilaterals, the flexibility provisions in the original MFA could increase the volume of textile imports in excess of the 6% mark in any given year. Under the flexibility provisions, countries were allowed to transfer unused quotas among categories and between years. A "carry-over" provision allowed allocating an unused portion of the previous year's quota to the present year. A "carry-forward" provision allowed allocating to the present year a portion of next year's quota. Any such borrowing must be accounted for by an equivalent decrease in the following year's quota. A "swing" feature allowed an exporting country to shift or reallocate a portion of the quota from one product group or category to another.

While the original MFA (MFA I) provides the "framework" for an orderly and equitable[7] regulation of trade in textile products, the specific implementation of this agreement is dependent on the set of bilateral agreements drawn up. Under most of the bilaterals, within each aggregate limit, specific quota levels for subgroups and specific quotas for items within subgroups were established. In the event that a particular item was perceived to be "very sensitive", specific levels were negotiated for the duration of the agreement which would allow for less then 6 percent growth.

At the expiration of the first MFA (December, 1977) the U.S. was satisfied with the controls these regulations provided. Textile imports (excluding apparel) over the 1974-77 period increased by 1.5 percent or at an annual average rate of 0.4 percent. Apparel imports, on the other hand, increased by 27 percent or at an annual average rate of 6.8 percent.[8] The EEC member states, who had no consistent textile trade policy during this period were not satisfied with MFA I and demanded major modifications. In large part to satisfy EEC concerns, the extension protocol renewing the MFA, contained an amendment which allowed "jointly agreed reasonable departures" from the 6 percent growth rate in quotas and from the agreement's "flexibility provisions", allowing not only growth at less than 6 percent, but also for zero or negative growth in those products considered sensitive by importing countries.

Under MFA II, which included the new protocol providing for jointly agreed "reasonable departures" from the MFA, the European Community negotaited a series of five year bilateral agreements which cut quotas below previously achieved levels and curtailed still further the growth of imports from certain developing countries. In effect the EC managed to use this clause to establish "global" quotas for a number of what they considered to be "sensitive products". While the U.S. never formally invoked the "reasonable departures" clause, it did respond to industry pressure threatening to hinder U.S. participation in the multilateral trade negotiations by reducing some of the flexibility in existing agreements. Under the provisions of MFA II, the United States had concluded bilateral agreements with 22 supplying countries including the PRC and consultative mechanisms with 11 other countries. In effect these bilateral agreements controlled over 80 percent of total U.S. imports of textile and apparel products.[9]

Under the current agreement (MFA III), which is to last over the 1983-86 period, country specific bilaterals are designed to limit the aggregate growth rate of imports to the growth of the domestic market, defined as per capita consumption of textiles and apparel of 1.5 percent per annum. For the first time, this MFA allows for the globalization of quotas and attempts to redistribute quota

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[7] By equitable, the authors of the MFA meant that it provided for a small but guaranteed 6% expansion in the exports of LDCs. Furthermore, it was considered "orderly" in that developed country producers would not be subjected to competition at prices "substantially below" their own.

[8] These growth rates are determined from imports measured in millions of equivalent square yards. The growth rate within product group was very different from these average growth rates.

[9] It is very difficult to determine precisely the quantity of textile exports controlled under the quota system. The eighty percent noted here refer to the percent of textile imports in the 1980-82 covered by MFA specific and consultative quotas.

shares in favor of the new entrants at the expense of the more established NICs. As the product of repeated refinements this Multifiber Arrangement (MFA III) not only attempts to control the international trade of textile and apparel commodities, but also affects the investment plans of both existing as well as newer producers and exporters.

C. THE U.S.-PRC TEXTILE AGREEMENTS

The People's Republic of China has, since the normalization of political relations between it and the United States, signed two textile agreements under the framework of the MFA. The first agreement signed in September 1980 covered PRC textile exports for the period January 1, 1980 through December 31, 1982. The second and more comprehensive agreement signed in August 1983 covers the five-year period from January 1, 1983 through December 31, 1987.

The specific quota limits contained in both agreements are presented in Table 1 through Table 3 for cotton, man-made and wool textile and apparel categories, respectively. Specific quota limits for the top three exporters—Hong Kong, South Korea, and Taiwan are presented for comparison purposes. The first textile agreement, which by all accounts was based on expected Chinese strengths, imposed specific limits on what was perceived as the PRC's current comparative advantage, namely, a limited set of cotton and synthetic fiber textile and apparel products. Consequently, the first agreement listed 8 categories (four of which were combined to two).

The first agreement included such items as cotton gloves, knit shirts, blouses and trousers made of cotton, and sweaters made of synthetic fibers. In terms of the quantity of textile and apparel exports under control, this initial agreement was very generous. In terms of cotton exports the controls affected 23 of China's initial 1980 exports. However, as the PRC began to export larger quantities of cotton textile and apparel to the U.S., these controls affected only 15 percent of its 1982 cotton textile and apparel exports. A similar set of events occurred in manmade fiber textile and apparel exports. Initially these controls affected 38.4 percent of the PRC's manmade fiber textile and apparel exports, declining to 9.7 percent in 1982. In wool products, where the U.S. has historically imposed very tight controls, the initial agreement did not control any of the PRC's wool textile and apparel exports during the 1980–82 period.

In large part, as a response to the PRC's success in utilizing the first quota agreement, the U.S. insisted in the second agreement on a more comprehensive set of specific quotas. This second agreement covers 33 items under specific quotas. Not only does the current list include the initial 8 categories but it also encompasses all the other textile and apparel items in which the PRC demonstrated an export potential in the 1980–82 period.

This current agreement now specifically limits, in addition to the old list, the exports of cotton fabric, cotton coats, playsuits, shirts, skirts, sweaters, dressing gowns, nightwear apparel and terry towels. In terms of manmade fiber textile and apparel categories the agreement now also includes the exports of gloves, coats, dresses, shirts, blouses and trousers. Also for the first time this agreement limits China's exports of wool apparel. Specifically, it imposes upper limits on the exports of wool suits, sweaters and trousers. This new agreement affected 56 percent of China's cotton textile and apparel exports, 40 percent of its wool apparel exports and 53 percent of its manmade fiber apparel exports in 1983.

Compared to the bilateral textile agreements with Hong Kong, Korea and Taiwan, the two bilateral U.S.-PRC textile agreements stipulate far larger growth rates. Using the PRC's controlled list as a benchmark one notes that the U.S.-PRC bilaterals allow for an annual growth rate in cotton textile and apparel exports of 14.15 percent as compared to 0.64 percent for Hong Kong, 4.39 percent for Korea and 4.55 percent for Taiwan. Given this differential in growth rates, the share of PRC's exports in these controlled items, assuming full utilization, will increase at an annual average rate of 9.18 percent over the 1980-87 period. For manmade fiber apparel, the U.S.-PRC bilaterals allow for a 17.05 percent growth rate as compared to 2.76 percent for Hong Kong, 0.76 percent for Korea and 6.44 percent for Taiwan. Assuming full utilization, the PRC's share of these controlled exports should grow at an annual rate of 12.42 percent over the 1980-87 period. For wool the prescribed growth rate for the PRC is 0.43 percent as compared to 0.21 percent for Hong Kong, 0.21 percent for Korea and 0.19 percent for Taiwan. Given this degree of control, it is expected that the PRC's share of these items will grow by 0.17 percent per annum over the 1983-87 period.

In general, both bilateral U.S.-PRC textile agreements are very much akin to the textile agreements drawn up with the three major suppliers. While the current agreement stiplulates for larger growth rates for China's exports, it also goes a long way in limiting the majority of China's potential textile and apparel exports to the United States. A discussion of the impact of this agreement on China's future development of its textile and apparel sector will be presented in section IV. We now turn to a discussion of the current state of the Chinese textile and apparel industry.

III. The PRC Textile Industry

The textile complex in the People's Republic of China consists of three major segments, the fiber producers—both natural and manmade, the textile industry, and the apparel industry as end user. The other major participant is the textile machinery sector which acts as intermediary in the production process. The extent to which the current bilateral U.S.-PRC textile agreement will affect current and future expansion programs in China depends on the ability of the PRC to shift across product lines from restricted to unrestricted categories. The degree to which this is possible depends on the level of technical sophistication and integration of the industry. The more closely related are the technologies between restricted and unrestricted textile categories the more likely is the PRC to shift its exports to unrestricted categories, ceteris paribus. In what follows we will focus on the textile production process in the PRC, its current technological state and on its plans to innovate some of the industry subsectors.

A. THE PRODUCTION PROCESS

A general description of the production process and the general supply and demand relationships underlying the textile industrial complex is provided in Figure 1. The primary supply link in this complex is the fiber industry. It is generally decomposed into suppliers of natural fibers and man-made fibers. The natural fiber supply generally originates from agriculture and consists of such fibers as cotton, jute and wool. A major factor in the supply of cotton and other natural fibers is the degree of agricultural efficiency and the tradeoff between the growth of natural fibers and foodstuffs.

Cotton represents nearly 90 percent of China's total textile fiber consumption at the present time. Even though cotton's share is gradually declining, for the next decade it will still represent 80 percent of the total PRC textile fiber consumption. China has the largest mill consumption of cotton in the world, reaching 13.7 million bales in 1980. (See Table 4 for current data on the production and consumption of cotton in the PRC.) By way of contrast, U.S. mill consumption of cotton for the same period came to 6.1 millon bales. The area devoted to the cultivation of cotton in China declined from a peak of 6.2 million hectares (1 hectare=2.471 acres) in 1956 to about 4.8 million hectares in 1980. Since 1980, the Chinese government has made an effort to increase domestic cotton production. This proved effective since China's output of cotton rose by 21% in 1982 to 3.59 million metric tons.[10]

While natural fibers were important to the textile complex in the early 20th century, of even greater importance today is the whole array of man-made fibers and manmade fiber textiles and apparel products.[11] By world standards, the man-made fiber industry in China is very small. Table 5 lists the output of various fibers over the period 1949–82. While the share of man-made fibers has increased since the late 1960s, it still represents less than 25 percent of total fibers consumed. By way of contrast, in the U.S. textile industry man-made fibers consumed exceeds 80 percent.

In the past few years China has proceeded with its plans to expand the man-made fiber industry. Several petrochemical and fiber complexes have been developed in various parts of the country. Those in Shanghai, Tianjin, and Liaoyang in Liaoning Province utilize oil as the base raw material. Polyester fibers are produced in all three complexes, while nylon is produced only in Liaoyang, and acrylic and vinylon fibers are produced in Shanghai. The smaller complex in Chongqing, in Sichuan Province, utilizes natural gas as its raw material and produces vinylon fiber. In addition to these relatively large petrochemical and fiber complexes, there are other smaller man-made fiber plants located throughout China, producing a variety of staple and filament yarn.

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[10] This shift to increase domestic output of cotton is reflected by a substantial decrease in cotton imports. The U.S. who, in the recent past, has been the major exporter of cotton to the PRC saw a decrease in its cotton exports, from $464.0 million in 1981 to $4.4 million in 1983. Likewise in synthetic fibers, the Chinese have drastically reduced their purchases from $316.6 million in 1981 to $24.5 million in 1983. See USDA, Current Situation Report, various years.

[11] Man-made fibers consist of cellulosic fibers and synthetic or non-cellulosic fibers. Examples of cellulosic fibers are rayon, acetate, and triacetate. The most common synthetic fibers are polyester, nylon, acrylic, and polypropylene.

As part of the rethinking of the expansion plans for light industries, the second phase of the expansion of the production of polyester fibers from the Shanghai Petrochemical and Fiber Complex has been delayed, and the ambitious plan to develop the Yizheng General Chemical Fiber Plant in Yizheng in Jiangsu Province, originally slated to produce 1.2 billion pounds of polyester fibers yearly, has been postponed.

The major factor limiting the growth of this sector in the PRC is the large capital cost and economies of scale requirements. Consequently, the major world producers of man-made fibers are based in the developed countries and are an integral part of a larger chemical industry. In the United States, this industry is represented by such giants as DuPoint, Celenese, Eastman and Monsanto. Outside to the United States their counterparts include; ENI and Montedison in Italy, Hoechst, Bayer and BASF in Germany, ICI in the U.K., Rhone-Poulenc in France, Akzo in the Netherlands, Mitsubishi Rayon, Asahi Chemical, Mitsui Chemical, Toray Industries, and Teijin in Japan. Knowlege creation and utilization in terms of creating new products, aggressively sustaining markets and inventing new products has become the major pre-condition in this industry. While the Chinese synthetic fiber industry is no match for these larger U.S. and European chemical producers, they have since the mid-1970s initiated a number of orders for both whole plants as well as machinery imports. Table 6 lists some of the larger Chinese contracts initiated since 1974.

The intermediate stage of the textile complex involves the processing of fiber into yarn and fabric. This is essentially the work of the textile industry. The process at this level can be broken into three distinct functions, yarn spinning, fabric forming, and the finishing of fabrics. China's 100 year old textile industry consists of approximately 11,900 enterprises containing a mixture of various-sized mills, with both modern and outmoded machinery focusing primarily on the production of cotton fabrics. At the end of 1982 there were approximately 19 million cotton-system spindles and half a million looms in China.[12] With the exception of Tibet, cotton mills are found in every province. As a number of Chinese commentators have pointed out, this is one of the problems of the Chinese textile industry.[13]

In today's market the process of spinning yarn has become a highly capital intensive process, requiring textile machinery designed to separate fibers, spin yarns, and to chemically treat them. The spinning of several different kinds of fibers (blends) into a single yarn requires additional machinery and technical know-how. China has, according to some reports, the largest number of pure cotton-system spinning spindles in the world, spinning 100 percent cotton yarn. Of all the textile sectors in China, cotton spinning is by far the most important and the most advanced. Despite the geo-

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[12] International Federation of Cotton and Allied Textile Industries.

[13] See for example, "Too Many Small Textile Mills Being Built" in JPRS, No. 114, 3/2/81; "Measures to Develop Textile Industry Examined" in JPRS, No. 192, 24/12/81 and "Reform of Clothing Production" in JPRS, No. 167, 2/9/81.

graphic dispersion of the cotton-systems, Shanghai still remains the nucleus of cotton spinning in China.[14]

The size of the cotton mills in China varies considerably. The biggest is the Shanghai No. 17 Cotton Mill, with 140,000 spindles followed by the No. 1 Cotton Mill in Chendu, Sichuan with a total of 107,000 spindles and the Zhengzhou Textile Mill with 100,000 spindles. Most of the mills currently erected in such areas as Zhengzhou in Henan Province and Shijiazhuang in Hebei Province contain 30,000 to 50,000 spindles with a weaving capacity of 1,000 looms to 50,000 spindles. Despite these economical mills, China still has a very large number of small mills with fewer than 10,000 spindles.[15]

Once a fiber is spun into yarn it must be transformed into a fabric. This process can be accomplished either by weaving, knitting or by nonwoven technologies. Until the 1950's, weaving was the major fabric forming process in the world. Knitting was primarily used in the production of apparel fabrics such as sweaters, stockings and underwear. In the mid-1960s knitted fabrics, largely in the form of double-knits, were introduced in the United States and in Europe. Nonwoven fabrics were introduced in the 1970's in the form of tufted carpets.[16]

The weaving sector in China, despite its size of about 500,000 looms, is by world standards far less innovative. Most of these weaving mills are late nineteenth and early twentieth century, and are an amalgamation of small weaving sheds. While the larger mills are located near the important concentration of cotton spinning mills, a very large number of smaller mills are widely scattered throughout the country.

The knitting industry in China is equally fragmented and is dispersed over the entire country. The Shanghai No. 20 Knitting Mill producing an estimated 11,000 lbs. of cotton knitted fabrics and 3,300 lbs. of man-made fiber knitted fabrics, per day on its 230 machines is still one of the largest knitting mills in China. However, even this mill is a conglomerate of over 30 small knitting workshops using 1950s machines. This knitting mill along with others in China deal exclusively with either cotton or man-made yarn. Textured polyester filament yarn is mostly imported since texturing is still non-existent in the PRC.

On the whole, the knitting sector is the least developed in China. Consequently, the PRC has selectively purchased advanced knitting machinary from abroad. For example, China purchased five Jacquard Raschel machines for producing curtains and ten Tochon lace machines used in making tablecloths and upholstery from Nippon Mayer Co.[17]

The most visible element of the Chinese knitting sector is the well developed woolen sweater industry in Shanghai, which has made it possible for the PRC to increase its exports of woolen

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[14] Shanghai is reported to have over 2 million cotton spindles. IFCATI reports that the Shanghai textile industry in the past two years has accounted for approximately 24% of the total PRC textile output.

[15] For example, in Natong there are 27 textile mills with a total of 231,000 spindles.

[16] They are also commonly used in the production of disposable diapers, coated fabrics for furniture, wall coverings, and many packaging materials.

[17] JPRS, 1980.

sweaters to the United States. The woolen sweater industry has 14 mills with 1,600 knitting machines. The majority of these machines have been transformed and equipped with new digital process control and photoelectric process control techniques, designed to improve quality of the end product. An example of this newer woolen mill is the Tianshan Woolen Mill at Urumqi. This joint PRC-Japanese enterprise, using Japanese equipment, is designed to annually produce 464 tons of cashmere yarn and woolen yarn and 720,000 pieces of cashmere and woolen sweaters.[18]

The final process in the textile stage is the finishing of fabrics. The degree and the nature of processing is far more important today then was the case historically. Fabric forming requires a great deal of technology both in terms of capital and human skills. In many developed countries, the finishing is done as part of the overall textile operation in an integrated textile facility. In the case of the PRC, this sector is for all practical purposes non-existent. Two reasons account for this fact. First, the Chinese textile industry is a non-integrated industry. That is, the dyeing and finishing operations are separate from spinning and weaving, requiring outside contracts. Secondly, the PRC has not historically shown a desire to produce what Western retailers have called "well-finished" garments. As one Chinese commentator has noted the major problem of the finishing sub-sector is that "over a long period of time little importance has been attached to the (Chinese) clothing industry" and as a result they have been "considered as small commodities of the third category".[19] Apart from some casual purchases by the Chinese of finishing equipment there is little evidence that the PRC will invest in the finishing portion of the industry.

In most developed and developing countries, the principal end users of textile products are the apparel, home furnishings and industrial uses segments of the textile complex. The largest of these end users is the apparel industry. Worldwide this segment of the industry has traditionally been the most labor intensive and most fragmented. In this case, the apparel industry in the PRC differs very little from the apparel industries of the other major producers. In 1979 the Chinese apparel industry consisted of approximately 5,600 enterprises under the department of light industries.[20] However, given that this industry supports many cottage enterprises it is difficult to determine the exact number of apparel establishments in the PRC.

An interesting development in this industry has been the use of the Special Economic Zones to process apparel primarily for the export market. For example in Futian and in Shangbu in Guangdong Province both Japanese and Hong Kong textile firms have been encouraged to establish apparel processing centers. The use of these Special Economic Zones is part of a larger trend by the Chinese government to attract both new technology and managerial skills. In a recent Chinese investment conference held in Guangzhou (7-11/6/1982) the Chinese presented a whole array of preferred

[18] JPRS, No. 197, 10/13/81.
[19] JPRS, No. 167, 2/9/81, p. 20.
[20] Ibid., p. 21.

projects, joint ventures and co-production deals. The textile and apparel industry was one of the primary sectors where the PRC attempted to attract foreign participation. A list of these requests is presented in Table 7. Apart from the fact that the Chinese were requesting in excess of $30 million of foreign investment, they were also stipulating a preference for coproduction or compensation trade agreements as a means of repaying the foreign participants. In effect, not only are they willing to share the risk in these investment projects but more importantly they are determined to acquire a certain quality standard in the final output of the plants. Both of these requirements could be provided in a compensation agreement.

B. TECHNOLOGICAL REQUIREMENTS IN THE PRC TEXTILE INDUSTRY

While the rate of increase in capital expenditure in the major textile producing countries, over the 1960–80 period, has ranked below that of other manufacturing industries, the investment that has taken place has made some major changes in the nature of the technology used and subsequently in the cross-country competitive positions of the respective textile industries. In this section we will point out some of the major changes which have taken place in this industry and their significance to the textile industry in the PRC.

The production processes in use by a typical short fiber spinning and weaving textile mill are presented in Figure 2. It presents the great variety of processes that are part of what we normally consider a single integrated textile operation. In what follows we will discuss the variety of technological changes that are common to this industry using this scheme. The major technological changes which we will describe are listed in Figure 3 for textiles and in Figure 4 for apparel.

In the initial production stage—the opening room—three processing functions are performed: plucking, cleaning and picking. The aim of these operations is to mix the fibers from different sources, to break up the compressed cotton from the bales, and to clean the cotton of foreign matter that has not been separated in the ginning process. Since efficient spinning and weaving is possible only if the fiber mix is a uniform mixture, the blending of different fibers to eliminate the small variations among fiber sources is absolutely crucial. These three steps are normally performed in a continuous manner as the fiber is conveyed from one machine to another by moving belt or by air flow through ducts.

The next step in the production process, the spinning shed usually contains five processing steps: carding, drawing, roving, spinning and winding. To obtain a high-quality yarn, a sixth processing step, combing, which consists of removing the shorter fibers, can be incorporated.

After the initial disentanglement of the fibers at the carding step, the material is put through drawing frames several times to disentangle the fibers and to draw them into a fine sliver. In the roving and spinning steps, the thickness of this sliver is further reduced through the application of tension. Its strength is further increased by means of twisting. In the winding step, the yarn is cleaned of irregularities and transferred from the small spinning bobbins onto larger bobbins. In many cases this represents the final output of the smaller Chinese textile firms.

In the next stage, the preparatory section, we begin to see the difference between a modern textile plant using "shuttleless looms" from that using the older shuttle looms. During this stage the yarn which enters either directly from the spinning process or through the yarn-finishing section after dyeing, is prepared for the weaving process. In order to weave cloth the yarn must be separated into either "warp yarn" (which runs lengthwise) making up the base of the cloth or to "weft yarn" the cross threads.

In order to create "warp yarn" three operations are performed sequentially: warping, sizing and drawing. Warping consists of winding a large number of strands of yarn onto a "warp beam". Each yarn must be wound under the same tension so as to minimize the number of yarn breakages and subsequently the number of machine stoppages. These beams are then coated with starch in the sizing process and finally in the drawing stage, each thread is pulled through an eyelet on the weaving machine.

If the textile firm has "shuttleless looms" this will be the end of the preparatory stage. The "weft yarn" would be the same as that produced in the spinning stage. However, if the firm has the older looms, then weft yarn must be wound onto very small bobbins which can be placed in the shuttle. This would add a considerable time and labor cost to the textile operation. In the case of the PRC, out of total of 500,000 looms it had in place in 1981, approximately 600 were shuttleless looms.[21]

The next step in the production process, the weaving operation, while only a single operation, is a very important part of the mill's cost structure. This step generally accounts for about a third of the capital and labor cost of the textile mill. The output of this process is called "grey cloth". In many LDCs including the PRC this represents the second major end product of a textile firm. This is not the case for many of the recent joint PRC-Hong Kong textile operations in the Special Economic Zones where, an additional step in the production process is the finishing of the cloth through dyeing, printing or sanforizing. This process is very expensive and very sophisticated. It is therefore found only in two or three very large mills where there is joint foreign participation.

Despite the importance of the Chinese textile industry in its overall modernization program, the level of technological improvements have been very slow. For example, in the yarn spinning stage the Chinese still depend, in large part, on the ring spindle which is approximately 3.5 times slower then the open-end spinning systems introduced worldwide in the late 1960s. Open-end spinning is the most revolutionary technological change in this stage, subsuming in one process what conventional spinning accomplishes in three. This new spinning process employs a rotor instead of spindles, with speeds varying from 23,000–100,000 rpm, three to six times faster than ring spinning. It also reduces labor requirements, floor space and energy requirements. In a recent sale of open-ended spinning machines by Toyo Menka Kaisha to the PRC,

[21] ITMF estimate.

it is estimated that it would save the PRC 40 percent of its current manpower costs. In addition, these new machines will provide fewer yarn faults, superior dyeing and printing performance and will allow the PRC to use lower grades and shorter fiber staple lengths. All of this will reduce its operations costs even further.

A similar development in technological improvements has also occurred in the weaving process. The push for increased productivity in the developed countries has taken firms out of the use of rigid rapier looms to shuttleless looms, air-jet and water-jet looms. This has meant a marginal increase in output per loom over the 1972–78 period of apx. 7,725 more yards of fabric. Furthermore, given the fact that these newer looms are capable of weaving fabrics in excess of 100 inches the increased productivity of these shuttleless looms, measured in square yards is even greater.

These more efficient looms are, however, overwhelmingly geared to the processes used in the developed countries. While the larger Asian textile producers have since 1978 been importing large quantities of these newer shuttleless looms, the PRC still uses the older looms which are under 56 inches in width and operate at speeds of 170 to 340 rpm, much lower than the more efficient jet looms.

Along with these newer machines, the modern weaving machinery has introduced electronic monitoring systems which can detect both technical problems of the machine as well as problems in the feeding of the yarn. This new technology leads to reduced labor cost, as monitoring is done by machine, reduces the frequency of human error and improves fabric quality. Industry sources claim that this new computer technology can reduce production of defective fabric from 12 to 14 percent to 2 to 3 percent. This equipment is, however, extremely expensive, requiring both sophisticated fabrics and large uniform runs. All of these characteristics are in short supply in the PRC.

In the fabric preparation stage, which includes the dyeing and finishing of grey fabric, new innovations have been made in the choice of dyes, and the time required to produce a better quality color. The end result of the introduction of more sophisticated machinery at this stage has been the reduced cost of energy and labor. Washers have been designed to reuse water as well as to recycle heat. The same applies to the newer dryer facilities and to the solvent scouring equipment.

In general, one observes that most of the large developed country textile firms have increased their spending on R&D in the form of purchased new equipment which is embodied with new process technology. Secondly, the cost of this equipment in the post 1960's has increased sharply, leading to some concentration within the textile sectors of the developed countries. Both factors have contributed to the increased competitiveness of developed country textile firms. This has been verified by a number of studies of the competitiveness of European and U.S. textile industries. (See Pelzman, 1980 and Wolf et. al., 1984) while the PRC has not as yet purchased the great majority of this sophisticated machinery, it has been able to use older vintage capital along with their lower cost labor to significantly affect some U.S. textile producers in standard goods such as print cloth and sweaters.

The major technological improvements found in the textile industry have not, however, been duplicated in the apparel industry. As can be seen in Figure 4, most of the changes in this industry are paper innovations. A major reason for this lack in implementation of newer technology is attributed to the large number of small apparel firms without large sums of capital. This is true both for the developed and less developed country apparel industries. In many respects this lack of innovation by developed countries has allowed the less developed countries and in particular the PRC to maintain its comparative advantage in many apparel products.

The major production processes in the apparel industry, composed primarily of marking, pattern-cutting, ironing, inspection, labelling and packing are still mainly manual processes. Innovations in securing, the major machinery input to the industry, have traditionally been geared to creating higher operating speeds rather then eliminating the sewing operation.

As of the 1970's a limited number of large apparel producers in the developed countries have been making what is considered far-reaching innovations. Innovations are being made in the application of lasers to the laying and cutting of cloth. Computers are being used in the grading, marking and cutting operations. Water jet cutting initially used in the leather industry is being tested in the apparel industry. All these improvements are designed to achieve improved accuracy in the cutting operation thus reducing the cost of waste. Given the cost of these machines, only large developed country firms with mass production cutting justify their use.

In the sewing operation, research into robotics is now underway. However, as in the cutting technology, only the very large apparel firms will be able to justify their use. As far as the apparel industry in the PRC is concerned these new innovations are, at a minimum, 20 years ahead of what could be economically justified as the next generation of technology to be imported. However, even without this new technology, given China's very low labor costs, it can maintain its comparative advantage over developed country apparel firms for the foreseeable future. In large part, this gap in labor costs is the decisive factor attracting foreign apparel and textile processing operations to China's Special Economic Zones.

IV. Impact of the U.S.-PRC Bilaterals on PRC Textile Exports

The discussion thus far has focused on a comparison of the two bilateral U.S.- PRC textile agreements with those agreed to with the three major Asian exporters and has focused on an evaluation of the current characteristics of the Chinese textile industry, its level of development and technology relative to the world norm. Based on the above discussion one can conclude that the latest bilateral textile agreement while more restrictive then the first agreement [22] does allow the PRC growth rates exceeding those for the top three exporters.[23] Furthermore, while the textile and ap-

[22] By restrictive we mean encompassing a wider net of goods.
[23] By all accounts the PRC is the fourth largest textile exporter to the U.S. measured in square yard equivalents.

parel industries in the PRC are at least 20 years behind the world norm, in terms of technological developments, they have and will continue to have a labor cost advantage over the other three major textile and apparel producers for the foreseeable future. In fact, China's cost advantage in the textile and apparel industries may very well outweigh its disadvantages in terms of older technologies. The major question left, and the one we now turn to, is determining the impact of the former as well as current bilateral U.S.-PRC textile agreement on PRC textile exports to the U.S. A companion question is whether or not these agreements will inhibit the PRC's textile development plans.

A. GENERAL EFFECTS OF NON-TARIFF RESTRICTIONS

Restrictions on imports are generally intended to reduce the foreign supply of a product to a particular market, thus lowering the level of imports and of home demand for that product and raising its price. It is presumed that the domestic industry will benefit from the price increase while the exporting industry will have to shift its exports to alternative markets.

In practice the shifts originating from the imposition of quantitative restrictions are far more complex. Since most quantative restrictions are product and country specific, the resulting foreign responses can partially offset the intended impact of its restrictions.

There are two major offsetting shifts to quantitative restrictions. First, the restricted country may shift its exports to unrestricted markets. In effect the trade restrictions imposed by one country will divert trade to a free market. Secondly, the composition of exports may change, as a result of the uneven sector and product coverage of the quota system.

Sector specific measures can lead to major changes in effective rates of protection along the production process. These trade restrictions may induce offsetting shifts in the degree of processing of traded products, where restricted exports of finished products will be replaced by unrestricted exports of components and vice-versa.

Secondly, the degree of restrictiveness usually varies by product categories. One would, therefore, expect that exporting countries will shift the composition of their exports to those sectors with the least restrictions. Consequently one may find the total volume of exports from a restricted country will increase as the exporting country adjusts to the quota system.

Finally, the compositional changes which are induced by the trade restriction are accentuated by the incentives quantitative restrictions create for exporting countries to move among the restricted categories from those with lower to those with higher value added, and from those with higher to lower elasticities of demand.

The extent of these offsetting changes is partially dependent on the inherent "restrictiveness" of the quota system in terms of the leeway it provides for compositional shifts and in the ability of the exporting country to shift across product categories. The latter being a function of the complementarity in the technology used across product categories. The crucial factor is the relevant short-run cost function.

Activities which depend on complex technology, capital intensity or static and dynamic scale economies display substantial barriers to entry and exit and thus limit product substitution. In contrast, in highly labor-intensive activities—such as in the textile and apparel industries of the PRC, variable costs dominate the cost structure and the sunk cost required to initiate a new product are relatively low. In these industries a large and persistent cost differential separates the U.S. from the PRC textile and apparel suppliers. Therefore, despite the threat that quotas will be extended to new products, discriminatory quota controls can be quickly offset by the emergence of new products. As we will point out below that was in fact the Chinese response to the first textile bilateral. One would expect that it will also be the response to the second bilateral.

B. PRC RESPONSE TO THE U.S. TEXTILE QUOTAS

The textile and apparel industries in the PRC have three key features which help it preserve its competitive advantage against its more developed Asian competitors and which provide it with some degree of flexibility against the U.S. textile bilaterals. First, in comparison to the U.S. industries, the competitiveness of Chinese textile and apparel products depends exclusively on labor cost differentials—given that product differentiability has been minimized by U.S. retailers. Secondly, despite the current vintage of PRC textile and apparel equipment the current state of Chinese technology is still dominated by labor. Transition from a restricted product to one with less or no restrictions is, therefore, relatively easy. Under these circumstances, China's vintage of textile and apparel equipment may preserve its flexibility in terms of output decisions. Finally, the very organized distribution channels in the U.S. is highly sensitive to new and cheaper sourcing opportunities. The PRC with its abundant and cheap labor supply can utilize this retail network to maintain its competitive advantage against other Asian suppliers.

Actual PRC textile and apparel exports to the U.S. for the period 1980–83 are presented in Tables 8, 9 and 10 by textile category for cotton, man-made and wool fiber textiles respectively. The tables also include total U.S. textile and apparel imports for these categories and their growth rates over the 1980–83 period.

An examination of this data points out that both the U.S. and the PRC responded to the quantitative restrictions as expected. Once confronted by binding ceilings, the PRC diverted its exports to unrestricted categories. The U.S. on its part, in the second agreement, imposed restrictions on those items where the PRC shifted as a result of the first agreement and demonstrated through both rapid growth rates and increased market penetration, an ability to compete with U.S. and third country producers.

An evaluation of the PRC's performance in the initial list of controlled items demonstrates that the PRC not only utilized the quotas effectively [24] but also shifted into comparable nonrestricted items once the quotas were completely filled. In cotton textile and apparel products (Table 8) the U.S. imposed restrictions, in the first

[24] Effectively is defined as the ability to utilize the quota by a 100 or more percent.

agreement, on six categories. In cotton gloves (TC331) the PRC expanded its exports to the U.S. from 12,972 to 16,664 thousand square yards (syd) over the 1980–82 period. Its share of total U.S. imports increased from 31.69 percent in 1980 to 34.23 percent in 1982 declining to 27.98 percent in 1983. The degree of utilization of the quota increased from 115.33 percent in 1980 to 139.65 percent in 1982, declining to 109 percent in 1983.[25] In knit shirts and blouses (TC339) PRC exports increased from 5,060 thousand syd's in 1980 to 8,273 thousand syd's in 1982. Quote utilization rates increased from 97.61 percent in 1980 to 132.8 percent in 1982 declining to 109 percent in 1983. The share of this item in total U.S. imports increased from 9.85 percent in 1980 to 14.66 percent in 1982, declining to 13.25 percent in 1983. In non-knitted shirts (TC340) PRC exports increased from 9,797 thousand syd's in 1980 to 15,105 thousand syd's in 1982, increasing to 18,731, thousand syd's in 1983. Its share of total U.S. imports increased from 6.46 percent in 1980 to 8.16 percent in 1982, increasing further to 10.96 percent in 1983. Quota utilization levels in this textile category increased from 75.6 percent in 1980 to 107.8 percent in 1982, and to 129.7 percent in 1983. In non-knitted blouses (TC341) PRC exports declined from 7,931 thousand syd's in 1980 to 6,849 thousand syd's in 1982, increasing to 9,856 thousand syd's in 1983. Its share of total U.S. imports of this category declined from 9.11 percent in 1980 to 6.89 percent in 1982, increasing to 7.92 percent in 1983. Quota utilization rates in this category declined from 143.5 percent in 1980 to 106.5 percent in 1982, increasing to 148.8 percent in 1983. In trousers (TC 347 and 348) PRC exports declined from 31,557 thousand syd's in 1980 to 23,778 thousand syd's in 1982, increasing to 52,811 thousands syd's in 1983. Its share of total U.S. imports declined from 27.4 percent in 1980 to 21.0 percent in 1982, increasing to 33.3 percent in 1983. Quota utilization in this category declined from 123 percent in 1980 to 77 percent in 1982, increasing to 166 percent in 1983. The fluctuations in these categories, as noted by U.S. industry representatives, was attributable to China's initial problems with U.S. fashion in women's garments.[26]

A similar picture arises in the PRC's export performance in manmade fiber textile and apparel products (Table 9) controlled by the first agreement. For sweaters (TC 645 and 646) the PRC increased its exports from 16,745 thousand syd's in 1980 to 27,075 thousand syd's in 1982, declining to 25,777 thousand syd's in 1983. Its share of the U.S. market increased from 12 percent in 1980 to 17.4 percent in 1982, declining to 13.7 percent in 1983. Quota utilization rates increased from 82.7 percent in 1980 to 126 percent in 1982, declining to 116.5 percent in 1983. For wool textile and apparel products (Table 10) there were no controls under the first agreement.

While the PRC demonstrated its ability to expand its exports of the initial list of controlled items, it did not ignore the much larger list of uncontrolled textile categories. As an indication of this one need only observe the difference between the rate of growth of con-

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[25] Quota utilization figures are determined by dividing actual PRC exports, by category as presented in Tables 8 through 10 by the quota celings provided in Tables 1 through 3.

[26] See *Ed.* Johnson's Redbook Review of the Textile and Apparel Industry, weekly reports.

trolled and uncontrolled items, and the difference in the relative shares of the controlled items versus uncontrolled items in total PRC exports. In cotton textile and apparel products, for example, the rate of growth of exports controlled under the initial bilateral was 5.89 as compared to 10.56 percent for the list of uncontrolled items, over the 1980-83 period. Similarly, the share of the initially controlled 6 cotton items in total PRC exports to the United States declined from 25.76 percent in 1980 to 19.96 percent in 1983 as the share of uncontrolled items increased from 74.24 percent in 1980 to 80.04 percent in 1983. In man-made textile and apparel products the rate of growth of the initially controlled items was 5.6 percent as compared to 39.04 percent for the uncontrolled items, over the 1980-83 period. Similarly, the share of the controlled items declined from 31.8 percent in 1980 to 9.9 percent in 1983, as the share of uncontrolled items increased from 68.2 percent to 90.1 percent over the same period.

While the information presented above strongly indicates that the PRC did in fact divert its exports to uncontrolled textile and apparel categories it would be useful to generate a summary measure ranking the degree of trade diversion across restricted categories. In order to provide a rough estimate of this ranking of trade diversion we calculate what PRC exports of the controlled commodities would have been if they grew at the average uncontrolled growth rate. Measured as a percent of the actual growth of PRC exports of controlled categories over the 1980-82 period this index will present a rough estimate of the ranking of the losses of PRC exports due to the first bilateral textile agreement.

The estimate of the trade diversion impact of the first U.S.-PRC textile agreement are presented in Table 11. The losses due to the textile bilateral range from 2.2 percent for knit shirts and blouses to 321.3 percent for sweaters for men and boys. This measure points out that the PRC had the greatest trade diversion in the man-made fiber categories where the rate of growth of uncontrolled exports were the greatest. It should be noted, however, that this measure is a very rough estimate and should, at best, be used to get an indication of the ranking of trade diversion across restricted categories.

In addition to trade diversion, one would expect that, as a result of the quantitative controls, the export prices of controlled items would rise faster than uncontrolled items. Some evidence of this is available for the PRC. Tables 12, 13 and 14 present the unit values of PRC exports over the 1980-83 period along with their growth rates for cotton, man-made and wool textile and apparel textile products, respectively. For cotton products, the data in Table 12 demonstrate that while the average growth rate in export unit values was 2.31 over the 1980-83 period the rate of growth of unit values of controlled items ranged from 2.86 percent for cotton gloves to 9.86 percent for knit shirts and blouses. Likewise for man-made textile and apparel items the average growth rate was 3.22 percent while the growth rate of unit values of controlled items ranged from 4.13 percent for men's sweaters to 5.71 percent for women's sweaters.

Finally if we compare the rate of growth of PRC exports and the rate of growth of unit values we find a strong correlation between price increases and increased rates of export growth for the majority of categories. The major exceptions were cotton fabrics and man-made yarn where increases in exports were associated with a significant decline in unit values.

Based on the PRC's export performance during the first textile agreement one expects that during the second agreement it will also be able to divert its exports to uncontrolled categories. In cotton textiles, one would expect the PRC to increase its exports of sheets, pillowcases, down-filled coats, underwear and hosiery. In man-made textiles, one would expect the PRC to increase its exports of skirts, suits, nightwear and in floor coverings. In wool textile and apparel categories the U.S. has already imposed controls on those items with the fastest rate of growth and highest market penetration rates. The only items showng a potential are women's wool coats and wool floor coverings. In all of these categories the PRC has demonstrated both a rapid growth of output and continued purchases of foreign textile equipment.

V. Conclusion

Textile and apparel exports are, by far, the most important of China's exports. In 1983, total PRC textile and apparel exports equalled $6,718.6 million or 28 percent of its total exports. In terms of U.S. trade, textile and apparel exports in 1983 equalled $975.1 million or 43 percent of total PRC exports to the U.S.

The textile industry has always been viewed as one of the first manufacturing industries in an economy's development process. The importance of the textile industry to the PRC reflects both its current comparative advantage and the current Chinese economic policy of stressing the importance of light industry over heavy industry. It is therefore not surprising to find in the PRC a discussion of the benefits of expanding the textile industry. Increased output of this industry would not only increase the per capita consumption in the PRC but is also expected to increase the country's foreigh exchange earnings.

Today's international trade environment for textiles is constrained for all developing country exporters under the the Multifiber Arrangement. The PRC as a new entrant to this exporting world signed the first textile bilateral with the U.S. in September 1980 to be followed by a more comprehensive biliateral agreement signed in August 1983. This latter agreement imposed specific quantity limits on 33 textile categories or 55 percent of total PRC textile exports to the U.S. in 1983.

The intent of this paper was to determine the impact of the first textile agreement on the export performance of the PRC and to speculate on the effect of the second agreement on the decision of the PRC to continue its expansion and modernization of the textile and apparel industries.

An evaluation of the current characteristics of the Chinese textile industry, its level of development and technology showed that while the vintage of Chinese textile machinery is at least 20 years behind the world norm, they have and will continue to have a labor cost advantage over the other three major textile and apparel producers for the foreseeable future. In fact, China's cost advantage in the textile and apparel industries may very well outweigh its disadvantages in terms of older technologies. Based on this cost advantage the PRC will maintain its competitive advantage over the other Asian textile producers and will continue to maintain its flexibility with respect to the U.S. textile bilateral.

The first bilateral U.S.-PRC textile agreement, which by all accounts, was based on expected Chinese strengths, imposed specific limits on what was perceived as the PRC's then current comparative advantage, namely, a limited set of 8 cotton and synthetic fiber textile and apparel categories.

This first agreement included such items as cotton gloves, knit shirts, blouses and trousers made of cotton, and sweaters made of synthetic fibers. In terms of the quantity of textile and apparel exports under control, this initial agreement was very generous. In terms of cotton exports the controls affected 23 of China's initial 1980 exports. However, as the PRC began to export larger quantities of cotton textile and apparel to the U.S., these controls affected only 15 percent of its 1982 cotton textile and apparel exports. A similar set of events occurred in manmade fiber textile and apparel exports. Initially these controls affected 38.4 percent of the PRC's manmade fiber textile and apparel exports, declining to 9.7 percent in 1982. In wool products, where the U.S. has historically imposed very tight controls, the initial agreement did not control any of the PRC's wool textile and apparel exports during the 1980–82 period.

The experience of the PRC in utilizing the first textile bilateral is very instructive. Since the initial bilateral agreement was limited in its commodity coverage and in the degree of restrictiveness across controlled items, it created an incentive for the PRC to change the composition of its textile and apparel exports to the U.S. In effect, the PRC over the 1980–82 period managed to successfully shift its exports from restricted to unrestricted categories. Despite the existence of the bilateral agreement, one finds that the total volume of PRC textile exports actually increased as its exports adjusted to the quota system.

In large part, as a response to the PRC's success in utilizing the first quota agreement, the U.S. insisted in the second agreement on a more comprehensive set of specific quotas. This second agreement covers 33 items under specific quotas. Not only does the current list include the initial 8 categories but it also encompasses all the other textile and apparel items in which the PRC demonstrated an export potential in the 1980–82 period.

This current agreement now specifically limits, in addition to the old list, the exports of cotton fabric, cotton coats, playsuits, shirts, skirts, sweaters, dressing gowns, nightwear apparel and terry towels. In terms of manmade fiber textile and apparel categories the agreement now also includes the exports of gloves, coats, dresses, shirts, blouses and trousers. Also for the first time this agreement limits China's exports of wool apparel. Specifically, it imposes upper limits on the exports of wool suits, sweaters and trousers. This new agreement affected 56 percent of China's cotton textile and apparel exports, 40 percent of its wool apparel exports and 53 percent of its manmade fiber apparel exports in 1983.

Based on the PRC's export performance during the first textile agreement one expects that during the second agreement it will also be able to divert its exports to uncontrolled categories. In cotton textiles, one would expect the PRC to increase its exports of sheets, pillowcases, down-filled coats, underwear and hosiery. In man-made textiles, one would expect the PRC to increase its exports of skirts, suits, nightwear and floor coverings. In wool textile and apparel categories the U.S. has already imposed controls on those items with the fastest rate of growth and highest market penetration rates. The ony items showing a potential are women's wool coats and wool floor coverings. In all of these categories the PRC has demonstrated both a rapid growth of output and continued purchases of foreign textile equipment.

One can, therefore, conclude that despite the U.S.—PRC bilateral controls, the PRC will be able to continue its textile expansion program with little difficulty in accessing the U.S. market. The quantitative controls in the bilateral will only serve to force the PRC to maintain its flexibility in producing textile and apparel products. They will not limit the total volume of PRC textile and apparel exports to the United States. In fact, based on the earlier PRC export performance, one should find that the total volume of PRC textile and apparel exports to the U.S. will rise above the limits imposed by the 1983 U.S.-PRC bilateral textile agreement.

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FIGURE 1

THE TEXTILE COMPLEX

FIBER PRODUCTION

Natural Fibers	Man-Made Fibers	
	Cellulosic	Non-Cellulosic
Cotton		
Wool		
Jute	Rayon	Polyester
	Acetate	Nylon
	Triacetate	Acrylic
		Polypropylene

TEXTILE MILL PRODUCTION

Yarn Production

Natural Fibers	Man-Made Fibers
Spinning	Throwing and Twisting

Fabric Production

Weaving	Knitting

Fabric Finishing

Bleaching, Dyeing, Sanforizing, Etc.

EXPORTS INDUSTRIAL USES HOME FURNISHING APPAREL

Source: Pelzman. 1980. The Competitiveness of the U.S. Textile Industry, Division of Research, College of Business Administration. University of South Carolina.

FIGURE 2

PRODUCTION PROCESS IN TEXTILES

Cotton | Man-Made Fibers

BLOW ROOM

Opening

SPINNING

Carding
Drawing
Roving
Spinning
Winding

PREPARATION

Warp yarn

Warping
Sizing
Drawing in

Weft Yarn

Pin Winding
(for shuttle looms)

WEAVING

Weaving
Inspection

FINISHING

FIGURE 3

MAJOR TECHNOLOGICAL CHANGES IN THE TEXTILE INDUSTRY SINCE 1960

TECHNOLOGY	DESCRIPTION AND IMPACT
Texturizing	Heat sets a crimp in synthetic fiber to provide bulk, an additional process on specialized machines. Stimulated growth of knitting sector.
Direct-feed Carding	Eliminates picking process and associated manpower.
Open-end Spinning	Integrates roving, spinning, and winding. Can produce 2 or more times the output of the conventional spindle.
Spinning Attachments	Automativ doffing (unloading) machines reduce unit requirements for doffer operations. Automatic devices for piecing (tying) broken yarn reduces unit requirements for spinners.
Shuttleless Looms	Operate at faster speed and require fewer auxiliary operations than shuttle looms. Can produce about 50 per cent more cloth than the average shuttle loom per hour.
New Knitting Machines	New machines operate at faster speeds and are more automated. Electronic patternmaking devices reduce pre-knit time. Reduce unit labor requirements and permit greater flexibility in design change.
Continuous Computerized Finishing	Integrates dyeing and finishing techniques and incorporates computerized instrumentation. Reduces unit labor costs and improves quality.

Source: U. S. Department of Labor. 1974. Technological Changes and Manpower Trends in Six Industries. BLS Bulletin No. 1817.

FIGURE 4

MAJOR TECHNOLOGICAL CHANGES IN THE APPAREL INDUSTRY IN THE 1970s

TECHNOLOGY	DESCRIPTION	DIFFUSION
Automatic contour seamers, profile stiching machines, and numerically-controlled sewing machines.	Equipment which transports cloth through sewing operations automatically.	Limited to large plants.
Laser cutting.	Computer guided laser cutting systems cut fabric at high speeds with high accuracy.	Used in a limited way. High cost will limit use.
Numerically controlled cutting devices	These devices increase speed and quality of the cutting operation.	Used only in very large apparel plants.
Ultrasonic sewing	High frequency sound is used to create a bond between thermoplastic cloth. The bond simulates stiching with no thread.	Limited growth is expected. Requires synthetic fibers only.

Source: U.S. Dept. of Labor. 1977. Technological Change and its Impact in Five Industries. BLS Bulletin No. 1961.

TABLE 1

SPECIFIC QUOTA LIMITS ON COTTON
TEXTILE EXPORTS OF THE PRC, HONG KONG,
KOREA AND TAIWAN, 1980-87
(in square yard equivalents)

Cotton Category	Description	1980	1981	1982	1983	1984	1985	1986	1987	Growth Rate 1980-87
The People's Republic of China										
Fabric										
314	Poplin and Broadcloth	0	0	0	15,000,000	15,450,000	15,913,500	16,390,905	16,882,632	1.29%
315	Printcloth	0	0	0	118,000,000	138,000,000	157,600,000	165,000,000	171,400,000	4.10%
Apparel										
331	Gloves	11,247,600	11,585,028	11,932,578	12,290,558	12,659,273	13,039,054	13,430,225	13,833,131	1.29%
333	Suit-type coats, MB	0	0	0	1,882,400	1,976,520	2,075,346	2,179,131	2,288,057	2.14%
334	Other coats, MB	0	0	0	8,272,555	8,603,451	8,947,604	9,305,468	9,677,705	1.72%
335	Coats, WGI	0	0	0	11,327,558	11,724,038	12,134,353	12,559,082	17,128,638	3.97%
337	Playsuits	0	0	0	20,735,000	21,771,750	22,860,350	24,003,350	25,203,525	2.14%
338	Knit shirts, MB	0	0	0	5,529,384	5,722,913	5,923,217	6,130,526	6,345,094	1.51%
339	Knit shirts,blouses, WGI	5,184,000	6,566,400	6,230,016	6,448,068	6,673,752	6,907,334	7,149,089	7,399,303	1.70%
340	Shirts,not knit MB	12,960,000	13,478,400	14,017,536	14,438,064	14,871,216	15,317,352	15,776,856	16,250,160	1.39%
341	Blouses,not knit,WGI	5,528,850	6,598,950	6,430,112	6,623,020	6,821,714	7,026,367	7,237,153	7,454,262	1.48%
342	Skirts	0	0	0	2,759,000	2,924,540	3,100,012	3,286,005	3,483,175	2.56%
345	Sweaters	0	0	0	2,944,000	3,061,760	3,184,230	3,311,595	3,444,075	1.72%
347/348	Trousers	25,632,000	32,467,200	30,803,968	31,728,091	32,679,928	33,660,334	34,670,146	35,710,253	1.53%
350	Dressing gowns	0	0	0	4,539,000	4,765,950	5,004,273	5,254,479	5,517,180	2.14%
351	Nightwear	0	0	0	15,080,000	15,834,000	16,625,700	17,456,972	18,329,844	2.14%
Made-ups and misc.										
363	Terry & other pile towels	0	0	0	9,000,000	9,495,000	10,017,225	10,568,173	11,149,422	2.35%
PRC TOTAL		60,552,450	70,695,978	69,414,210	286,596,697	313,035,803	339,336,251	353,709,155	371,496,456	14.15%
Hong Kong										
Fabric										
314	Poplin and Broadcloth	0	0	0	0	0	0	0	0	0.00%
315	Printcloth	0	0	0	0	7,611,932	0	0	0	0.00%
Apparel										
331	Gloves	11,585,028	11,932,578	11,992,243	12,052,205	12,112,464	12,173,028	12,233,893	12,295,063	0.31%
333/334	Suit-type coats	8,801,825	9,329,940	8,234,684	8,358,200	8,483,573	8,610,842	8,740,007	8,871,108	-0.06%
335	Coats, WGI	11,210,307	11,546,613	11,604,350	11,662,377	11,720,692	11,779,297	11,838,191	11,897,374	0.31%
338/339	Knit shirts	17,507,297	18,032,515	31,564,526	31,722,350	31,880,959	32,040,360	32,200,560	32,361,566	3.82%
340	Shirts,not knit MB	55,883,640	57,560,136	57,847,944	58,137,192	58,427,880	58,720,008	59,013,600	59,308,680	0.31%
341	Blouses,not knit,WGI	34,198,221	35,224,169	35,400,286	35,577,287	35,755,173	35,933,944	36,113,613	36,294,182	0.31%
342	Skirts	4,408,971	4,541,243	6,923,541	7,045,187	7,132,798	7,239,794	7,348,392	7,458,609	3.27%
345	Sweaters	6,977,243	7,395,843	11,245,418	11,414,109	11,585,302	11,759,072	11,935,454	12,114,486	3.37%
347/348	Trousers	97,966,590	102,042,683	102,552,902	103,065,667	103,580,995	104,098,903	104,619,393	105,142,482	0.35%
350	Dressing gowns	4,937,922	5,234,181	5,155,080	5,232,396	5,310,885	5,390,547	5,471,382	5,553,441	0.62%
351	Nightwear	55,898,076	57,575,024	53,584,284	53,852,188	54,121,444	54,392,052	54,664,012	54,937,324	-0.17%
Hong Kong TOTAL		309,375,119	320,414,924	336,105,257	338,119,157	347,724,098	342,137,847	344,178,497	346,234,314	0.64%

TABLE 1 (Continued)

SPECIFIC QUOTA LIMITS ON COTTON
TEXTILE EXPORTS OF THE PRC, HONG KONG,
KOREA AND TAIWAN, 1980-87
(in square yard equivalents)

Cotton Category	Description	1980	1981	1982	1983	1984	1985	1986	1987	Growth Rate 1980-87
Korea										
Fabric										
315	Printcloth	0	0	0	21,359,219	0	0	0	0	0.00%
Apparel										
331	Gloves	0	0	1,504,692	1,549,832	1,596,329	1,644,216	1,693,545	1,744,351	1.29%
333/334	Suit-type coats	1,951,577	2,078,411	2,213,501	2,313,120	2,417,203	2,525,986	2,639,627	2,758,443	2.12%
335	Coats, WGI	2,083,544	2,218,966	2,363,227	2,469,575	2,580,713	2,696,849	2,818,188	2,945,020	2.12%
338/339	Knit shirts	0	0	3,865,435	4,039,380	4,221,151	4,411,102	4,609,606	4,817,038	1.93%
340	Shirts,not knit MB	3,678,336	3,917,424	4,172,064	4,359,816	4,555,992	4,761,024	4,975,272	5,199,144	2.12%
341	Blouses,not knit,WGI	0	0	1,570,336	1,640,994	1,714,843	1,792,012	1,872,661	1,956,920	1.93%
347/348	Trousers	4,066,891	4,331,238	4,612,781	4,820,365	5,037,275	5,263,941	5,500,823	5,748,368	2.12%
Korea	TOTAL	11,780,347	12,546,040	20,302,036	42,552,300	22,123,506	23,095,128	24,109,721	25,169,284	4.39%
Taiwan										
Fabric										
314	Poplin and Broadcloth	0	0	0	0	3,274,848	0	0	0	0.00%
315	Printcloth	0	0	0	0	27,069,100	0	0	0	0.00%
Apparel										
331	Gloves	0	0	1,647,286	1,655,521	1,663,799	1,672,118	1,680,480	1,688,855	0.22%
333/334	Suit-type coats	2,081,374	2,206,273	2,338,637	2,443,865	2,553,833	2,668,778	2,788,858	2,795,810	1.92%
335	Coats, WGI	2,602,478	2,758,634	2,924,123	3,055,704	3,193,233	3,336,916	3,487,083	3,644,023	2.07%
337	Playsuits	0	0	3,197,250	3,277,175	3,359,100	3,443,100	3,529,175	3,615,750	1.08%
338/339	Knit shirts	3,531,722	3,743,626	3,968,237	4,027,759	4,088,174	4,149,497	4,211,741	4,274,640	1.08%
340	Shirts,not knit MB	14,869,512	15,315,600	15,392,184	15,469,152	15,546,480	15,624,216	15,702,336	15,780,000	0.31%
341	Blouses,not knit,WGI	5,203,978	5,360,099	5,386,895	5,413,836	5,440,893	5,468,110	5,495,442	5,521,731	0.31%
342	Skirts	0	0	0	0	3,194,192	0	0	0	0.00%
347/348	Trousers	14,817,895	15,706,969	15,942,570	16,181,713	16,424,434	16,670,804	16,920,858	17,173,440	0.81%
350	Dressing gowns	0	0	0	0	4,710,615	0	0	0	0.00%
Taiwan	TOTAL	43,106,958	45,091,200	50,797,181	51,524,726	90,518,701	53,033,538	53,815,972	54,494,248	1.68%
	TOTAL TOP FOUR	424,814,874	448,748,142	476,618,684	718,792,880	773,402,108	757,602,764	775,813,345	797,394,302	4.55%
	SHARE OF PRC IN TOTAL	14.25%	15.75%	14.56%	39.87%	40.48%	44.79%	45.59%	46.59%	9.18%

Source: Compiled from Official Statistics of the U.S. Department of Commerce.

TABLE 2
SPECIFIC QUOTA LIMITS ON THE MANMADE
TEXTILE EXPORTS OF THE PRC, HONG KONG,
KOREA AND TAIWAN, 1980-83
(in square yard equivalents)

Manmade Category	Description	1980	1981	1982	1983	1984	1985	1986	1987	Growth Rate 1980-87
People's Republic of China										
Apparel										
631	Gloves	0	0	0	2,152,500	2,303,175	2,464,399	2,636,904	2,821,490	2.98%
634	Other coats, MB	0	0	0	15,673,226	16,331,507	17,017,417	17,732,155	18,476,918	1.80%
635	Coats, WGI	0	0	0	16,301,564	16,986,236	17,699,652	18,443,052	19,217,633	1.80%
636	Dresses	0	0	0	13,363,500	14,165,310	15,015,229	15,916,155	16,871,124	2.56%
640	Shirts,not knit MB	0	0	0	25,680,000	26,450,400	27,243,912	28,061,232	28,903,056	1.29%
641	Blouses,not knit,WGI	0	0	0	12,542,500	13,044,200	13,565,968	14,108,602	14,672,956	1.72%
645/646	Sweaters	20,240,000	20,847,200	21,472,616	22,116,800	22,780,304	23,441,637	24,167,627	24,892,661	1.29%
647	Trousers, MB	0	0	0	13,366,999	13,901,675	14,457,747	15,036,052	15,637,496	1.72%
648	Trousers, WGI	0	0	0	17,203,130	17,891,261	18,606,910	19,351,181	20,125,232	1.72%
PRC	Total	20,240,000	20,847,200	21,472,616	138,400,220	143,854,068	149,512,871	155,452,959	161,618,566	17.05%
Hong Kong										
Apparel										
633/634	Other coats, MB	15,165,980	16,075,901	14,183,618	14,396,354	14,612,312	14,831,491	15,053,974	15,279,802	-0.07%
635	Coats, WGI	32,744,375	33,726,736	30,357,895	30,813,269	31,275,458	31,744,584	32,220,773	32,704,066	-0.05%
641	Blouses,not knit,WGI	9,840,483	10,430,923	10,483,080	10,535,497	10,588,176	10,641,115	10,694,316	10,747,792	0.41%
645/646	Sweaters	0	0	44,454,768	44,677,040	44,900,416	45,124,933	45,350,554	45,577,315	0.22%
648	Trousers, WGI	19,910,849	20,508,181	17,249,606	17,335,847	17,422,533	17,507,866	17,597,187	17,685,172	-0.80%
Hong Kong	Total	77,661,686	80,741,742	116,728,967	117,758,007	118,798,894	119,849,989	120,916,803	121,994,147	2.76%
Korea										
Apparel										
631	Gloves	0	0	0	735,000	0	0	0	0	0.00%
634	Other coats, MB	31,172,536	32,388,286	33,234,275	33,433,672	33,634,266	33,836,099	34,039,088	34,243,358	0.50%
635	Coats, WGI	22,943,348	23,838,112	25,233,061	25,384,467	25,536,781	25,690,004	25,844,136	25,999,176	0.69%
640	Shirts,not knit MB	136,735,416	142,068,096	140,771,472	149,917,320	150,666,912	151,420,248	152,177,352	152,938,224	0.70%
641	Blouses,not knit,WGI	13,882,793	14,424,223	14,510,774	14,597,832	14,685,426	14,773,543	14,862,181	14,951,356	0.38%
645/646	Sweaters	109,523,461	113,794,874	120,804,685	121,408,720	122,015,736	122,625,843	123,238,968	123,855,147	0.68%
648	Trousers, WGI	0	0	5,454,401	5,645,306	5,842,886	6,047,390	4,479,050	6,478,114	0.25%
Korea	Total	314,257,555	326,513,591	340,008,667	351,122,316	352,382,007	354,393,127	354,640,775	358,465,376	0.76%

TABLE 2 (Continued)
SPECIFIC QUOTA LIMITS ON THE MANMADE
TEXTILE EXPORTS OF THE PRC, HONG KONG,
KOREA AND TAIWAN, 1980-83
(in square yard equivalents)

Manmade Category	Description	1980	1981	1982	1983	1984	1985	1986	1987	Growth Rate 1980-87
Apparel										
633/634	Other coats, MB	37,530,549	39,031,763	40,795,975	41,040,760	41,286,991	41,534,708	41,783,912	42,034,644	0.62%
635	Coats, WGI	27,911,531	29,027,994	30,340,054	30,522,104	30,705,228	30,889,468	31,074,781	31,261,250	0.62%
640	Shirts,not knit MB	74,332,080	76,562,040	77,714,280	78,102,840	78,493,368	78,885,840	79,280,256	79,676,664	0.37%
641	Blouses,not knit,WGI	9,530,894	10,102,745	10,153,263	10,204,027	10,255,053	10,306,325	10,357,858	10,409,652	0.41%
645/646	Sweaters	0	0	145,250,373	145,976,621	146,706,512	147,440,046	148,177,224	148,918,118	0.22%
647	Trousers, MB	0	0	41,713,748	42,339,454	42,974,540	43,619,167	44,273,459	44,937,560	0.65%
648	Trousers, WGI	0	0	54,722,166	54,995,770	55,270,762	55,547,107	55,824,841	56,103,962	0.22%
Taiwan	Total	149,305,054	154,724,541	400,689,858	403,181,576	405,692,454	408,222,661	410,772,330	413,341,851	6.44%
TOTAL TOP FOUR		561,464,295	582,827,074	878,900,108	1,010,462,118	1,020,727,422	1,031,978,647	1,041,782,867	1,055,419,939	4.12%
SHARE OF PRC IN TOTAL		3.60%	3.58%	2.44%	13.70%	14.09%	14.49%	14.92%	15.31%	12.42%

Source: Compiled from Official Statistics of the U.S. Department of Commerce.
time x square

TABLE 3
SPECIFIC QUOTA LIMITS ON THE WOOL
TEXTILE EXPORTS OF THE PRC, HONG KONG,
KOREA AND TAIWAN, 1983-87
(in square yard equivalents)

Wool Category	Description	1983	1984	1985	1986	1987	Growth Rate 1980-87
People's Republic of China							
Apparel							
443	Suits, MB	526,500	531,792	537,084	542,430	547,884	0.4328%
445/446	Sweaters	3,794,772	3,832,716	3,871,047	3,909,765	3,948,854	0.4331%
447	Trousers, MB	1,245,870	1,258,326	1,270,908	1,283,616	1,296,450	0.4330%
448	Trousers, WGI	333,000	336,330	339,678	343,080	346,518	0.4329%
PRC	Total	5,900,142	5,959,164	6,018,717	6,078,891	6,139,706	0.4330%
Hong Kong							
Apparel							
443	Suits, MB	463,644	465,966	468,288	470,610	472,986	0.2166%
445/446	Sweaters	17,519,831	17,607,430	17,695,460	17,783,936	17,872,859	0.2168%
447/448	Trousers	937,710	942,390	947,106	951,840	956,592	0.2167%
Hong Kong	Total	18,921,185	19,015,786	19,110,854	19,206,386	19,302,437	0.2168%
Korea							
443	Suits, MB	695,034	698,490	702,000	705,510	709,020	0.2167%
445/446	Sweaters	757,660	761,454	765,264	769,088	772,927	0.2168%
447	Trousers, MB	1,465,128	1,472,454	1,479,816	1,487,214	1,494,648	0.2168%
Korea	Total	2,917,822	2,932,398	2,947,080	2,961,812	2,976,595	0.2168%
Taiwan							
445/446	Sweaters	1,879,136	1,888,540	1,897,974	1,907,467	1,912,973	0.1985%
Taiwan	Total	1,879,136	1,888,540	1,897,974	1,907,467	1,912,973	0.1985%
TOTAL TOP FOUR		29,618,285	29,795,888	29,974,624	30,154,556	30,331,711	0.26%
SHARE OF PRC IN TOTAL		19.92%	20.00%	20.08%	20.16%	20.24%	0.17%

Source: Compiled from Official Statistics of the U.S. Department of Commerce.

TABLE 4

Cotton Supply and Utilization
in the PRC, 1960-80

Year	Area Harvested (1,000 hectares)	Yield Kilogram per hectare	Production (1,000 bales)	Mill Consumption (1,000 bales)
1960	5301	172	4198	5199
1965	4775	347	7601	7900
1970	4816	416	9200	9000
1974	4856	516	11500	11900
1975	4816	484	10700	11250
1976	4654	468	10000	11050
1977	4411	454	9200	11750
1978	4850	447	9400	n.a.
1979	4500	490	10140	n.a.
1980	4800	564	12430	n.a.

Source: U.S. Department of Agriculture, Situation Report, various editions.

TABLE 5

Output of Major Textile Products
in the PRC, 1949 - 82

Year	Cotton Yarn (10,000 tons)	Cotton Fabric (100 million tons)	Total Chemical Fibers (10,000 tons)	Synthetic Fibers (10,000 tons)	Wool Fabric (10,000 tons)	Silk Fabric (10,000 tons)
1949	32.7	18.9	-	-	544	0.18
1952	65.6	38.3	-	-	423	0.58
1957	84.4	50.5	0.02	-	1,817	0.99
1965	130.0	62.8	5.01	0.52	4,240	0.91
1978	238.2	110.3	28.46	16.94	6,885	2.97
1979	263.5	121.5	32.63	21.36	9,017	2.97
1980	292.6	134.7	45.03	31.41	10,095	3.54
1981	317.0	142.7	52.73	38.47	11,308	3.74
1982	335.4	153.5	51.70	37.53	12,669	3.71

Source: Chinese Statistical Abstract, JPRS, 12/8/1983, No. 371.

TABLE 6

Contracts by the PRC to Acquire
Whole Plants and Textile Technology

Country of Origin	Manufacturer	Nature of Technology or Plant	Value of Contract (\$ million)	Starting Date	Completition Date
Japan	Teijin	Polyester spinning	$16	1/74	–
Japan	NISSO Petrochemical	Synthetic fiber	$14	3/74	1976
W. Germany	Rhone Poulenc	Nylon spinning	$10	8/74	1977
Japan	Teijin	Polyester polymer	$40	3/76	–
W. Germany	Zimmer	Polyester fiber & film	$12	1/77	1980
Japan	Kanebo, Mitsui & Hitachi	Polyester plant	$85	12/78	1982
Japan	Asahi Chemical & Chori	Nylon 66 for tires	$72	12/78	1981
W. Germany	Zimmer	Polyester plant	$180	12/78	–
Japan	Mitsui Bussan	Wool Processing plant	$2	6/79	1981

Source: Constructed from various JPRS reports.

TABLE 7
Foreign Investment Projects Requested
by the PRC at Guangzhou, June 1982

Type of Investment	Planned Addition to Capacity	Technology Transfer	Total Cost of Project ($ Million)	Foreign Funding Requested ($ Million)	Form of Cooperation	Chinese Plant
Silk printing & dyeing	1.5 mill. meters of printed silk fabric and 500,000 meters of dyed silk fabrics	silk printing and dyeing technology & equipment	15.6	7.8	Coproduction	Zhejiang Provincial Silk Co.
Knotted pile carpets and foundations	2.5 mill. sq. meters of knotted pile carpet, 1.65 mill. meters of jute foundations	Production equipment & technology	16.52	9.06	Compensation Trade	Zhejiang Jute Mill.
Pile cut printed bath towels	2.25 million pieces	Complete set of equipment	3	2.5	Compensation Trade	Jinan Towel Factory
Weft knitted underwear	200,000 dozens	knitting, dyeing and finishing equipment	2.42	1.59	Compensation Trade	Qingdao No. 5 Knitwear Factory
Superfine fiber	100 tons	Patent technology and equipment	1	0.5	Joint Venture	Jinan Chemical Fiber Plant
Fabrics printing, dyeing & finishing	7 mill. meters of printed cloth, 3 mill. meters of imitation silk crepe	Printing, finishin setting and key equipment	7.4	3	Joint Venture	The No. 4 Printing and Dyeing Mill. Shijiazhuang City
Fusible lining	8 mill. meters	Complete set of technology & equipment	2	1.6	Joint Venture	The No. 3 Printing and Dyeing Plant Shijiazhuang City
Silk fabrics, printing & dyeing	2 mill. meters of printed tussah silk fabric	Continuous steamer palmer and continuous boil-off machines and fashions.	3.5	1.72	Joint Venture	Liaoning Provincial Silk Printing Mill.

TABLE 7 (Continued)
Foreign Investment Projects Requested
by the PRC at Guangzhou, June 1982

Type of Investment	Planned Addition to Capacity	Technology Transfer	Total Cost of Project ($ Million)	Foreign Funding Requested ($ Million)	Form of Cooperation	Chinese Plant
High-medium grade knitted fabric	2400 tons	Warp & weft knitting machines and finishing equipment	27	7.7	Compensation Trade	The No. 1 Knitwear Mill, Wuhan City.
Angora and cashmere sweaters	100 tons of angora, 300000 angora & 450000 cashmere sweaters	spinning & fulling technology & equipment	2.15	1.15	Compensation Trade	Kaifeng Woolen Mill.
Knitting Rabbit Hair Yarn	465 tons	new dyeing technology & equipment	3.6	1.8	Joint Venture or Compensation Trade	Xinxiang City Woolen Mill.

Source: China Business Review, May-June 1982, p.37.

TABLE 8
PRC Exports of Cotton Textiles
Compared to Total U.S. Imports
(In thousand equivalent square yards and percent)

Cotton Category	Description	1980 PRC Exports	1980 Total U.S. Imports	1980 PRC Exports as a % of Total U.S. Imports	1980 Commodity Share of PRC Exports	1981 PRC Exports	1981 Total U.S. Imports	1981 PRC Exports as a % of Total U.S. Imports	1981 Commodity Share of PRC Exports	1982 PRC Exports	1982 Total U.S. Imports	1982 PRC Exports as a % of Total U.S. Imports	1982 Commodity Share of PRC Exports
Yarn													
300	Carded yarns	186	71,631	0.26%	0.07%	28	65,565	0.03%	0.01%	0	91,607	0.00%	0.00%
Fabric													
310	Gingham	214	6,475	3.31%	0.08%	0	11,164	0.00%	0.00%	245	10,082	2.43%	0.06%
311	Velveteen	37	2,544	1.45%	0.01%	0	700	0.00%	0.00%	0	462	0.00%	0.00%
312	Corduroy	153	401	38.15%	0.06%	17	914	1.86%	.00%	2	609	0.33%	.00%
313	Sheeting	29,463	243,014	12.12%	11.27%	40,693	319,203	12.75%	9.19%	30,078	248,222	12.12%	6.86%
314	Poplin and Broadcloth **	0	9,619	0.00%	0.00%	11,101	30,891	35.94%	2.51%	9,763	36,380	26.84%	2.23%
315	Printcloth **	66,903	88,626	75.49%	25.60%	110,546	188,237	58.73%	24.95%	68,900	105,676	65.20%	15.72%
317	Twill and sateen	6,802	134,766	5.05%	2.60%	10,956	152,136	7.20%	2.47%	4,578	85,727	5.34%	1.04%
318	Yarn-dyed fabric	470	27,792	1.69%	0.18%	368	19,352	1.90%	0.08%	562	18,765	2.99%	0.13%
319	Duck	20	71,614	0.03%	0.01%	59	91,910	0.06%	0.01%	350	67,614	0.52%	0.08%
320	Woven fabrics	16,766	132,728	12.63%	6.41%	62,080	263,676	23.54%	14.01%	79,613	256,354	31.06%	18.17%
Apparel													
330	Handkerchiefs	2,877	5,707	50.41%	1.10%	4,155	7,133	58.25%	0.94%	2,550	5,163	49.39%	0.58%
331	Gloves *	12,972	40,929	31.69%	4.96%	15,698	45,490	34.51%	3.54%	16,664	48,685	34.23%	3.80%
332	Hosiery	0	143	0.00%	0.00%	0	290	0.00%	0.00%	0	391	0.00%	0.00%
333	Suit-type coats, MB **	857	6,697	12.80%	0.33%	826	6,371	12.96%	0.19%	1,478	7,711	19.17%	0.34%
334	Other coats, MB **	5,395	37,294	14.47%	2.06%	8,699	41,961	20.73%	1.96%	7,005	38,203	18.34%	1.60%
335	Coats, WGI **	7,581	57,861	13.10%	2.90%	16,678	73,514	22.69%	3.76%	13,872	71,614	19.37%	3.17%
336	Dresses	439	31,665	1.39%	0.17%	2,494	35,198	7.09%	0.56%	1,651	35,108	4.70%	0.38%
337	Playsuits **	6,205	34,575	17.95%	2.37%	14,303	42,950	33.30%	3.23%	16,727	46,725	35.80%	3.82%
338	Knit shirts, MB **	3,003	38,095	7.88%	1.15%	5,779	47,405	12.19%	1.30%	3,975	48,938	8.12%	0.91%
339	Knit shirts,blouses, WGI *	5,060	51,394	9.85%	1.94%	3,662	50,846	7.20%	0.83%	8,273	56,434	14.66%	1.89%
340	Shirts,not knit MB *	9,797	151,560	6.46%	3.75%	11,351	153,288	7.41%	2.56%	15,105	185,208	8.16%	3.45%
341	Blouses,not knit,WGI *	7,931	87,102	9.11%	3.03%	2,017	99,499	2.03%	0.46%	6,849	99,354	6.89%	1.56%
342	Skirts **	878	15,112	5.81%	0.34%	1,485	21,574	6.88%	0.34%	1,757	21,823	8.05%	0.40%
345	Sweaters **	471	18,658	2.52%	0.18%	1,359	17,443	7.79%	0.31%	4,952	27,306	18.14%	1.13%
347	Trousers, MB *	12,722	87,309	14.57%	4.87%	14,305	94,304	15.17%	3.23%	10,275	87,256	11.78%	2.34%
348	Trousers, WGI *	18,835	147,402	12.78%	7.21%	18,376	161,602	11.36%	4.15%	13,503	146,512	9.22%	3.08%
349	Brassiers	0	662	0.00%	0.00%	0	514	0.00%	0.00%	0	672	0.00%	0.00%
350	Dressing gowns **	527	10,761	4.90%	0.20%	1,589	12,750	12.46%	0.36%	4,258	18,360	23.19%	0.97%
351	Nightwear **	6,778	72,280	9.38%	2.59%	9,854	90,896	10.84%	2.22%	14,593	110,604	13.19%	3.33%
352	Underwear	1,209	25,333	4.77%	0.46%	806	33,242	2.42%	0.18%	1,589	54,318	2.93%	0.36%
353	Down-filled coats,MB	0	0	0.00%	0.00%	67	289	23.18%	0.02%	63	289	21.79%	0.01%
354	Down-filled coats,WGI	0	0	0.00%	0.00%	55	165	33.29%	0.01%	186	330	56.30%	0.04%
359	Other Apparel	6,744	82,791	8.15%	2.58%	7,728	83,642	9.24%	1.74%	10,504	77,703	13.52%	2.40%
Made-ups and misc.													
360	Pillowcases	952	1,528	62.31%	0.36%	1,692	2,592	65.29%	0.38%	1,778	2,836	62.70%	0.41%
361	Sheets	148	3,044	4.86%	0.06%	268	4,526	5.92%	0.06%	1,025	10,862	9.44%	0.23%
362	Bedspreads and quilts	333	4,244	7.85%	0.13%	487	4,492	10.84%	0.11%	399	3,919	10.18%	0.09%
363	Terry & other towels **	2,922	24,574	11.89%	1.12%	3,891	30,289	12.85%	0.88%	8,593	37,937	22.65%	1.96%
369	Other manufactures	25,726	182,275	14.11%	9.84%	59,512	237,696	25.04%	13.43%	76,456	262,090	29.17%	17.45%
	Total	261,376	2,008,203	13.02%	100.00%	442,984	2,563,908	17.28%	100.00%	438,171	2,428,047	18.05%	100.00%

* denotes 1980-82 bilateral; ** denotes 1983-87 bilateral.

Source: Compiled from Official Statistics of the U.S. Department of Commerce.

TABLE 8 (Continued)
PRC Exports of Cotton Textiles
Compared to Total U.S. Imports
(In thousand equivalent square yards and percent)

1983

Cotton Category	Description	PRC Exports	Total U.S. Imports	PRC Exports as a % of Total U.S. Imports	Commodity Share of PRC Exports	Rate of Growth PRC Exports 1980-83	Rate of Growth Total U.S. Imports 1980-83
Yarn							
300	Carded yarns	83	126,385	0.07%	0.02%	-22.11%	8.01%
Fabric							
310	Gingham	559	11,201	4.99%	0.11%	43.91%	6.93%
311	Velveteen	19	547	3.47%	.00%	0.00%	-19.61%
312	Corduroy	6	3,018	0.20%	.00%	-40.24%	27.81%
313	Sheeting	64,064	320,460	19.99%	12.55%	9.21%	2.54%
314	Poplin and Broadcloth **	19,755	49,177	40.17%	3.87%	13.33%	24.57%
315	Printcloth **	118,269	258,308	45.79%	23.17%	5.52%	12.11%
317	Twill and sateen	11,086	137,903	8.04%	2.17%	2.61%	-2.17%
318	Yarn-dyed fabric	260	18,321	1.42%	0.05%	-5.71%	-5.41%
319	Duck	133	75,947	0.18%	0.03%	38.29%	-0.57%
320	Woven fabrics	11,398	191,080	5.97%	2.23%	-3.87%	4.73%
Apparel							
330	Handkerchiefs	3,346	5,952	56.22%	0.66%	-0.15%	-0.85%
331	Gloves *	13,407	47,908	27.98%	2.63%	0.69%	2.37%
332	Hosiery	0	1,113	0.00%	0.00%	0.00%	32.41%
333	Suit-type coats, MB **	1,495	7,204	20.75%	0.29%	10.27%	1.80%
334	Other coats, MB **	10,327	47,578	21.71%	2.02%	7.81%	2.80%
335	Coats, WGI **	8,901	67,402	13.21%	1.74%	1.30%	1.89%
336	Dresses	5,430	46,523	11.67%	1.06%	36.31%	5.13%
337	Playsuits **	14,530	45,725	31.78%	2.85%	12.49%	4.09%
338	Knit shirts, MB **	5,977	62,690	9.53%	1.17%	7.62%	6.85%
339	Knit shirts,blouses, WGI *	7,067	53,345	13.25%	1.38%	8.21%	0.94%
340	Shirts,not knit MB *	18,731	170,928	10.96%	3.67%	10.17%	2.42%
341	Blouses,not knit,WGI *	9,856	124,512	7.92%	1.93%	8.48%	4.76%
342	Skirts **	2,690	18,548	14.50%	0.53%	16.55%	2.76%
345	Sweaters **	1,709	30,838	5.54%	0.33%	25.12%	8.86%
347	Trousers, MB *	19,034	109,933	17.31%	3.73%	3.89%	2.70%
348	Trousers, WGI *	33,777	211,767	15.95%	6.62%	6.47%	4.38%
349	Brassiers	69	1,291	5.34%	0.01%	0.00%	10.37%
350	Dressing gowns **	4,647	23,511	19.77%	0.91%	38.60%	12.49%
351	Nightwear **	19,771	109,876	17.99%	3.87%	16.94%	6.51%
352	Underwear	11,774	80,542	14.62%	2.31%	38.55%	18.77%
353	Down-filled coats,MB	30	330	9.08%	0.01%	-16.01%	2.94%
354	Down-filled coats,WGI	106	372	28.52%	0.02%	15.31%	19.25%
359	Other Apparel	11,885	113,781	10.45%	2.33%	9.11%	3.90%
Made-ups and misc.							
360	Pillowcases	1,188	3,405	34.89%	0.23%	3.15%	11.44%
361	Sheets	2,757	22,835	12.07%	0.54%	55.16%	35.06%
362	Bedspreads and quilts	773	3,291	23.49%	0.15%	0.00%	-3.83%
363	Terry & other towels **	6,321	39,871	15.85%	1.24%	14.45%	7.55%
369	Other manufactures	69,294	306,995	22.57%	13.57%	15.02%	7.48%
	Total	510,524	2,950,410	17.30%	100.00%	9.06%	4.89%

TABLE 9
PRC Exports of Manmade-Fiber Textiles
Compared to Total U.S. Imports
(In thousand equivalent square yards and percent)

Manmade Category	Description	1980 PRC Exports	1980 Total U.S. Imports	1980 PRC Exports as a % of Total U.S. Imports	1980 Commodity Share of PRC Exports	1981 PRC Exports	1981 Total U.S. Imports	1981 PRC Exports as a % of Total U.S. Imports	1981 Commodity Share of PRC Exports	1982 PRC Exports	1982 Total U.S. Imports	1982 PRC Exports as a % of Total U.S. Imports	1982 Commodity Share of PRC Exports
Yarn													
600	Textured	0	31,717	0.00%	0.00%	0	42,609	0.00%	0.00%	0	65,212	0.00%	0.00%
604	Noncontinuous noncellulosi	0	74,308	0.00%	0.00%	86	77,752	0.11%	0.08%	442	89,806	0.49%	0.20%
605	Otherryarns	70	22,047	0.32%	0.13%	50	26,387	0.19%	0.05%	1	2,429	0.04%	.00%
Fabric													
610	Continuous cellulosic	21	14,401	0.15%	0.04%	18	11,069	0.16%	0.02%	3	8,621	0.03%	.00%
611	Spun cellulosic woven	0	4,883	0.00%	0.00%	1	11,863	0.01%	.00%	0	10,763	0.00%	0.00%
612	Continuous noncellulosic	0	150,981	0.00%	0.00%	201	234,532	0.09%	0.18%	514	277,371	0.19%	0.23%
613	Spun noncellulosic woven	1,473	27,457	5.36%	2.80%	5,395	85,405	6.32%	4.91%	9,982	76,738	13.01%	4.51%
614	Woven babric, nes	157	109,207	0.14%	0.30%	618	110,455	0.56%	0.56%	3,337	93,869	3.55%	1.51%
625	Knit fabric	0	20,498	0.00%	0.00%	4	16,271	0.02%	.00%	2	17,714	0.01%	.00%
626	Pile or tufted fabrics	2	2,177	0.09%	.00%	7	1,813	0.39%	0.01%	35	2,189	1.60%	0.02%
627	Specialty fabrics	38	155,306	0.02%	0.07%	50	131,773	0.04%	0.05%	222	132,389	0.17%	0.10%
Apparel													
630	Handkerchiefs	98	534	18.36%	0.19%	141	850	16.59%	0.13%	103	564	18.26%	0.05%
631	Gloves **	423	13,220	3.20%	0.80%	615	12,145	5.06%	0.56%	1,633	13,178	12.39%	0.74%
632	Hosiery	1	13,814	0.01%	.00%	35	9,333	0.37%	0.03%	27	10,028	0.27%	0.01%
633	Suit-type coats, MB	193	4,525	4.27%	0.37%	367	5,068	7.24%	0.33%	82	5,068	1.62%	0.04%
634	Other coats, MB **	2,179	85,780	2.54%	4.14%	5,989	101,144	5.92%	5.46%	18,421	130,012	14.17%	8.33%
635	Coats, WGI **	1,578	99,698	1.58%	3.00%	5,985	111,675	5.36%	5.45%	21,278	142,650	14.92%	9.62%
636	Dresses **	497	52,775	0.94%	0.94%	2,737	59,841	4.57%	2.49%	7,057	52,457	13.45%	3.19%
637	Playsuits	109	15,251	0.71%	0.21%	191	13,675	1.40%	0.17%	711	12,120	5.87%	0.32%
638	Knit shirts, MB	555	97,182	0.57%	1.05%	3,414	100,584	3.39%	3.11%	6,407	105,678	6.06%	2.90%
639	Knit shirts,blouses, WGI	1,569	214,650	0.73%	2.98%	3,737	225,330	1.66%	3.40%	7,321	228,060	3.21%	3.31%
640	Shirts,not knit MB **	9,392	234,720	4.00%	17.84%	18,016	256,776	7.02%	16.41%	23,511	263,200	8.93%	10.63%
641	Blouses,not knit,WGI **	4,621	64,163	7.20%	8.78%	8,229	74,661	11.02%	7.50%	13,608	75,777	17.96%	6.24%
642	Skirts	1	5,304	0.02%	.00%	33	8,775	0.38%	0.03%	370	10,538	3.51%	0.17%
643	Suits, MB	55	5,130	1.07%	0.10%	32	6,264	0.51%	0.03%	19	6,534	0.29%	0.01%
644	Suits, WGI	6	6,210	0.10%	0.01%	578	9,612	6.01%	0.53%	123	13,014	0.95%	0.06%
645	Sweaters, MB *	4,765	60,131	7.92%	9.05%	4,677	55,200	8.47%	4.26%	7,063	68,374	10.33%	3.19%
646	Sweaters, WGI *	11,980	289,211	4.14%	22.75%	15,238	293,995	5.18%	13.88%	20,012	282,293	7.09%	9.05%
647	Trousers, MB **	985	45,426	2.17%	1.87%	4,309	54,735	7.87%	3.93%	12,883	76,166	16.91%	5.82%
648	Trousers, WGI **	1,247	105,857	1.18%	2.37%	9,252	115,237	8.03%	8.43%	35,645	158,135	22.54%	16.11%
649	Brassiers	8	60,130	0.01%	0.02%	871	63,629	1.37%	0.79%	2,224	57,787	3.85%	1.01%
650	Dressing gowns	804	8,517	9.44%	1.53%	1,074	10,149	10.58%	0.98%	1,055	9,741	10.83%	0.48%
651	Nightwear	1,676	16,380	10.23%	3.18%	2,978	16,952	17.57%	2.71%	3,757	25,168	14.93%	1.70%
652	Underwear	16	54,400	0.03%	0.03%	108	63,536	0.17%	0.10%	231	58,736	0.39%	0.10%
653	Down-filled coats,MB	0	0	0.00%	0.00%	861	6,980	12.34%	0.78%	1,024	4,089	25.04%	0.46%
654	Down-filled coats,WGI	0	0	0.00%	0.00%	615	4,997	12.31%	0.56%	771	4,632	15.96%	0.35%
659	Other Apparel	4,036	233,602	1.73%	7.67%	5,070	242,408	2.09%	4.62%	6,362	264,888	2.40%	2.88%
Made-ups and misc.													
665	Floor Coverings	4	3,460	0.12%	0.01%	7	3,438	0.20%	0.01%	10	4,200	0.24%	.00%
666	Other furnishings	4,085	55,185	7.40%	7.76%	8,173	63,484	12.87%	7.45%	12,230	59,280	20.63%	5.53%
669	Other manufactures	10	118,295	0.01%	0.02%	16	133,544	0.01%	0.01%	2,556	188,737	1.35%	1.16%
	Total	52,654	2,576,529	2.04%	100.00%	109,778	2,873,947	3.82%	100.00%	221,232	3,128,606	7.07%	100.00%

* denotes 1980-82 bilateral; ** denotes 1983-87 bilateral.

Source: Compiled from Official Statistics of the U.S. Department of Commerce.

TABLE 9 <Continued>
PRC Exports of Manmade-Fiber Textiles
Compared to Total U.S. Imports
(In thousand equivalent square yards and percent)

1983

Manmade Category	Description	PRC Exports	Total U.S. Imports	PRC Exports as a % of Total U.S. Imports	Commodity Share of PRC Exports	Rate of Growth PRC Exports 1980-83	Rate of Growth Total U.S. Imports 1980-83
Yarn							
600	Textured	2	97,653	.00%	.00%	0.00%	17.97%
604	Noncontinuous noncellulosi	942	125,013	0.75%	0.36%	68.17%	7.68%
605	Other yarns	51	33,205	0.15%	0.02%	-19.04%	-4.90%
Fabric							
610	Continuous cellulosic	1	12,464	0.01%	.00%	-37.78%	-2.83%
611	Spun cellulosic woven	267	19,352	1.38%	0.10%	0.00%	19.15%
612	Continuous noncellulosic	736	344,473	0.21%	0.28%	32.56%	12.16%
613	Spun noncellulosic woven	12,682	104,067	12.19%	4.89%	35.96%	18.41%
614	Woven babric, nes	4,898	123,478	3.97%	1.89%	68.45%	0.90%
625	Knit fabric	0	16,832	0.00%	0.00%	0.00%	-2.17%
626	Pile or tufted fabrics	110	3,359	3.27%	0.04%	80.76%	6.68%
627	Specialty fabrics	57	152,950	0.04%	0.02%	12.48%	-0.18%
Apparel							
630	Handkerchiefs	66	740	8.92%	0.03%	-6.31%	2.50%
631	Gloves **	1,917	19,383	9.89%	0.74%	27.04%	5.49%
632	Hosiery	1	15,304	0.01%	.00%	-1.12%	1.66%
633	Suit-type coats, MB	353	6,335	5.57%	0.14%	1.37%	4.48%
634	Other coats, MB **	21,368	124,437	17.17%	8.24%	41.38%	6.12%
635	Coats, WGI **	21,850	146,078	14.96%	8.42%	48.81%	6.23%
636	Dresses **	15,431	80,498	19.17%	5.95%	63.03%	5.05%
637	Playsuits	2,298	17,423	13.19%	0.89%	57.50%	1.22%
638	Knit shirts, MB	7,491	114,048	6.57%	2.89%	44.26%	2.33%
639	Knit shirts,blouses, WGI	15,149	276,120	5.49%	5.84%	38.35%	3.39%
640	Shirts,not knit MB **	20,262	258,480	7.84%	7.81%	11.82%	1.70%
641	Blouses,not knit,WGI **	17,543	92,713	18.92%	6.76%	21.69%	4.98%
642	Skirts	920	20,808	4.42%	0.35%	170.23%	20.45%
643	Suits, MB	347	7,182	4.83%	0.13%	24.28%	4.67%
644	Suits, WGI	394	22,518	1.75%	0.15%	61.28%	19.84%
645	Sweaters, MB *	4,994	67,050	7.45%	1.92%	2.43%	2.38%
646	Sweaters, WGI *	20,783	329,470	6.31%	8.01%	8.72%	1.53%
647	Trousers, MB **	17,843	92,827	19.22%	6.88%	52.95%	11.34%
648	Trousers, WGI **	17,981	143,041	12.57%	6.93%	50.12%	5.44%
649	Brassiers	2,017	61,411	3.28%	0.78%	114.08%	-0.14%
650	Dressing gowns	2,551	12,648	20.17%	0.98%	16.14%	5.10%
651	Nightwear	6,281	35,464	17.71%	2.42%	19.99%	12.50%
652	Underwear	1,107	74,688	1.48%	0.43%	79.50%	3.86%
653	Down-filled coats,MB	805	3,098	25.99%	0.31%	-1.45%	-16.17%
654	Down-filled coats,WGI	986	9,458	10.43%	0.38%	10.79%	14.86%
659	Other Apparel	11,954	339,292	3.52%	4.61%	16.34%	5.39%
Made-ups and misc.							
665	Floor Coverings	56	7,409	0.76%	0.02%	43.24%	11.40%
666	Other furnishings	14,029	95,612	14.67%	5.41%	19.51%	7.10%
669	Other manufactures	12,930	306,431	4.22%	4.98%	217.03%	14.92%
	Total	259,453	3,813,012	6.80%	100.00%	26.90%	5.63%

TABLE 10
PRC Exports of Wool Textiles
Compared to Total U.S. Imports
(In thousand equivalent square yards and percent)

Wool Category	Description	1980 PRC Exports	1980 Total U.S. Imports	1980 PRC Exports as a % of Total U.S. Imports	1980 Commodity Share of PRC Exports	1981 PRC Exports	1981 Total U.S. Imports	1981 PRC Exports as a % of Total U.S. Imports	1981 Commodity Share of PRC Exports	1982 PRC Exports	1982 Total U.S. Imports	1982 PRC Exports as a % of Total U.S. Imports	1982 Commodity Share of PRC Expor
Yarn													
400	Wool tops and yarn	0	7,324	0.00%	0.00%	18	9,350	0.19%	0.20%	35	14,916	0.23%	0.31
Fabric													
410	Woolens and worsteds	981	16,184	6.06%	9.17%	1,655	20,937	7.90%	18.08%	1,465	24,288	6.03%	12.90
411	Tapestries and upholstery	13	1,406	0.92%	0.12%	18	1,859	0.97%	0.20%	14	1,799	0.76%	0.12
Apparel													
431	Gloves	58	263	22.10%	0.54%	71	422	16.82%	0.78%	136	445	30.55%	1.20
432	Hosiery	0	258	0.00%	0.00%	0	283	0.00%	0.00%	0	255	0.00%	0.00
433	Suit-type coats, MB	0	1,908	0.00%	0.00%	108	2,376	4.55%	1.18%	105	2,916	3.60%	0.92
434	Other coats, MB	17	2,214	0.77%	0.16%	2	1,458	0.14%	0.02%	23	1,890	1.22%	0.20
435	Coats, WGI	241	10,260	2.35%	2.25%	653	10,314	6.33%	7.13%	870	10,044	8.66%	7.66
436	Dresses	152	4,133	3.68%	1.42%	498	4,625	10.77%	5.44%	2	1,624	0.12%	0.02
438	Knit shirts, MB	54	9,270	0.58%	0.51%	150	10,920	1.37%	1.64%	86	7,230	1.19%	0.76
440	Shirts,not knit MB	37	5,496	0.67%	0.35%	197	4,008	4.92%	2.15%	29	4,392	0.66%	0.26
442	Skirts	29	1,944	1.49%	0.27%	36	1,926	1.87%	0.39%	102	2,356	4.33%	0.90
443	Suits, MB **	23	6,048	0.38%	0.22%	341	6,210	5.49%	3.72%	796	6,858	11.61%	7.01
444	Suits, WGI	4	1,566	0.26%	0.04%	5	2,916	0.17%	0.05%	39	4,644	0.84%	0.34
445	Sweaters, MB **	1,078	7,529	14.32%	10.08%	641	9,598	6.68%	7.00%	2,085	15,178	13.74%	18.36
446	Sweaters, WGI **	6,994	30,474	22.95%	65.41%	3,511	24,879	14.11%	38.35%	3,139	23,243	13.51%	27.63
447	Trousers, MB **	297	2,898	10.25%	2.78%	351	3,060	11.47%	3.63%	1,352	4,230	31.96%	11.90
448	Trousers, WGI **	53	1,458	3.64%	0.50%	77	2,016	3.82%	0.84%	315	2,322	13.57%	2.77
459	Other apparel	51	7,710	0.66%	0.48%	64	6,636	0.96%	0.70%	89	6,594	1.35%	0.76
Made-ups and misc.													
464	Blankets	27	433	6.24%	0.25%	30	425	7.06%	0.33%	5	307	1.63%	0.04
465	Floor coverings	578	6,008	9.62%	5.41%	721	6,228	11.58%	7.88%	667	6,926	9.63%	5.87
469	Other manufactures	6	3,714	0.16%	0.06%	8	2,906	0.28%	0.09%	5	2,374	0.21%	0.04
	Total	10,693	128,497	8.32%	100.00%	9,155	133,352	6.87%	100.00%	11,359	144,834	7.84%	100.00

** denotes 1983-87 bilateral.

Source: Compiled from Official Statistics of the U.S. Department of Commerce.

TABLE 10 (Continued)
PRC Exports of Wool Textiles
Compared to Total U.S. Imports
(In thousand equivalent square yards and percent)

1983

Wool Category	Description	PRC Exports	Total U.S. Imports	PRC Exports as a % of Total U.S. Imports	Commodity Share of PRC Exports	Rate of Growth PRC Exports 1980-83	Rate of Growth Total U. S. Imports 1980-83
Yarn							
400	Wool tops and yarn	10	16,128	0.06%	0.07%	-11.98%	13.10%
Fabric							
410	Woolens and worsteds	1,475	28,970	5.09%	10.10%	4.90%	8.58%
411	Tapestries and upholstery	20	2,888	0.69%	0.14%	4.62%	9.68%
Apparel							
431	Gloves	134	525	25.52%	0.92%	14.72%	9.70%
432	Hosiery	4	384	1.04%	0.03%	0.00%	4.85%
433	Suit-type coats, MB	504	4,248	11.86%	3.45%	39.72%	11.98%
434	Other coats, MB	59	3,186	1.85%	0.40%	30.76%	6.04%
435	Coats, WGI	900	14,850	6.06%	6.16%	20.22%	4.81%
436	Dresses	187	4,182	4.47%	1.28%	-19.15%	-4.30%
438	Knit shirts, MB	390	9,570	4.08%	2.67%	26.29%	-1.37%
440	Shirts,not knit MB	79	4,656	1.70%	0.54%	1.57%	-1.75%
442	Skirts	568	4,392	12.93%	3.89%	54.16%	12.16%
443	Suits, MB **	503	7,344	6.85%	3.44%	55.08%	3.00%
444	Suits, WGI	547	6,264	8.73%	3.75%	107.51%	-22.24%
445	Sweaters, MB **	2,276	15,713	14.48%	15.58%	16.02%	12.27%
446	Sweaters, WGI **	3,708	28,198	13.15%	25.39%	-8.38%	-1.30%
447	Trousers, MB **	1,647	4,950	33.27%	11.28%	32.54%	8.74%
448	Trousers, WGI **	339	3,294	10.29%	2.32%	35.39%	11.89%
459	Other apparel	365	9,880	3.69%	2.50%	31.09%	3.26%
Made-ups and misc.							
464	Blankets	5	546	0.92%	0.03%	-25.74%	1.62%
465	Floor coverings	881	10,163	8.67%	6.03%	5.29%	7.56%
469	Other manufactures	3	2,576	0.12%	0.02%	-10.48%	-5.49%
	Total	14,604	182,906	7.98%	100.00%	5.12%	5.08%

TABLE 11
Estimates of Trade Diversion Due to
the first U.S. - PRC Textile Agreement
(Percent)

Cotton Category	Description	Trade Diversion Measured as a Percent of Actual Growth
Apparel		
331	Gloves *	93.60%
339	Knit shirts,blouses, WGI *	11.36%
340	Shirts,not knit MB *	2.20%
341	Blouses,not knit,WGI *	46.70%
347	Trousers, MB *	111.10%
348	Trousers, WGI *	45.10%
645	Sweaters, MB *	321.30%
646	Sweaters, WGI *	180.90%

* denotes 1980-82 bilateral.

Source: Compiled from Official Statistics of the U. S. Department of Commerce.

TABLE 12
Unit Values of PRC Exports of Cotton Textiles
(U.S. dollars and growth rate)

Cotton Category	Description	1980	1981	1982	1983	Rate of Growth PRC Unit Values 1980-83
Yarn						
300	Carded yarns	$0.26	$0.39		$0.66	17.44%
Fabric						
310	Gingham	$0.76		$0.65	$0.51	-6.68%
311	Velveteen	$2.51			$1.63	-5.47%
312	Corduroy	$1.30	$1.71	$1.50	$1.00	-3.91%
313	Sheeting	$0.37	$0.40	$0.43	$0.35	-0.26%
314	Poplin and Broadcloth **		$0.36	$0.36	$0.31	-2.98%
315	Printcloth **	$0.37	$0.37	$0.39	$0.32	-1.62%
317	Twill and sateen	$0.54	$0.53	$0.57	$0.45	-2.20%
318	Yarn-dyed fabric	$0.84	$0.94	$0.91	$0.56	-5.29%
319	Duck	$0.80	$0.25	$0.49	$0.30	-9.41%
320	Woven fabrics	$0.33	$0.33	$0.33	$0.36	1.23%
Apparel						
330	Handkerchiefs	$1.02	$1.16	$1.10	$1.00	-0.46%
331	Gloves *	$0.81	$0.87	$0.97	$0.97	2.86%
332	Hosiery					0.00%
333	Suit-type coats, MB **	$2.91	$3.39	$3.75	$3.92	4.38%
334	Other coats, MB **	$1.17	$1.27	$1.66	$1.91	7.86%
335	Coats, WGI **	$2.23	$2.63	$3.13	$2.82	3.85%
336	Dresses	$0.84	$1.19	$1.15	$1.12	3.59%
337	Playsuits **	$0.82	$0.90	$0.90	$0.90	1.10%
338	Knit shirts, MB **	$2.22	$2.75	$2.92	$3.69	7.11%
339	Knit shirts,blouses, WGI *	$1.19	$1.76	$1.99	$2.34	9.86%
340	Shirts,not knit MB *	$1.17	$1.53	$1.81	$1.67	5.49%
341	Blouses,not knit,WGI *	$1.62	$2.28	$2.33	$2.43	5.50%
342	Skirts **	$1.59	$2.15	$2.23	$1.93	2.74%
345	Sweaters **	$2.52	$2.03	$1.80	$2.06	-3.12%
347	Trousers, MB *	$1.80	$2.24	$2.71	$2.27	3.98%
348	Trousers, WGI *	$1.37	$2.26	$2.53	$2.09	6.25%
349	Brassiers				$2.36	0.00%
350	Dressing gowns **	$1.16	$0.99	$1.03	$1.41	2.70%
351	Nightwear **	$0.75	$0.81	$0.85	$0.78	0.70%
352	Underwear	$0.34	$0.43	$0.33	$0.29	-3.12%
353	Down-filled coats,MB		$5.78	$5.32	$6.43	2.37%
354	Down filled coats,WGI		$7.09	$9.23	$8.27	3.41%
359	Other Apparel	$0.67	$0.79	$0.77	$0.90	3.83%
Made-ups and misc.						
360	Pillowcases	$1.96	$1.64	$1.64	$1.86	-0.64%
361	Sheets	$0.50	$0.51	$0.56	$0.50	0.37%
362	Bedspreads and quilts	$7.81	$4.92	$9.08	$4.30	-4.99%
363	Terry & other towels **	$1.66	$1.95	$1.98	$1.76	0.79%
369	Other manufactures	$0.43	$0.41	$0.42	$0.49	1.91%
	Total	$0.80	$0.81	$0.91	$0.92	2.31%

* denotes 1980-82 bilateral; ** denotes 1983-87 bilateral.

Source: Compiled from Official Statistics of the U.S. Department of Commerce.

TABLE 13

Unit Values of PRC Exports of Manmade-Fiber Textiles

(U. S. Dollars and rate of growth)

Manmade Category	Description	1980	1981	1982	1983	Rate of Growth PRC Unit Values 1980-83
Yarn						
600	Textured				$0.50	0.00%
604	Noncontinuous noncellulosic		$0.28	$0.31	$0.26	-1.17%
605	Other yarns	$0.71	$0.90	$2.00	$0.29	-7.77%
Fabric						
610	Continuous cellulosic	$1.29	$1.89	$2.67	$1.00	-1.76%
611	Spun cellulosic woven		$2.00		$0.23	0.00%
612	Continuous noncellulosic		$0.41	$0.38	$0.21	-13.13%
613	Spun noncellulosic woven	$0.61	$0.38	$0.39	$0.28	-9.81%
614	Woven babric, nes	$0.82	$0.49	$0.44	$0.27	-13.82%
625	Knit fabric		$0.25	$0.50		0.00%
626	Pile or tufted fabrics	$3.50	$3.71	$3.63	$3.75	0.78%
627	Specialty fabrics	$0.47	$0.52	$0.17	$0.18	-16.37%
Apparel						
630	Handkerchiefs	$2.87	$3.96	$3.27	$2.18	-4.30%
631	Gloves **	$1.00	$1.55	$1.10	$1.29	1.68%
632	Hosiery	$1.00	$1.17	$1.22	$1.00	0.18%
633	Suit-type coats, MB	$0.98	$1.00	$2.59	$4.00	25.11%
634	Other coats, MB **	$1.11	$1.18	$1.64	$1.58	6.16%
635	Coats, WGI **	$1.16	$1.43	$1.68	$1.40	3.30%
636	Dresses **	$0.96	$0.94	$0.78	$0.99	-0.48%
637	Playsuits	$0.98	$0.91	$1.12	$0.55	-6.36%
638	Knit shirts, MB	$1.10	$1.20	$1.26	$1.36	2.95%
639	Knit shirts,blouses, WGI	$0.80	$0.96	$0.91	$1.28	5.98%
640	Shirts,not knit MB **	$1.27	$1.51	$1.44	$1.35	0.55%
641	Blouses,not knit,WGI **	$2.01	$2.59	$2.38	$2.67	3.39%
642	Skirts	$6.00	$2.09	$2.44	$2.84	-8.67%
643	Suits, MB	$3.36	$1.91	$1.84	$3.80	1.46%
644	Suits, WGI	$2.17	$0.42	$2.37	$1.84	5.58%
645	Sweaters, MB *	$0.76	$0.90	$0.99	$1.00	4.13%
646	Sweaters, WGI *	$0.56	$0.74	$0.88	$0.80	5.71%
647	Trousers, MB **	$1.69	$1.90	$1.82	$1.77	0.41%
648	Trousers, WGI **	$0.92	$1.23	$1.09	$1.08	1.54%
649	Brassiers	$2.75	$2.58	$3.07	$2.81	1.04%
650	Dressing gowns	$1.29	$1.15	$1.26	$0.85	-5.02%
651	Nightwear	$0.47	$0.64	$0.59	$0.51	0.71%
652	Underwear	$2.94	$0.59	$0.19	$0.21	-32.59%
653	Down-filled coats,MB		$5.50	$6.57	$7.85	8.06%
654	Down-filled coats,WGI		$9.56	$8.32	$8.09	-3.54%
659	Other Apparel	$0.60	$0.72	$0.66	$0.64	0.59%
Made-ups and misc.						
665	Floor Coverings	$2.75	$18.43	$20.30	$15.14	25.42%
666	Other furnishings	$0.99	$1.17	$1.31	$1.16	2.62%
669	Other manufactures	$2.60	$2.06	$0.08	$0.08	-44.57%
	Total	$0.98	$1.31	$1.33	$1.25	3.22%

* denotes 1980-82 bilateral; ** denotes 1983-87 bilateral.

Source: Compiled from Official Statistics of the U. S. Department of Commerce.

TABLE 14
Unit Values of PRC Exports of Wool Textiles
(U.S. Dollars and growth rate)

Wool Category	Description	1980	1981	1982	1983	Rate of Growth PRC Unit Values 1980-83
Yarn						
400	Wool tops and yarn		$11.94	$10.83	$7.50	-9.61%
Fabric						
410	Woolens and worsteds	$2.74	$3.18	$3.29	$2.98	1.22%
411	Tapestries and upholstery	$7.38	$12.00	$10.36	$7.15	-1.05%
Apparel						
431	Gloves	$9.36	$9.61	$10.32	$6.42	-4.50%
432	Hosiery				$8.50	0.00%
433	Suit-type coats, MB		$5.21	$6.48	$6.43	4.65%
434	Other coats, MB	$2.59	$3.00	$4.65	$4.85	10.61%
435	Coats, WGI	$2.97	$2.43	$3.07	$3.39	2.78%
436	Dresses	$4.06	$2.47	$6.00	$2.98	-0.18%
438	Knit shirts, MB	$3.52	$3.81	$3.24	$2.86	-3.33%
440	Shirts,not knit MB	$3.05	$3.54	$3.66	$3.57	2.19%
442	Skirts	$5.62	$4.69	$5.40	$5.25	-0.27%
443	Suits, MB **	$7.26	$5.25	$7.30	$7.93	2.62%
444	Suits, WGI	$5.50	$6.80	$4.59	$5.70	-1.23%
445	Sweaters, MB **	$5.84	$6.63	$6.07	$5.08	-2.19%
446	Sweaters, WGI **	$4.49	$4.22	$4.13	$4.93	1.14%
447	Trousers, MB **	$5.12	$5.53	$5.86	$5.93	2.20%
448	Trousers, WGI **	$8.42	$6.12	$5.90	$6.71	-3.07%
459	Other apparel	$4.92	$4.94	$4.56	$5.01	-0.11%
Made-ups and misc.						
464	Blankets	$3.74	$3.97	$2.80	$6.40	5.64%
465	Floor coverings	$65.80	$72.21	$65.11	$59.51	-1.74%
469	Other manufactures	$1.33	$4.50	$12.00	$17.33	45.76%
	Total	$7.80	$9.51	$8.49	$8.24	0.22%

** denotes 1983-87 bilateral.

Source: Compiled from Official Statistics of the U.S. Department of Commerce.

EQUITY JOINT VENTURES IN CHINA: NEW LEGAL FRAMEWORK, CONTINUING QUESTIONS

By Stanley B. Lubman*

CONTENTS

SUMMARY

Foreigners participating in equity joint ventures in the PRC since such investments were authorized in 1979 have encountered a variety of problems. New legal institutions have been established to provide a framework for joint ventures but their reach and interpretation of the new rules in practice are still often uncertain. Changes in policy have affected, and will continue to affect, the operation of both joint ventures and the new legal rules. Potential investors need contractual protection against changes in laws, regulations and policies which may affect the joint venture. Some specific

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issues of importance to foreign investors in China include access to the domestic market for sale of joint venture products and for purchase of goods and services, convertibility and repatriability of profits earned on the domestic market, the joint venture's relationship to the state economic plan, valuation of land used by joint ventures, and the level of wages and benefits to be paid to Chinese employees. After ventures are established misunderstandings may arise because of differences between the parties' management styles as well as their different conceptions of the obligations created in their contract. Given variations in practice, changes in policy, and the limitations and continued flexibility of Chinese legal institutions, participants in joint ventures should carefully investigate each opportunity offered to them and insist on drafting contracts which adequately address likely problem areas. The Chinese leadership has taken important steps in creating a legal framework for foreign economic activity, but existing questions are likely to be solved only slowly.

I. Introduction

This is a discussion of some of the elusive but critical interactions among law, policy and practice which influence the conditions for foreign equity investment in the PRC. Since 1979, the Chinese leadership has energetically promoted the creation of a legal framework for such investment. However, integration of the new institutions into the Chinese economy has not been easy, and foreigners have encountered many problems in planning, negotiating, and administering joint ventures.

The future of Sino-foreign joint ventures will be affected by extensive reforms and reorganizations of the Chinese economy which will create uncertainties for foreign trade and investment. In the midst of institutional reform, the emerging legal institutions are likely to provide only a moderate amount of stability, and their content and effect must be considered in the context of policies and practice which surround them and practice which gives them reality.

II. Policy

A. Some Major Policy Currents

To foreign observers, Chinese policy toward foreign investment has not appeared to be completely consistent even in the short period since 1979 when the Law on Joint Ventures Using Chinese and Foreign Investment (the "Joint Venture Law") [1] first ap-

[1] The text of the Joint Venture Law is found in "Law of the People's Republic of China on Joint Ventures using Chinese and Foreign Investment," in Franklin D. Chu, Michael J. Moser, Owen D. Nee, Jr., *Commercial, Business and Trade Laws: People's Republic of China*, Oceana Publications, 1983, at G3–G9. Analyses of the new law and of early developments are: William P. Alford & David E. Birenbaum, "Ventures in the China Trade: An Analysis of China's Emerging Legal Framework for the Regulation of Foreign Investment." *Northwestern Journal of International Law & Business*, Vol. 3, Spring 1981, pp. 56–102; David A. Hayden, "Foreign Partners' Problems in Joint Ventures in China," *Asian Wall Street Journal* (AWSJ), June 30, 1981, p. 4 and July 1, 1981, p. 6; Wei Yuming, "China's Policy on Absorption of Direct Investment from Foreign Countries," *Beijing Review*, No. 30, July 26, 1982, pp. 18–22; and Jerome Alan Cohen, "Some Problems of Investing in China," in Cohen, ed., *Legal Aspects of Doing Business in China*,

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peared. One important example has been the relationship between sales on the domestic market by joint ventures and the availability of repatriable profits in foreign exchange. When the new policy favoring foreign investment was instituted, much was made of the possibility that joint ventures could sell their products on the domestic market. However, it was also made clear that each joint venture had to maintain its own foreign exchange balance and had to guarantee its own foreign exchange through export sales.

Consistent with this policy, during the five years after promulgation of the Joint Venture Law, few joint ventures were created which were not heavily export-oriented. More recently, Chinese officials have expressed willingness to allow joint ventures that earn profits on the domestic market to convert some of them into foreign exchange. This important issue, discussed further below, is raised here only as an example of some of the important uncertainties which have confronted foreign investors.

Policy has changed, also, with regard to the organization of the foreign trade system. What previously appeared to foreigners as a rigidly centralized system was dramatically decentralized in 1979. However, the reforms initiated in that year were so extensive that they created considerable confusion among Chinese and foreigners alike on basic issues, such as the authority of Chinese agencies at the provincial, local and municipal level to enter into transactions with foreigners.[2] Decentralization was then followed by partial recentralization.[3]

More recently, however, the decision to give 14 coastal cities special autonomy in matters of foreign investment raises new questions about the relationships between the center and other parts of China.[4] Considerable decentralization of authority to approve foreign investment is apparent. At the same time further reforms have been announced in the administration of foreign trade, with the objectives of separating enterprise management from government administration, increasing decision-making powers of enterprises so that they become independent economic entities, and reforming trade planning and financial systems correspondingly.[5]

New York: Practicing Law Institute 1983, pp. 65–118; Stanley Lubman, "Foreign Investment in China: Selected Legal Problems and Some Perspectives on Them", *Businesss Transactions With China, Japan, and South Korea*, Columbia University, 1983, pp. 1–41.

In 1983 the new law was supplemented by the "Provisions for the Implementation of the Regulations on Joint Ventures Using Chinese and Foreign Investment" ("Joint Venture Regulations"). For a discussion of the Chinese attitude toward joint ventures with foreign parties, see Zhao Kexue "Legal Problems of Chinese-Foreign Cooperative Ventures Surveyed," Joint Publications Research Service [JPRS], April 18, 1983, pp. 74–79.

[2] For a general discussion of the approval process and related problems of authority, see Chu Baotai, *Zhongwai Hezijingying Qian Tan* [A Discussion of the Chinese Foreign Joint Venture Law and the Experience of Its Implementation], Beijing, 1983, pp. 83-93.

[3] See, e.g., "Organized Control of Foreign Trade Announced," Foreign Broadcast Information Service (FBIS), March 15, 1984, K3-4; Amanda Bennett, "Peking Exerts Control on Foreign Trade," AWSJ, March 16–17, 1984, p. 3; Christian Tyler, "Peking Tightens Grip on Foreign Trade," *Financial Times*, March 3, 1984, p. 8.

[4] The fourteen cities are: Shanghai, Dalian, Qinhuangdao, Tianjin, Yantai, Qingdao, Lianyungang, Nantong, Ningbo, Wenzhou, Fuzhou, Guangzhou, Zhangjiang and Beihai. See, "Fourteen More Coastal Cities to be Opened," *Beijing Review*, Vol. 27, No. 16, April 16, 1984, p. 6, and see the discussion infra at Section III D. For discussion of the increased independence granted to individual enterprises in Shanghai, see *Xinhua New Bulletin*, February 3, 1985, p. 53.

[5] See, e.g., "China Carries Out Reforms in Foreign Trade System," *China Economic News*, September 24, 1984, pp. 2-3. For an excellent summary of the reforms in the foreign trade system, see "That Old Sleeping Dragon is Awakening at Last," *"China '85,"* p. 75, *Far Eastern Economic Review* (FEER), March 21, 1985.

Reports that state trading corporations would be made more distinct from the Ministry of Foreign Economic Relations and Trade ("MFERT") and changed into independent profit centers have not been followed with details on how the new policy is supposed to work, or whether it will also apply to trading corporations established by other ministries.[6] The bureaucratic flux which has been produced by these changes has affected both foreign investment and trade. The decentralization of foreign trade is likely to create confusion as new companies are formed, and as local, provincial and central entities compete for the foreign trade business of domestic enterprises.[7]

The central government's decision in September 1984 to decentralize and reform the foreign trade system, intended as a means to encourage and facilitate commercial activities, has confused and complicated trading relationships. The state's previous monopoly over importing and exporting, exercised through the 14 national foreign trade corporations, has been superceded by a proliferation of new agencies anxious to negotiate deals independently. The results, as yet, are mixed. On the one hand, the liberalized trading environment increases the independence of the established foreign trade corporations, whose experience may give them an advantage over the new organizations. Competition between traders also encourages price differences for goods sourced in China, and increases the alternatives available to foreign companies. Concurrently, however, decentralization has encouraged organizations and enterprises to diversify into areas of business unrelated to their existing operations or expertise, creating uncertainty in sales authority and the participation of inexperienced traders.[8]

The retention of central control over foreign exchange despite commercial decentralization has compounded confusion over the types of business transactions local entities may legally conduct. Such uncertainty, and the emergence of a black market in foreign exchange, suggests that clarification by Beijing of the commercial reforms is already needed. At the same time, the administrative decentralization already accomplished may complicate the process of central clarification.[9] China's foreign trade apparatus can be expected to reflect ongoing tensions between the center and various local agencies.

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[6] For a discussion, see Christopher M. Clarke, "Decentralization," *China Business Review*, Vol. II, No. 2, March-April, 1984, pp. 8-10.

[7] See, e.g., "Laxer Laws To Attract Foreign Technology," *China Daily*, October 13, 1984, p. 1; Stanley B. Lubman, "Law: Problems of Extent and Applicability Remain," *Financial Times*, October 29, 1984. Also, a growing number of domestic enterprises have been given the power to engage in certain foreign transactions. See, e.g., "Policy easing grip on national firms," *South China Morning Post*, Bureau News, p. 8, February 8, 1985.

[8] See Robert Delfs, "Reform upon reform," FEER, March 7, 1985, pp. 59-61; "What to Expect as PRC Trade Establishment Fragments and Reforms," *Business China*, January 24, 1985, p. 1.

[9] The Guangdong provincial government, for example, has had to restrict the activities of localities in establishing joint ventures or cooperative foreign trade enterprises, and to limit the authority to sell imported goods to certain outlets (FBIS, November 23, 1984, Pl). See also, "New Rules for Foreign Trade Unveiled at Fair", *South China Morning Post*, November 7, 1984, p. 11, reporting that some export contracts were made by Chinese organizations which did not produce the goods contracted for, "hoping to buy them cheaply from other Chinese manufacturers to make up their own shortcomings."

B. JOINT VENTURE CONTRACTS AND POLICY CHANGES

The problems which changes and uncertainty in policies create for foreign investors are obvious, and need not be discussed at length here. Chinese officials have not been insensitive to the problems mentioned above; in the recent past they have repeatedly advised foreigners that contracts concluded for the establishment of joint ventures may also fix the legal position of the enterprise in China. Under such clauses, if law or policy change after the contract has come into effect, the provisions of the contract would take precedence over the supervening rules and regulations. This policy has now been given legislative expression in the Foreign Economic Contract Law adopted in March, 1985 ("Foreign Economic Contract Law"), which provides that contracts for joint ventures of various types, if they have been approved, may continue to be performed according to their original terms even though they are inconsistent with supervening laws.[10] [11]

III. LAW, POLICY AND PRACTICE

A. SOME LEGAL PROBLEMS IN NEGOTIATING JOINT VENTURES

The complex relationships between changing policies and the legal framework for equity joint ventures can be illustrated by considering some of the more important problems in negotiating such ventures. The section which follows immediately below discusses some of the issues which most concern foreign investors and their Chinese counterparts.

1. Access to the domestic market

The issue of domestic sale of products produced by joint ventures lies at the core of the very different foreign and Chinese perceptions of the purpose of co-production and investment. For the PRC, joint ventures are attractive as a source of foreign exchange earnings. Export sales also provide a means of entering international markets through the established marketing networks of the foreign partner. Guiding joint ventures toward export markets also helps protect domestic enterprises from competition with more advanced or higher quality joint venture products.[12] The foreign investor, in contrast, would like the joint venture to be a means of penetrating the domestic markets with its apparently vast sales potential.

In general, entry of joint venture products into the domestic market has been limited by Chinese restriction of permissible areas

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[10] Economic Contract Law of the PRC involving Foreigners, adopted at the 10th Session of the Stang Committee of the Sixth National People's Congress, March 21, 1985 effective July 1, 1985, Art. 40 in *Business China*, March 24, 1985, p. 44 and *East Asian Executive Reports*, May 1985, pp. 27, 29. See also for an example of application of the policy before the Foreign Economic Contract Law was adopted, Langston, "Laying Down the Law", FEER, January 24, 1985, pp. 64–65 at p. 65.

[11] The Foreign Economic Contract law was promulgated while this article was in press, and carried out promises previously made by Chinese leaders. For example, during a series of investment conferences in Shanghai and Dalian in November, 1984 in which this author participated as a member of a delegation led by former Secretary of State Cyrus Vance, Chinese officials and law professors repeatedly emphasized the primacy of the joint venture contract. See also infra note 15.

[12] For a Chinese view of the benefits of joint ventures generally, and a discussion of China's experience of joint ventures, see Chu Baotai, supra note 2.

of sales, insistence on export quotas, and the utilization of foreign exchange restrictions to limit repatriable profits so that they do not exceed the joint venture's foreign exchange earnings. A formal easing of Chinese resistance to domestic sales by joint ventures has, however, been evident since May, 1983.[13] The primary change has been a willingness to grant joint ventures permission to sell products on the domestic market if they are "urgently needed," [14] usually at domestic prices, or to foreign trade corporations for foreign currency. Chinese policy in the forseeable future seems likely to reflect continuing concern about outflow of foreign exchange by exhibiting great reluctance to provide guarantees that domestically-earned profits in local currency will be convertible into foreign exchange and repatriable.

A threshold issue concerning sales by joint ventures on the domestic market is the definition of the types of products which may be sold on the domestic market. Although import substitution is a major criterion, some products may embody technologies so new that they have not been imported before in substantial quantities. Perceptions of what is "urgently needed" are by no means uniform among Chinese agencies negotiating joint ventures.

Other important issues include the percentage of total production to be sold domestically, whether profits from domestic and international sales will be segregated or shared according to an agreed-upon formula, and uncertainty over whether local authorities will be allowed—or will agree—to supplement insufficient foreign exchange balances. Chinese negotiators and leaders alike express strong preference for deciding these issues on a case-by-case basis. Although Chinese limitations are understandable, there is no apparent immediate prospect that greater certainty—or less flexibility—will soon be manifested. The foreign investor must expect to negotiate hard on this issue, and to obtain only limited satisfaction.[15]

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[13] See, "Running Chinese Foreign Joint Ventures With Better Results," *Renmin Ribao*, May 14, 1983. The new policy was prefigured by the Sino-American Shanghai Squibb Pharmaceuticals Ltd. and Sino-Swede Pharmaceutical Corp. Ltd. joint ventures. Both of these joint ventures, which were started in late 1982, provided for the bulk of the product to be sold on the domestic market. See "Two Unique Pharmaceutical Ventures," *China Business Review*, Vol. IX, No. 6, November-December 1982, p. 2; "Squibb JV with PRC: Flexibility, Gray Areas at Outset," *Business China*, Vol. VIII, No. 24, December 22, 1982, pp. 185–186.

The policy has recently been taken a step further. Chu Baotai, a leading cadre of the Foreign Investment Administration of MFERT, has stated that in future if joint ventures match foreign exchange expenditures with income, the quotas will be set for the percentage of a company's products which may be exported. *China Trade Weekly Bulletin*, October 22, 1984, p. 1.

[14] Joint Venture Regulations, Article 61.

[15] See, e.g., "Emphasis on growth in special zones", *Financial Times*, September 4, 1984. Prospective investors repeatedly told me that as long as the joint venture contract and its supporting feasibility study reflected the need for foreign exchange supplements and were approved, such supplements would be forthcoming.

Premier Zhao Ziyang's discussion of this issue with participants at the investment conference in November 1984 mentioned supra note 11 was consistent. According to this author's contemporaneous notes of the meeting, Premier Zhao said that it is "out of the question" to assume that each enterprise will be able to assume its own foreign exchange balance. This question, he said, must be "solved on a case-by-case basis." These issues can be negotiated and agreed on, he continued. It is not possible to have "definitive rules" on this issue in the applicable legislation, and the parties must express their understanding in their contract. Earlier in the course of this discussion, Premier Zhao had stated that "in the absence of an adequate legal system, contracts have a binding legal force."

For a report on one joint venture contract that contains a guarantee of convertibility of Chinese profits into foreign exchange see "VW and China Complete Auto Production Pact," *Wall Street Journal*, October 11, 1984. A more recent report of continuing difficulty is "Shanghai

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2. Integration of the joint venture into the Chinese economy

Since the Joint Venture Law was promulgated, Chinese and foreigners alike concerned with investment in China have had to struggle to define the relationship between joint ventures and China's state plans. This section discusses some of the issues that have arisen.

(a) Domestic purchase of goods and services

Among the obvious problems is that of domestic sourcing of goods and services. It is no doubt with the purpose of encouraging development of domestic industry that Article 9 of the Joint Venture Law provides that a joint venture "should give first priority to purchases in China." At the same time, the article also makes clear that such priority for domestic purchases is not invariably required, and in recent years the policy has been liberalized, so that it seems fair to say that joint ventures may now import duty-free goods they need for their business activities in China which they cannot readily obtain on the domestic market.[16]

Nonetheless, there have been several instances in which foreigners have encountered difficulties in this regard. One was a joint venture established by Hitachi for the manufacture of television sets in Fujian, which reportedly encountered problems in importing the Japanese television tubes it required. In that case there was, apparently, considerable lack of clarity in the original agreement.[17] An analagous problem was encountered by foreign oil companies which wanted to lease rigs and contract for other offshore services, so that they could begin operations under the contracts for offshore exploration which they had signed in 1983. In South China they were told that they could not obtain certain services using competitive bidding, but had to contract with Chinese agencies or with Sino-foreign joint ventures, although such a requirement would have violated both Chinese regulations and the contracts between the oil companies and the China National Offshore Oil Corporation.[18] After the problem received some publicity and the companies complained competitive bidding was reinstated.

(b) Integration into state plans

The difficulties mentioned above may only be growing pains, but some issues are likely to persist such as the extent to which joint ventures are to be integrated into state plans.[19] A policy of intergrating the joint venture into the state-planned economy is vaguely enunciated in Article 19 of the Joint Venture Law, which requires that "the production and operating plans of a joint venture shall be

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Snags Are Worrying Foreign Firms," AWSJ, March 12, 1985. During the first several years after the new policy was given expression in the Joint Venture Regulations, apparently very few guarantees were given.

[16] See, Liu Chu, "Rules and Regulations For the Utilization of Foreign Funds, with Characteristics Special to China," JPRS Economic Affairs, No. 17, March 1, 1984, pp. 40-48.

[17] See, John Makinson, "Chinese Handshake Has Its Pitfalls," *Financial Times,* March 28, 1983, p. 4; *cf.* Vigor Keung Fung, "Mr. You Runs Fujian Plant Japan Style," AWSJ, April 22-23, 1983, pp. 1, 3.

[18] Horace Philips, "Braving the Labyrinth of Chinese Bureaucracy," AWSJ, June 3-4, 1983, p. 6.

[19] For a recent statement by a Chinese official, see Liu Chu, supra note 16.

fileu with the departments in charge and shall be implemented through economic contracts."

The Joint Venture Regulations provide somewhat more detail: Article 54 stipulates that the capital construction plan of the joint venture shall be "brought into the state or local capital construction plan." Article 56 further requires the production and operation plan of a joint venture to be "filed" with "the department in charge." Finally, Articles 58 and 64 require that the materials to be supplied or sold under the state's distribution plan be "brought under" the plan of the department in charge and be distributed or sold "in a planned way."

The dilemma for both Chinese economic planners and for China's foreign investment partners is clear: On the one hand, integration of the joint venture into the Chinese economy would strengthen the Chinese government's political and economic control over foreign policy equity ventures in China, while, for the foreign investor, integration into the state-planned economy would seem to provide needed access to critical supplies and raw materials.[20] On the other hand, however, rigorously-practiced integration would subject the foreign investor to dependence on a complex, often impenetrable system of bureaucratic allocations which is presently under severe criticism and is still undergoing extensive reform because of its rigidity and irrationalities. To impair the supply of items which are crucial to the venture's success and profitability would obviously be undesirable, as would forcing ventures to purchase more expensive supplies from inefficient domestic suppliers. Also, integration into the state economic plan does not guarantee freedom from shortages of supplies.

Recently, Chinese officials have made greater efforts to distinguish the integration of a joint venture into the Chinese economy from what foreign investors may characterize as inroads into their managerial autonomy. Although the regulations articulate a policy of integration, they also stress the power of a joint venture to be free from bureaucratic influences on economic decison-making. A Chinese official recently commented on these issues in the following manner:

> In terms of self-governing power of management, Article 7 of the Regulation stipulates: "A joint venture has the right to operate on its own according to its own characteristics within the scope of the provisions of Chinese laws, decrees and pertinent regulations, and the joint venture. The departments concerned shall provide support and assistance." Article 6 says that "departments in charge are responsible for giving overall guidance and assistance and exercising supervision over the joint venture." It is therefore to be understood that the department in charge guides and not leads a joint venture. Joint ventures are not to be dealt with in the same way as state enterprises and no administrative interference is allowed."[21]

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[20] See, e.g., Jiang Zehong and Lin Shuzhong, "Chinese-Foreign Joint Ventures in Shanghai, the Purchasing of Raw Materials and the Marketing of Exports," unpublished paper written for conference on international investment law, Shanghai, November, 1984, p. 3: "if 'joint ventures' want to purchase raw materials, especially materials which are distributed according to plan, if they have not signed contracts with the relevant department or enterprise so that their requirements are incorporated with the supply plan, there is no guarantee that they will be able to purchase the required raw material." See also Satoshi Imai, "Joint Ventures in China and Related Problems", *China Newsletter*, No. 51, July-August 1984, pp. 15–19 at p. 19, quoting a representative of a Shanghai-based U.S. Chinese joint venture as saying "we can hardly get supplies of even one ton of steel sheeting if it is not included in the plan of our supplier".

[21] Hu Wenzhi, "The Legal Framework of Chinese-Foreign Joint Ventures," unpublished paper written for conference on international investment law, Shanghai, November 1984, p. 19, deny-

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The skeptical prospective investor may well wonder about the message of this passage. Clearly, the boundary between "guidance" and "leading" is a fine one which may easily become blurred, and has been blurred in the past in the PRC. Given the current struggle between the opposing forces of decentralization and centralization in the Chinese economy, this all-important issue will continue to confront foreign investors. Precisely how a joint venture can operate within the parameters of the state plan, yet maintain a degree of autonomy from the "guiding" state organs and planners, remains unclear. The message in the statement quoted above is benign, but many questions remain.

It may be that the problem of defining the relationship of the plan to the joint venture will abate, as policies of commercial reform, involving a loosening of centralized planning, are implemented. Reforms of the price system, however, which have long been discussed and have recently been initiated, are scheduled to be implemented only gradually.[22] The price of products of joint ventures must be established by consultation with price authorities, and problems may also arise in this area.

3. Valuation of Chinese land

China prohibits foreign ownership of land, which may either be rented or capitalized as part of the contribution to the venture by the Chinese partner. However, unlike other equity contributions, the value of which is determined jointly by the partners to the venture, Chinese legislat'on appears to give Chinese authorities the power to value land u..ilaterally.[23] In the absence of a real estate market in China, this seems to some foreigners to have created an opportunity to overvalue the land and overcharge the joint venture.

During the period immediately following the promulgation of the Joint Venture Law, complaints were heard about attempts to charge land use fees that seemed steep to foreigners who were aware of lower and often concessionary land use fees in other Asian jurisdictions, such as Taiwan, the Philippines, Malaysia and Sri Lanka. Since then, foreign protests have led to land valuations which appear to be more reasonable. Although Chinese officials have denied the existence of any unified national standard for land use fees, there have been persistent reports that in 1980 the State Council issued internally "Provisional Regulations on Land Use by Joint Ventures," which apparently sets maximum and minimum limitations on annual land use fees.[24]

Recently, Chinese sensitivity to foreign equity investors' concerns had led to further adjustment of land use fees. In addition, officials have been more open in discussing the variety of factors used by local governments in determining land use fees. Such factors in-

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ing that "the relationship of the superior and the subordinate" exists between joint venture enterprises and the agency with which it must file its plans.

[22] See, e.g., Jonathan Mirsky, "No urban free-for-all yet," *China Trade Report*, March 1985, p. 4.

[23] See, for example, Joint Venture Law, Article 5.

[24] See, "Text of Wei Yunming Speech to Investment Meeting," Hong Kong, *Wen Wei Po*, June 8, 1982, in FBIS, June 10, 1982, pp. W3-W6; *cf.* Chu Baotai, supra note 2, pp. 99-101, 117; King La, "China Laws and Regulations on Use of Foreign Capital and External Economic Affairs," speech at a seminar convened by the National Council for US-China Trade, June 1, 1981.

clude the nature of the joint venture's activity (commercial/industrial or agricultural) and its location (urban or rural). Hopefully, the trend toward more frank discussion of the land valuation process will continue.

4. Relevant approvals

Foreign investors have often encountered difficulty in ascertaining which Chinese agencies must review and approve contracts for the establishment of joint ventures. Of paramount importance is MFERT, which must approve all joint venture contracts which involve investment of over a certain amount.[25] In addition to MFERT, government agencies such as the State Administration of Industry and Commerce, State Administration of Exchange Control, the Ministry of Finance (which handles tax issues) and the Customs Administration also play major roles in the life of a joint venture.

Although MFERT has a crucial role in approving the joint venture contract, MFERT is usually on the same governmental level as the other above-mentioned agencies and ministries. For this reason, MFERT is likely to resist attempts by foreign investors to insert into the contract language that appears to resolve issues which are within the jurisdiction of Chinese agencies that are not subordinate to MFERT itself. This problem commonly arises with respect to tax exemptions, some of which can be granted only by the Ministry of Finance, while others can be granted by the Tax Bureaus at lower (i.e., provincial or municipal) levels.

The Finance Ministry's policy is not to grant a tax exemption until the joint venture has been established and applies for such an exemption. As a result, the contract and MFERT's formal approval of it do not establish the joint venture's right to a tax exemption, even though by the time MFERT approval is given it would have already consulted the Ministry of Finance on the matter and received an indication that such an exemption would be granted.

Foreign investors are obviously uneasy about the prospects of having to apply for certain benefits crucial to the viability of the venture *after* the signing of the joint venture contract, as opposed to being assured that such benefits have already been approved. One method of dealing with this lack of certainty is to condition the obligation of the foreign investor to contribute capital on the receipt of official approval of the desired treatment or benefits.

5. Wages, unions and labor discipline [26]

(a) Wages of Chinese workers

One aspect of China's [26] economy that has attracted foreign investment is the nation's low cost of labor. Experience in joint venture negotiations and in implementing those agreements which have been signed has often disappointed the expectations of foreigners about inexpensive Chinese labor. In practice, labor costs for

[25] At lower levels, where local governments such as provinces or municipalities may approve smaller investment transactions, the problems discussed below also exist, even though this discussion focuses on MFERT at the national level.

[26] On this subject generally, see Jamie P. Horsley, "Chinese Labor," *China Business Review*, Vol. XI, No. 3, 1984, pp. 16–25.

joint ventures in China are significantly higher than for comparable Chinese state enterprises, not to mention comparable investments in other Asian countries.

While the Regulations on Labor Management in Joint Ventures Using Chinese and Foreign Investment (hereafter "Joint Venture Labor Regulations") apparently give the board of directors the authority to decide the framework for labor compensation,[27] this seemingly broad power is restricted by Article 8, which states:

> The wage levels of the staff and workers of joint ventures shall be fixed at 120 to 150% of the real wages of the staff and workers of state enterprises in the locality in the same line of business.[28]

A further problem arises from the interpretation of the "real wages" mentioned in Article 8. Are they the basic cash wages received directly by the worker, or the basic wage *plus* costs for labor insurance, medical expenses, housing costs, and various other subsidies normally contributed by state enterprises? The difference in definitions involves a significant difference in costs, since the various subsidies provided by state enterprises usually amount to at least 100% of the basic wages. In informal discussion with knowledgeable Chinese officials, some investors have been advised to assume that such subsidies should be calculated at approximately 130% of such wages. However, if the venture must pay 120–150% of the combined basic wage and all the subsidies, the venture's wage bill may reach a sum more than three times the average worker's take-home pay. There has not yet been any official clarification of this issue, and practice has not been uniform. Foreign investors must therefore press the Chinese negotiators into breaking down their wage proposal into its component parts so that they can identify the subsidies which are included.

Although the meaning of "real wage" is not entirely clear, it does seem fairly certain that the term does *not* include bonuses and collective welfare costs, such as costs for clinics and nurseries. These are required by the Joint Venture Labor Regulations to be paid separately from a special fund to be established out of after-tax profits.[29]

The issue is further complicated by the lack of uniformity in practice. The city of Shanghai promulgated regulations in November 1984 which provide that "the level of real wage (including basic wage, subsidy and bonus) . . . shall be . . . at least 120% of the real wage level of the workers and staff members of state-owned enterprises of the same trade in Shanghai. . . . "[30] The regulation further provides that to this basic wage shall be added a monthly percentage of 30% of the real wage for "premiums" for old-age pensions for each worker, and 30 RMB monthly per worker for housing subsidies. Whether other subsidies must be included in calculating the "real wage" and, if so, how the result would compare with such calculation elsewhere in China are issues which remain

[27] Regulations on Labour Management in Joint Ventures Using Chinese and Foreign Investment (Approved by State Council on July 26, 1980), Article 9.
[28] *Ibid*, Article 8.
[29] *Ibid*, Article 10.
[30] "Regulations of Shanghai for the Implementation of Labor Management in Joint Ventures Using Chinese and Foreign Investments (for Trial Implementation)," *China Economic News*, November 19, 1984, pp. 2–3.

unclear. The Shanghai regulations appear to fix a lower wage level than that which has been established in practice elsewhere in China other than in the Special Economic Zones. If Shanghai is free to set a lower wage level than that which pertains in practice elsewhere in China, the question arises of whether other cities and provinces will attempt to do the same, and engage in competition to attract foreign investors.

(b) Wages of Chinese officers and managers

Among other wage-related issues are the wages of Chinese officers and high-level managers. The Chinese usually ask for wages which approach the level of wages received by the foreign officers and managers at the venture. The laws and regulations are silent on this issue, the resolution of which must be bargained for in the negotiations. Wage increases must also be the subject of negotiations. Although the Joint Venture Labor Regulations are silent on the issue, recently issued implementing provisions for the Regulations provide that the Board of Directors has the power to decide wage increases. Regulations on the Special Economic Zones require a 5–15% annual increase in wages. Outside the zones, the Chinese often ask for increases of up to 15%.[31] In view of impending nation-wide wage increases in the context of large-scale price reform, pressure to include clauses on wage escalation may increase.

(c) Labor discipline

Although, as noted above, the joint venture's Board of Directors possesses the legal authority to determine labor policy, joint ventures are required to permit the organization of trade unions, which have the power to express their views on all labor-related issues, such as hiring and firing of workers, bonuses, and wage adjustments. Under Article 98 of the Joint Venture Regulations, the union has the right to send non-voting representatives to board meetings in order to represent employee opinions and demands. If the union refuses to accept a board decision on a labor matter, Article 14 of the Joint Venture Labor Regulations gives it the right to submit the dispute to arbitration before the local labor bureau and ultimately to the local people's court.

Finally, it is important to note that labor discipline is of concern not only to the foreign investor but to the Chinese as well. In an effort to eradicate the "iron ricebowl" mentality, China has emphasized worker responsibility and discipline. Workers can theoretically be dismissed if their performance is substandard. Article 5 of the Joint Venture Labor Regulations allows joint ventures, in accordance with the seriousness of the case, to impose sanctions on employees who violate labor regulations and "thereby cause bad consequences." Possible sanctions are "education through criticism," fines, and dismissal.[32] Any decision to discharge an employee must be reported to the department in charge of the joint venture and the local labor management department for approval and in practice dismissal of workers is rare. Nevertheless, there have been re-

[31] J. Horsley, supra, note 26, at p. 19.
[32] *Cf.*, Joint Venture Regulations, Article 10.

ported cases in which unsatisfactory workers were dismissed.[33] If and to the extent job mobility and worker responsibility at China's domestic enterprises increase, these problems should shrink in significance.

B. PROBLEMS IN CONTRACT IMPLEMENTATION

This section would no doubt be longer in a discussion of equity joint ventures in China written five years from now, because a body of experience is sure to grow and provide instruction to prospective investors. Presently, information is scarce on the problems which have been encountered in the course of implementing contracts to establish joint ventures. The number of equity joint ventures is still small, and the contracts to create most of them have been signed only within the last few years. Moreover, even when problems have already appeared, foreign and Chinese partners alike are reluctant to discuss their difficulties.

However, it is already possible to identify some problems that have already arisen. They are discussed only generally here, on the basis of impressionistic evidence, chiefly conversations with foreigners and Chinese who do not wish to be quoted.

Perhaps the most common general problems originate in differences between the expectations of the two sides. Illustratively, in one joint venture the Chinese expressed impatience at the slowness of with which advanced technology was transferred; the foreign partner found that the Chinese side consistently underestimated the complexity of introducing advanced designs into a Chinese factory to replace older Chinese products.

Differences in managerial style are another and inevitable problem that has arisen. It is not uncommon, for instance, to hear foreign managers and Chinese alike to say, "at the beginning we were unfamiliar with their logic." [34] Chinese expectations about the degree of concern which managers must have over mundane, even trivial aspects of operations may be considerably higher than those of their foreign counterparts,[35] which foreign expectations regarding quality control and performance standards are often higher than those on the Chinese side.[36]

In the largest Sino-American joint venture, the Great Wall Hotel in Beijing, the problems mentioned above occurred together, according to a report on the difficulties that led to the signing of an agreement in March, 1985, under which the management of the hotel was taken over by the Sheraton Hotel chain.[37] The Chinese partner, China International Travel Service, reportedly wanted to manage the hotel directly, while the American partner wanted it managed by a major hotel chain. The parties first compromised on a Chinese-American manager, but when he left after a year and

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[33] See, J. Horsley, supra note 24, at pp. 24-25, for a discussion of several reported instances of worker dismissals.

[34] "China Pursues the Promise of Oil Riches," ' ASWJ, February 6, 1985.

[35] *Ibid;* see also "Shanghai Snags Are Worrying Foreign Firms," March 12, 1985.

[36] "Shanghai Snags are Worrying Foreign Firms", supra note 36. An interesting account of the quality problems encountered by one U.S. firm, which, though not in the context of a joint venture, tried to make a major commitment to sourcing its products in China is "Running Into Trouble", *China Trade Report,* October 1984, p. 6.

[37] The discussion of the problems of the Great Wall Hotel in this paragraph is based on a "A New Team Checks In at the Great Wall Hotel", *New York Times,* March 24, 1985, p. F13.

the hotel's financial condition required a renegotiation of repayment of the loan which had raised the funds for the construction of the hotel, a management contract was signed with Sheraton. One of the issues in the operation of the venture is the extent to which expatriate personnel will be used to manage it:

> The Chinese have mandated that expatriates should be withdrawn as quickly as possible, and . . . Sheraton hopes to have the hotel run entirely by local people in three to five years." [38]

It might be noted that the Great Wall Hotel was one of the first large joint ventures established. Since then, Chinese and foreigners involved in negotiating investment contracts have learned more about the expectations on each side. With regard to the alleged reluctance of the Chinese partner in that venture to have foreigners involved in its management for more than a relatively brief period of time, while not uncommon; it is not invariable, and other Chinese partners are often more flexible.

Difficulties in carrying out contracts to establish joint ventures may arise from a variety of other causes, of course. Most notable are disagreements caused by differences between Chinese and foreign views and non-contractual obligations, and delays or inefficiencies resulting from limitations of authority within the Chinese bureaucratic system. Basic differences in professional standards and relative social and economic values may also contribute to difficulties in contract implementation. All of these problems between Chinese and foreign counterparts are quite distinct from alleged failure to observe contract provisions.

The discussion which follows notes examples of problems which have been classified into three separate categories. Although the categories are themselves artificial, they have been used here tentatively to identify and distinguish among different causes of difficulty. Illustrated below are difficulties caused by different perceptions of the obligations created by the contract, by characteristics of the Chinese bureaucracy, and by differences in cultural values.[39]

A common procedural issue for American counterparts is how to respond to Chinese requests for special services not specified in the contract at no additional fee. From the Chinese perspective, successful conclusion of a contract with a foreign company may be accompanied by the expectation of special services or beneficial terms in future contracts. This attitude is sometime fostered by the American investor's eagerness to establish a business relationship in China and his generosity in initial contract provisions. The ability to respond to special requests from Chinese counterparts is often complicated by insufficient information on the part of the American project manager about unwritten commitments which may have been made by contract negotiators.

A second major difficulty arises from limitations engendered by the Chinese bureaucracy on the ability of the Chinese counterpart to meet contract responsibilities.[40] Joint venture enterprises may

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[38] *Ibid.* Not discussed here is the need to provide in the contract for an adequate presence in the joint venture of personnel chosen by the foreign partner.

[39] See generally, Genevieve Dean, "After the Contract is Signed: The Experience of U.S. Companies in Shanghai," January 24, 1984, American Consulate General Shanghai, cable.

[40] For a discussion of this problem see Ruben Kraiem, "The All-Too-Easy Path to Misunderstanding in China," AWSJ, October 10, 1984, p. 10.

be unable to obtain required materials although the Chinese side may have assured the foreign partner of their availability when they signed their contract to establish the joint venture. Such problems may result from the fact that the contract negotiation was handled by one bureaucratic "system" or hierarchy—such as import/export corporations under the Ministry of Foreign Trade—while many aspects of implementation are the responsibility of Chinese organizations which are part of a different bureaucratic hierarchy. As already observed, commitments made by one bureaucratic "system" cannot necessarily be successfully fulfilled by another. Further, the focus of authority in a specific situation is often unclear, because responsibility may be shared or delegated in ways that are not explained to the foreign counterpart.

It should be noted also that as economic reforms are carried out, the ability of the Chinese counterpart which has signed the agreement to establish a joint venture to fulfill its obligations may be impaired. Chinese agencies may have encouraged foreigners to have certain expectations about availability and prices of raw materials, only to find that economic reforms had changed the situation.[41]

The personal living arrangements of company representatives may also become an important area of conflict with the Chinese counterpart. Dissatisfaction most commonly focuses on visa status, living accommodations and customs exemptions, issues which the company should attempt to clarify in contract provisions, but which are often overlooked. In short, implementation may differ markedly from negotiators' expectations. To minimize these problems, it is necessary to develop appropriate contract clauses, which, like many other things in China, is often easier said than done.

C. DISPUTE SETTLEMENT

Making provision for the settlement of disputes has been a subject that has probably received far more attention than it deserves; from the optimism-tinted perspectives of the present the number of disputes likely to be arbitrated or adjudicated seems small. Perhaps there has been so much discussion of this topic because in no area of legal and practical concern has there been a wider difference between the attitudes of foreigners and Chinese.

Until recently the China trade was conducted in a legal vacuum, in which conventional transactions for the purchase or sale of commodities were dealt with by means of more or less standard form contracts. In such an atmosphere, little attention was paid to the choice of a forum in which a dispute might be settled or to the law that might be applied. Moreover, the traditional Chinese preference for negotiating a compromise solution to any problems that might arise during implementation was not as alien to foreigners as is commonly supposed, especially to dealers in commodities.

However, the growing complexity of the transactions for trade and investment that have become possible within the last five years has provoked Chinese and foreigners alike to direct their attention to these matters. The Joint Venture Regulations provide

[41] "Shanghai Snags are Worrying Foreign Firms," ASWJ, March 12, 1985.

that "the formation of a joint venture contract, its validity, interpretation, execution and the settlement of disputes under it shall be governed by Chinese law." [42] Recently promulgated legislation on contracts between foreigners and Chinese parties makes specific provision for the applicability of Chinese law to disputes arising out of such contracts.[43]

The Joint Venture Law permits the parties to choose arbitration outside China.[44] At the same time, Chinese legal specialists have stressed the desirability of conciliation in international dispute settlement,[45] there has also been a definite increase, if the impressionistic conclusions of this author are valid, in Chinese emphasis on the desirability of arbitrating in China if at all. Problems remain, however, because of the difficulty of ascertaining the content of the law which might be applied in an arbitration in which the PRC was the governing law.

If a dispute arises, the parties and the institutions which attempt to settle it should be able to refer to a well-developed and readily ascertainable body of codified rules. In common law and civil law countries alike, the rules are supplemented by the interpretations of courts and legal scholars. In China today the rules are not extensive, practice is diffuse, variations in practice are common, and the workings of the system may not readily be ascertainable by the foreigner. Both sides could regret a failure to designate clearly, in the contract itself, a developed body of substantive law to govern their relationships and the resolution of disputes growing out of them.

There remains some possibility of providing in the joint venture contract that arbitrators must refer first to Chinese law and, if they find it insufficient, to the law of another nation or to general principles of international law. In this connection, there is some lack of clarity. The Foreign Economic Contract Law provides that contracts for joint ventures, including contractual joint ventures, must be subject to Chinese law. The Foreign Economic Contract Law is consistent, but also states that if Chinese law has "not been stipulated," "international practice" may be used. "Stipulation" may mean that as long as a statute or regulation has been promulgated on a particular subject, the application of foreign laws has been preempted. An alternative view would allow the arbitrators to

[42] Article 15.

[43] Foreign Economic Contract Law of the PRC, Art. 5, and *Business China*, March 28, 1985, p. 44, *People's Daily*, March 22, 1985, p. 2; Regulations on Contracts Involving Foreigners in the Shenzhen Special Economic Zones (promulgated February 7, 1984), Article 35.

[44] Although Chinese negotiators have shown increasing willingness to agree to third-country arbitration clauses, particularly ones which designate Stockholm as the place of arbitration, and the Institute of Arbitration of the Stockholm Chamber of Commerce as the forum, they continue to resist agreeing on the law which the arbitrators may apply. See, e.g., "Australia and China Agree on Talks on Trade Arbitration Procedure," *Financial Times*, July 9, 1984, p. 4. Since in many cases, according to the procedural rules of the Arbitration Institute, this may result in the application of Chinese law, the Stockholm arbitration clause in the form in which Chinese negotiators usually prefer it does not offer much comfort to the foreigner. See, Hjerner, "Choice of Law Problems in Intentional Arbitration with Particular Reference to Arbitration in Sweden," *Yearbook of the Arbitration Institute of the Stockholm Chamber of Commerce*, 1982, p. 22. Since it is standard practice for Chinese negotiators to insist that the contracts for joint ventures state that they are to be governed by Chinese law, there seems to be little leeway for the foreigner.

[45] See, e.g., Shao Xunyi, "Conciliation is a Good Method for Settling International Economic and Trade Disputes—An Introduction to China's Practice of Conciliation," paper presented to the 7th International Arbitration Congress, Hamburg, West Germany, June 7-11, 1982; *cf.*, Tang Hongzhi, "Arbitration—A Method Used by China to Settle Foreign Trade and Economic Disputes," *Pace Law Review*, Vol. 4, No. 3, 1984, pp. 519-536.

apply international practice if promulgated Chinese rules fail to provide a clear answer to a particular issue.

Of importance is the commonly expressed Chinese views that equity joint ventures are partnerships,[46] and that if the partners cannot agree on all important issues which may arise the venture will not work. That is why the percentage of ownership which the foreigner may have in the joint venture may not be critical; in a system in which all "important questions," in the language of the Joint Venture Law, must be settled unanimously,[47] the difference between majority and minority ownership does not seem to be very important so far as control—and dispute settlement—are concerned.

At a time when Chinese legal institutions are undergoing remarkable growth and evolution and China's international economic activity is increasing rapidly, it is not surprising that China's lawmakers should want Chinese law to apply to economic activity involving foreigners within China. The considerable gaps in Chinese law, however, suggest that the application of third-country law to disputes should not be regarded as an infringement of Chinese sovereignty, but a symbol of the PRC's membership in the international economic community of nations. The leaders of the PRC, have viewed the situation—and the symbols—in this manner, except as to investment disputes, in which Chinese law is basically applicable. As noted above, however, some hospitality has been shown to the application of "international practice" even in investment disputes.[48]

D. THE 14 COASTAL CITIES AND THE SPECIAL ECONOMIC ZONES

Special attention is compelled by the emerging Chinese policy of choosing certain coastal areas as places where foreign investment should be specially encouraged. In 1979, the State Council created four Special Economic Zones ("SEZ's"), three in Guangdong Province and one in Fujian. In 1984, 14 coastal cities were declared open to foreign investment, and special incentives were created to make them attractive to foreign investment. Statements by Chinese leaders have suggested that other coastal areas in addition to the 14 cities may also receive special treatment for the same purposes.

The principal incentives offered are related to taxation: A 15% tax rate on equity joint ventures will apply to projects in which factories are being upgraded by foreign investment as well as to any projects located in Economic and Technical Development Zones which are to be established in each of the 14 cities. In addition, certain tax exemptions are available and the 10% tax on remittances of profits earned by foreign partners in joint ventures will not apply in these areas. Somewhat different tax incentives are offered in "Original Urban Districts" in the 14 cities.

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[46] See, e.g., Zhao, supra, note 1.

[47] Article 6. The law does not by its terms require unanimity, but states that such questions must be settled "through consultation". The effort is to give each party a veto, regardless of the percentage of its equity interest.

[48] The Foreign Economic Contract Law allows the parties to choose the governing law in contracts other than for joint ventures which are performed in the PRC for contracts for the exploitation of Chinese natural resources.

Other incentives also include increased local authority to approve projects without the necessity to obtain approval from Beijing. The cities of Shanghai and Tianjin will have authority to approve projects costing less than $30 million, while the threshold for Guangzhou and Dalian is $10 million and for the other cities is $5 million.

Until new legislation is developed, laws and regulations governing the SEZ's are also applicable to the 14 coastal cities.[49] The rush to open new areas for foreign investment, the need to develop appropriate legislation, and continuing questions caused by decentralization of authority have stimulated competition among the SEZ's and the coastal cities for foreign investors. In the scramble for foreign funds and technology, the "open" cities and zones are trying to develop preferential treatment packages in regard to taxes, land use fees, wages, customs duties, and access to the domestic market.[50] At the same time, inland provinces are also hastening to extend investment incentives to foreigners.[51]

It is too early to predict the fate of the experiment in the 14 coastal cities. The four SEZ's have had a mixed record: They have not attracted the high-technology investment that was sought for them, and the great majority of enterprises located in the zones are small assembly and simple manufacturing operations. Although the figures for the amount of foreign investment in the SEZ's often quoted in Chinese sources are high, they apparently include pledged as well as actual investment. The developing legal framework for foreign investment in the SEZ's has not resolved problems arising from bureaucratic complexity, from differing labor management practices, and from ambiguities regarding protection of imported technology. The SEZ's are still not fully competitive with investment alternatives elsewhere in Asia.

IV. Conclusion

A. LAW AND THE CHINESE INVESTMENT ENVIRONMENT

The difficulties discussed here are significant enough by themselves, but they also symbolize deeper problems. Some have argued that because the present uncertainties are inevitable and China is necessarily in a period of transition, foreign investors must simply make a leap of faith:

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[49] For the text of one of the eight sets of implementing rules and regulations for the Shenzhen SEZ, the Rules of Economic Contracts with Foreign Elements, promulgated on February 7, 1984, see *China Economic News*, October 15, 1984, pp. 1-5. Considerable description of the coastal cities and special economic zones may be found in *The China Business Review*, Vol. 11, No. 6, November-December, 1984, pp. 14–40.

[50] See, e.g., "More Preferential Treatment for Foreign Enterprises in Xiamen Special Economic Zone," *China Market*, December 1984, pp. 50-51; Timothy A. Gelatt, "Interim Provisions Sharpen EDZ's Competitive Edge," *East Asian Executive Reports*, December, 1984, pp. 9-10; Zheng Baoming, "Shanghai's New Inducements to Foreign Investors," *China Daily*, February 16, 1985, p. 2.

[51] See, e.g., "Sichuan's Governor on Investment Incentives," *China Economic News*, March 4, 1985, pp. 1-2.

By mid-1985, public statements by Chinese leaders reflected a decline in their enthusiasm for emphasizing all 14 cities at once. See, e.g., "The Not-so-open Cities", *China Trade Report*, Vol. XXIII, December 1985, p. 1.

Really, rather than the laws, what is now necessary are foreign companies willing to overlook minor gaps in the legal framework and go ahead boldly, based on friendship, economic cooperation and a long-term prospect.[52]

Another observer, writing more recently than the one quoted above, has argued that the promulgation of implementing regulations for equity joint ventures and tax, foreign exchange, labor and patent legislation has "done much to fill in the basic framework for such investments".[53] Such legislation has indeed eased somewhat the task of negotiating equity joint ventures in China, but neither the new rules nor their application in practice have dispelled many difficulties which are likely to continue to characterize the PRC's investment environment.

Decentralization and reform of the foreign trade system have encouraged Chinese organizations with little experience to enter into new business relationships with foreigners. As a result, problems arising from differing business practices, perceptions and expectations, which have troubled joint ventures to date, are likely to be aggravated. Decentralization also compounds existing difficulties in identifying appropriate partners and ensuring that all aspects of the transaction are properly authorized.[54] Concurrently, continuing central government control over foreign exchange insures that the foreign investor must still gain the approval of various bureaucratic departments.

The present uncertainties are more than transitional. A recent discussion states,

* * * given a traditional antipathy towards written law, reinforced by the fact that foreign consumers are still willing to come to China without many legal assurances, the vague language [of much recent Chinese legislation on many aspects of foreign investment] serves Chinese purposes well. "They can now say they have laws without worrying too much about their binding effect," said one Western lawyer.

One American businessman who has participated in numerous negotiations reckons the laws have helped to reduce the negotiating period * * * However, he cautioned: "Even now the laws are not rights but privileges that must still be bargained for."[55]

Consistent with the hard-bitten view quoted immediately above are the observations of several scholars of the Chinese economy, who, after reviewing the relationship between Chinese foreign trade policy and domestic economic reform, have concluded that Chinese policy has failed to give foreign investors clear and unambiguous encouragement. They conclude that the standard corporate income tax rate not only fails to provide "strong incentives", that the nominal rates have to be read with the "arbitrary character of official price formation practices and * * * pervasive cost-price irrationalities", and that the provisions for tax exemptions and reductions do not give adequate guidance to the prospective investor. Their general assessment of the attractiveness of equity investment should be pondered by prospective investors:

The upshot is to leave potential investors with the impression that the standard tax rates contain large margins within which the Chinese can discriminate from

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[52] Masao Sakurai, "Investing in China: The Legal Framework," *China Newsletter*, No. 37, March-April, 1982, pp. 7-10 at 10.

[53] Cohen, "A Legal Opinion," *China Trade Report*, October, 1984, p. 13.

[54] Langston, "Laying Down the Law," FEER, January 24, 1985, p. 64.

[55] *Ibid.*, at p. 65.

case to case. The individualized approach is indeed characteristic of Chinese trade practices, and has long been a source of confusion and complaint.[56]

This view was expressed about equity joint ventures generally, without reference to the 14 coastal cities. Policies with respect to those cities have been described by the same authors as "an even more drastic attempt to encourage foreign investors." [57]

In the face of confusing and rapidly changing developments, how should the prospective investor regard his possibilities in China? May he hope that his expectations may be made more certain by the new legal institutions? Through promulgation of new laws and the evolution of a body of interpretation and practice which increasingly gives them life and reality, a framework is evolving to provide guidance to foreigners and their Chinese counterparts alike in establishing joint ventures and implementing the contracts for such projects.

However, the new legal framework is increasingly complex, practice is neither uniform nor easy to ascertain. Not enough time has elapsed to permit the growth of doctrine and the authoritativeness of the new laws. Of fundamental importance is that the habits of thought which officials must have in order to give support and strength to regularity and legality are likely to take a long time to appear. Some Chinese laws and regulations remain secret, for "internal use only", so that promulgated Chinese law is the tip of an iceberg whose true contours remain unknown and unmappable. We have not yet seen the appearance of a legal *system*. Many issues crucial in the creation of a joint venture are matters settled by hard negotiating to which the law may be quite irrelevant. And, as discussed above, policies may change; at the same time, the bureaucracy may not change enough.

B. SUGGESTED APPROACHES TO INVESTMENT IN THE PRC

It is possible without being cynical to avoid a leap of faith and to avoid suspending judgment. Each prospective opportunity must be assessed on its own merits. Even before approaching the specific legal issues, prospective investors must try to understand their prospective partners and the lines of bureaucratic authority in which they are involved, as well as the expectations on both sides, such as how the burden of infrastructural costs will be borne by the parties.

Initial investigations and discussions must be pursued in an effort to ascertain the existence of technical and business complementarities of interest. If such explorations ripen into genuine commercial discussions, an appropriate course suggests itself for investors: Vague letters of intent, protocols and other preliminary understandings which Chinese negotiators so often want to obtain to show their superiors should be avoided, and investors should try instead to define the relationship among all of the essential parties in the contemplated transaction, including suppliers and purchasers of the products of the proposed joint venture. The feasibility

[56] Y.Y. Kueh and Christopher Howe, "China's International Trade: Policy and Organizational Change and their Place in the 'Economic Readjustment,' " *China Quarterly*, December 1984, p. 836.

[57] *Ibid.*, at p. 837.

study required by Chinese law is a key document, and the investor must take care to assure that it contains the results of rigorous examination rather than the wishes and dreams of both sides.

Ultimately, the investor must place heavy emphasis on the contract as the principal instrument which will define the relationships between the parties and between their venture and third parties. Even though Chinese preferences for simplicity and avoidance of precise clauses on legal issues continue to linger, a new tendency is evident in the growing emphasis on the need for Chinese parties to be represented by Chinese lawyers in negotiations on equity joint ventures. At the same time, Chinese negotiators seem increasingly more understanding of Western attempts to draft contracts which adequately address problems which the parties can contemplate at the time of their negotiations.

None of the foregoing is intended to discourage investors, as long as they are willing to be questioning and tough-minded. The efforts made by the current Chinese leadership to put into place a legal framework for foreign economic activity are impressive. At the same time, the influences that may inhibit development of a legal system are many and powerful. Investors should welcome the appearance of the new institutions but must still draft contracts which as much as possible create the rules by which they and their Chinese partners will live together in their investments. Careful drafting of the agreement can help protect the parties against continuing inadequacies of the legal system and against the strong influences in Chinese society which inhibit the growth of legal regularity.

SINO-JAPANESE ECONOMIC RELATIONS

By Dick K. Nanto and Hong Nack Kim*

CONTENTS

I. Introduction and Summary

The Sino-Japanese Treaty of Peace and Friendship signed in 1978 has ushered in a new era of diplomatic and economic relations between the two major powers in East Asia. Japan is currently China's largest trading partner, major provider of financial and technical assistance, the source of much of the sophisticated plant and equipment needed to modernize the Chinese economy, and a market for Chinese energy and labor-intensive exports.

The warming of relations between the two countries can be attributed to Japan's willingness to provide additional economic assistance to China, the continuing impasse in Sino-Soviet relations, and the noticeable improvement in Sino-American relations.

Japanese financial assistance to China includes 300 billion in yen (approximately $1.5 billion) credits extended between 1979 and 1983 at favorable interest rates and a 470 billion (approximately $2.1 billion) package of development loans promised over the 1984–90 period. The Japan Export-Import Bank also has provided over $2 billion in export financing.

Merchandise trade between the two countries has risen to a total of $10 billion in 1983 with $4.9 billion in Japanese exports to China

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and $5.1 billion in Chinese exports to Japan. While the bilateral trade balance favored Japan during the late 1960s and 1970s, it has swung in favor of China in the early 1980s. Since Chinese trade is still highly controlled, the message China seems to be sending to Japan is that if it wishes to sell to China, it must also buy from that country.

The Japanese Government has supported its exporters by providing loans and technical assistance for projects threatened by cancellations and by creating a favorable political climate in which to operate. Japan has also been willing to coordinate all aspects of a market. It not only sells products to China, but it assists in developing the Chinese exports needed to generate the foreign exchange needed to import those products.

Japan's role in China's moderization has been to provide technology, particularly in the form of whole new plants and equipment and in renovating existing plants; to provide technical assistance for key industries; to provide development assistance, loans, and direct investment; and to provide training and education.

II. Political Relations

As Japanese Prime Minister Nakasone Yasuhiro's colorful visit to China in March 1984 so clearly indicated, a significant change has been taking place in Sino-Japanese relations since the signing of the Sino-Japanese Treaty of Peace and Friendship in 1978. Nakasone was given an unprecedented 19-gun salute: the first Japanese Prime Minister to receive such a greeting in Beijing. This warm reception Beijing accorded to Nakasone underscored the growing ties between the two countries. Establishing a solid legal foundation for Sino-Japanese reconciliation, the treaty ushered in a new era of diplomatic relations between the two East Asian neighbors.

To the Chinese, the treaty clearly represented a victory over the Soviet Union in their race to court industrially developed Japan. Beijing was particularly gratified, for it was the first major treaty they had concluded containing an "anti-hegemony" clause.[1]

In the wake of the peace treaty, there were clear indications that Sino-Japanese relations were improving. For example, Japan and China agreed that beginning in 1980 they would hold regular ministerial meetings to discuss problems of common interest.

In addition, visits between the leaders of the two countries became more frequent. Deng Xiaoping's trips to Japan in October 1978 and February 1979 were followed by Prime Minister Ohira Masayoshi's visit to Beijing in December 1979 and by Prime Minister Suzuki Zenko in September 1982. Following these leaders' footsteps were visits by Chinese party leader, Hu Yaobang, in November 1983 and Prime Minister Nakasone Yasuhiro in March 1984. By these means, the officials of both countries have exchanged views on questions of mutual interest and concern.

Following the peace treaty, Beijing's concern with enlisting the support of Japan and the United States in coping with the Soviet threat led to a softening of China's attitude toward the U.S.-Japan

[1] Reported in the Tokyo newspaper, Asahi Shimbun, August 13, 1978.

security treaty as well as toward Japan's Self-Defense Forces. Chinese leaders not only expressed their support for the continuation of the U.S.-Japan treaty, but also endorsed Japan's right to strengthen its self-defense capability.[2] Beijing's decision not to renew the Sino-Soviet alliance pact (containing an "anti-Japan" clause) after 1980 was another welcome development for Japan. In addition, the full-fledged normalization of Sino-American diplomatic relations effective January 1, 1979, removed lingering uneasiness on the part of Japan in cultivating close ties with China.

By 1980, China and Japan had come to share a common apprehension about the growing Soviet military buildup in Asia. Both Beijing and Tokyo condemned not only the Soviet invasion of Afghanistan in 1979–1980, but also the Vietnamese occupation of Cambodia in 1979.[3] The growing congruence of political interests between Beijing and Tokyo was also evident in dealing with the problem of peace and security in Korea. For example, at their meetings in December 1979 and May 1980, Chinese Premier Hua Guofeng assured Prime Minister Ohira that North Korea would not invade the South. Similar assurances were subsequently given to the Japanese by Hua's successors.[4]

Despite this substantial improvement in Sino-Japanese political, economic and cultural relations, Tokyo-Beijing relations have not been devoid of problems. Rather, they have had their fair share of difficulties, including the 1981 dispute over the Chinese cancellation of contracts with Japanese companies and the 1982 controversy over Japanese textbook revisions that downplayed the severity of the Japanese invasion of China. These problems, however, were resolved through compromises worked out by officials of the two countries, as it became clear to the two countries that they had more to gain by cooperating with each other than by prolonging the disputes.

By the spring of 1983, it was apparent that the Japanese government was pursuing a policy of close cooperation with China, for "keeping China on the side of the Western powers would serve common interests of the West as a whole." [5] Japan did not want to seek the reemergence of a Sino-Soviet bloc which could threaten its security. Furthermore, Japan continued to share a common strategic interest with China in containing Soviet power and influence in East Asia. As long as Japan and China perceived the Soviet Union as posing the greatest potential threat to their security, it was natural for them to cooperate on common security interests.[6]

At the fourth Sino-Japanese Ministerial Conference held in Beijing in September 1983, Chinese Foreign Minister Wu Xueqian stated that there was no disagreement on Japan's defense policy

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[2] See, example, Deng Xiaoping's statement on the subject in Asahi Shimbun, October 24, 1978.

[3] For Japan's position on the Soviet invasion of Afghanistan, see Asahi Nenkan 1981. Tokyo, Asahi Shimbunsha, 1981. p. 212. For Japan's reactions to the Vietnamese occupation of Cambodia, see Seichiro Takagi. Tai Nichi Kankei, Chugoku Soran 1982 nen. Tokyo, Kazankai, 1982. p. 138–139. See also, Asahi Shimbun, March 24, 1984.

[4] For Premier Zhao Ziyang's statement on the subject, see Asahi Shimbun, June 1, 1982. For Ho Yaobang's assurance, see Asahi Shimbun, November 25, 1983.

[5] Asahi Shimbun, March 20, 1983.

[6] Jenkins, David. Close to Confrontation. Far Eastern Economic Review, December 15, 1983, pp. 28–29. See also, Wolf Mendl. Japan and Its Giant Neighbors. World Today, June 1983, p. 213–214.

between Tokyo and Beijing. This indicated that China was no longer critical of the Nakasone Government's defense policy.[7]

During Chinese party leader Hu Yaobang's visit to Japan in November 1983, Nakasone endeavored to allay further any Chinese apprehension about the possibility of a revival of Japanese militarism. He reaffirmed Japan's intent to adhere to its Constitution and to a military policy designed strictly for defensive purposes. Hu responded by saying that China's trust in Japan was so deep that it was confident that Japan would never invade China, even if Japan's defense capability were expanded. Nakasone and Hu agreed to solve any bilateral disputes between Japan and China strictly through peaceful means. To ensure the development of friendly relations between the two countries, they also agreed to establish a "Sino-Japanese Friendship Committee for the 21st Century." [8]

The mellowing of Beijing's attitude toward Japan can be attributed to a number of factors. First was Japan's willingness to provide additional economic assistance to China. Second was the continuing impasse in Sino-Soviet negotiations for the normalization of their bilateral relations. And third was a noticeable improvement in Sino-American relations, particularly after U.S. Secretary of Commerce Malcolm Baldrige's visit to China in 1983.

Current conditions indicate that harmonious relations between Tokyo and Beijing should continue. A breakthrough in Soviet-Japanese relations in the near future seems remote. Furthermore, tensions between Moscow and Beijing will probably persist despite their mutually professed desire to seek improvement in the relationship. Insofar as the foreseeable future is concerned, therefore, China can be expected to maintain close ties with Japan.

III. Financial and Developmental Assistance

The signing of the Sino-Japanese Trade Agreement in 1978 indicated that Beijing was eager to expand its trade with Japan in its quest for the advanced technology and industry hardware needed to uplift its developing economy. In addition to calling for $20 billion in two-way trade during the period 1978–1985, the agreement called for Japan to increase its oil imports from China from about 7 million tons in 1978 to 15 million tons by 1982, while exporting about $10 billion worth of industrial plant, equipment, and construction materials to China.

Following the signing of the long-term trade agreement, the Chinese concluded numerous contracts with Japanese firms relating to virtually every aspect of China's modernization programs except military hardware. By 1979, Beijing had signed about four dozen contracts involving over $3.8 billion worth of industrial plant and equipment, including a steel mill to be built at Baoshan near Shanghai with a total annual capacity of 6 million tons. Furthermore, negotiations for additional contracts worth several billions were in the offing with various Japanese firms.

[7] Asahi Shumbun, September 6, 1983.
[8] Asahi Shimbun, November 24, 1984 (evening edition).

China's plans, however, were thwarted by its inability to increase its oil production, lack of sufficient foreign exchange, shortages of yuan funds to provide domestic support to the imported industrial plants, and Beijing's decision to reassess the priorities of the projects involved in the ambitious modernization programs. On February 26, 1979, China called for a suspension of about 30 contracts involving $2.5 billion with Japanese manufacturers of plant equipment.

Both Japan and China faced large potential losses from the contract cancellations. Japanese manufacturers not only indicated their willingness to work out reasonable arrangements for financing the plant exports, but also carried out a series of consultations with the Chinese leaders to solve the financing problem.

On May 15, 1979, the first loan agreement involving the credits of 420 billion yen (about $2 billion) was signed between the Bank of China and the Export-Import Bank of Japan. the maximum life of the EXIM Bank loan was set at 15 years with an annual interest of 6.25 percent. Three months later, two commercial loan agreements totaling $8 billion were signed in Tokyo between the Bank of China and the Bank of Tokyo representing a consortium of Japanese commercial banks. The agreements provided for a $6 billion short-term (6-month) loan with an annual interest rate 0.25 percent higher than the prevailing Euro-dollar rate and a $2 billion medium-term (4.5 year) loan with an interest rate 0.5 percent higher than the Euro-dollar rate.

In addition to the $10 billion in credits, Beijing also requested additional financial assistance from Tokyo for the construction of eight major modernization projects involving $5.5 billion to have been undertaken between 1979 and 1983. During his visit to Beijing in December 1979, Ohira promised to extend $1.5 billion in development loans for six out of the eight construction projects. These loans would carry an interest rate of 3 percent per annum and be repayable in 30 years including a 10-year grace period. The loans were to be "untied," meaning China would not be obligated to buy goods from Japan with the credits provided under the agreement.[9]

Japan's commitment to provide substantial amounts of economic aid notwithstanding, in 1980 the ambitious "Four Modernizations" program had to be scaled down drastically. China still lacked the capital to finance the construction of the expensive industrial projects, even though the imported machinery might be financed by foreign loans or aid. China also was again reassessing its priorities in its economic development.

By December 1980, the Chinese Government decided to curtail its capital construction investment by over 30 percent for fiscal 1981. This drastic modification in China's economic policy inevitably required a substantial reduction in China's imports of foreign machinery and equipment, most of which were to come from Japan.

In the spring of 1981, this round of contract cancellations again strained Sino-Japanese relations. About $1.5 billion in contracts with Japanese companies for steel and petrochemical plants were dropped. The giant Baoshan steel mill near Shanghai was the hard-

[9] Japan Times, December 7, 1979.

est hit. Other key projects for petrochemical plants in Beijing, Nanjin, and Shengli also saw their contracts fall under the ax.

These abrupt cancellations threatened several Japanese companies with heavy losses because they had already manufactured or supplied equipment related to the projects. Some equipment was sitting on docks waiting to be shipped.

As it became clear that the Chinese Government was willing to reactivate several of the cancelled projects if necessary financial support could be secured, the Japanese Government decided to assist where possible. Initially, China requested $2.68 billion in new low-interest soft loans to reactivate petrochemical projects in Daqing and Nanjing and to complete the first-phase construction on the Baoshan steel complex.[10]

Following a series of negotiations between Tokyo and Beijing, in 1981 Japan agreed to extend a 300 billion yen (or $1.3 billion) financial aid package to China. It consisted of 130 billion yen in government commodity loans, 100 billion yen in suppliers' credits guaranteed by the EXIM Bank, and 70 billion yen in syndicated commercial loans.

This financial aid package enabled Beijing to push ahead with the first-phase construction plan for the Baoshan steel complex, setting September 1985 as the new target date for completion. The Chinese also settled the nagging problems of financial compensation for those Japanese companies whose contracts were cancelled.

In the spring of 1983, China indicated its desire to secure another 5-year development loan from Japan, since the 300 billion (about $1.5 billion) yen economic aid package negotiated in 1979 was to be exhausted by the end of 1983. China requested an additional $6 billion for modernization projects to be built in the ensuing five years—three railroads, four ports, two hydroelectric power plants, two mineral mines, one aluminum plant, and one telephone system.[11]

The question of the $6 billion loan requested by China was taken up again at the Fourth Sino-Japanese Ministerial Conference held in Beijing in September 1983. In the first round of meetings, the Japanese delegation promised to work out a new loan package for China after the feasibility studies on the proposed projects in China were completed later that year. By early March 1984, the basic outline of Japan's second economic aid package for China was devised on the basis of the feasibility studies. A high-level Japanese Government mission was dispatched to China in March 1984 to determine the exact loan amount for each project involved.

In his talks with Premier Zhao Ziyang in March 1984, Prime Minister Nakasone promised to provide China with a second economic aid package totaling 470 billion yen ($2.1 billion) to help finance the construction of seven key projects. The loans would carry an interest rate of 3.5 percent and be repayable in 30 years including a 10-year grace period. Nakasone also promised to offer an additional EXIM Bank loan to develop Chinese petroleum and coal resources. Zhao expressed his Government's gratitude to the

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[10] Ibid., p. 145. See also, Nitchu Keizai Kyokai, Nitchu Keizai Koryu 1981 nen. Tokyo, Nitchu Keizai Kyokai. p. 54.

[11] Asahi Shimbun, April 2 and 8 (evening edition), 1983.

Japanese Prime Minister saying that the projects financed by the Japanese aid would not only benefit China's economy but would also contribute to the promotion of Sino-Japanese friendship and cooperation.[12]

IV. Bilateral Trade: Two Steps Up, One Step Down

During the three-and-one-half decades following the Communist revolution in China, the level of trade with Japan has risen dramatically but also by fits and starts. China is able, through its system of economic controls, to expand or contract imports and (to a lesser extent) exports according to factors independent of the international marketplace. It is also able to direct trade toward or away from certain countries according to political considerations.

The "China fever" and lure of the massive China market that turned the heads of Japanese market strategists following the normalization of relations in 1972 has subsided. One observer, in fact, has referred to Sino-Japanese economic relations as a succession of disappointed expectations.[13] Japan's exporters now view the China market with much more caution and realism, but nevertheless are building a trading relationship that promises large current and future benefits.

The Trade Record.—From 1950 to 1956, total trade (exports plus imports) grew from $59.0 to $151.0 million under three private trade agreements. (See table 1.) In 1957, however, the breakdown in talks establishing a fourth trade agreement combined with an incident in Nagasaki over a Chinese national flag caused the People's Republic of China (PRC) to cancel about $100 million in import and export contracts. Within two years, total trade between the two countries had plummeted to $22.6 million.

By 1960, however, the Great Leap Forward had stumbled, and confrontation with the Soviet Union was increasing. China could not count on rising internal production or technology imports from the Soviet Union. The PRC, therefore, began again to encourage trade with Japan. By 1963, total trade had nearly regained the previous high recorded in 1956, and by 1966 had quadrupled to $621.4 million.

Again, however, political turmoil pinched off the blossoming trade. In 1966, the Cultural Revolution abruptly dampened both China's ability and inclination to rely on foreign trade. For the next two years, trade with Japan fell, although in 1969 it quickly recovered.

After normalization of relations between the two countries in 1972 and until China began to experience financial difficulties in 1980, total trade grew at an average rate of 30.8 percent per year. Bilateral trade peaked in 1981 at $10.4 billion but dropped to $8.9 billion in 1982, as China adopted a policy to promote exports and control imports. This was considered necessary by central authorities as the uneven development of national, regional, and enterprise efforts became increasingly apparent.[14]

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[12] Beijing Review, April 2, 1984, p. 10.
[13] Mendl, Wolf, Japan and Its Giant Neighbours, p. 211.
[14] Ehara, Noriyoshi. The Expansion of China's Foreign Economic Relations. China Newsletter, No. 49, March-April 1984. p. 12.

In 1983, however, total trade recovered to $10.0 billion, and it has continued to grow in 1984. In 1983, Japan exported $4.9 billion worth of commodities to the PRC, while importing $5.1 billion.

Barring dramatic political changes in the PRC during the remainder of the 1980s, trade with Japan should continue to grow. China's shopping list with Japan appears to be virtually endless. The major constraint seems to be China's ability to generate sufficient foreign exchange to pay for the expensive imports from Japan.

TABLE 1.—JAPAN'S TRADE WITH THE PEOPLE'S REPUBLIC OF CHINA: EXPORTS, IMPORTS, AND SHARES OF TOTAL TRADE, 1950-83, SELECTED YEARS

[In thousands of dollars and percent]

	Japan's exports to the PRC	Japan's imports from the PRC	Japan's trade with the PRC as a percent of Japan's total trade	The PRC's trade with Japan as a percent of the PRC's total trade
1950	$19,633	$39,328	3.3	4.9
1956	67,339	83,447	2.6	4.8
1959	3,648	18,917	0.3	0.5
1966	315,150	306,237	3.2	14.6
1972	608,921	491,116	2.1	18.6
1973	1,039,494	974,010	2.7	20.4
1974	1,984,475	1,304,768	2.8	24.0
1975	2,258,577	1,531,076	3.3	26.0
1976	1,662,568	1,370,915	2.3	22.9
1977	1,938,643	1,546,902	2.3	23.2
1978	3,048,748	2,030,292	2.9	23.8
1979	3,698,670	2,954,781	3.1	22.6
1980	5,078,335	4,323,374	3.9	23.1
1981	5,097,189	5,291,800	3.6	24.1
1982	3,510,825	5,352,417	3.3	21.7
1983	4,912,334	5,087,357	3.7	23.0

Note: Valuation is free-on-board for exports and customs clearance for imports.

Sources: Based on China Newsletter, March-April 1981, p. 32-36; March-April 1983, p. 24, 25; March-April 1984, p. 23-24; and various issues of Bank of Japan, Economic Statistics Monthly; Office of the Prime Minister, Japan Statistical Yearbook; International Monetary Fund, International Financial Statistics.

The PRC generally depends more on trade with Japan than Japan depends on trade with the PRC. Total two-way trade accounts for about 22 percent of China's external merchandise trade but only about 3 percent of Japan's. Even though Japan ranks as the largest trading partner of the People's Republic, the PRC ranks fifth (up from seventh in 1979) in Japan's trade—preceded by the United States, Saudi Arabia, Australia, and Indonesia.

China's imports from Japan, in general, also seem to contribute more to China's modernization strategy than imports from China contribute to Japan's economy. Although China is an important source of supply for rare minerals and silk, commodities such as coal and oil are widely available elsewhere. China's energy exports mainly reduce dependency on the Middle East or other potentially unstable supply sources and generate the foreign exchange necessary to buy imports.

Balance of Trade.—During the post-Revolution period, the bilateral balance of trade between the two countries has swung with the degree of control exercised by the Chinese authorities. During the sixteen years from 1950 to 1965, the balance averaged $17.6 million per year in favor of China. During the next fifteen years until 1980, however, the surplus shifted to an average of $375.5 million per year in favor of Japan. In 1981, the surplus swung back to the other side, as the Chinese authorities asserted control over trade. For 1981 through 1983, China's trade surplus with Japan averaged $737.1 million per year, even though at the same time Japan was generating large trade surpluses with the rest of the world.

The disappearance of the Chinese trade deficit with Japan appears to have reflected both economic constraints and policy decisions. China has had distinct limits on its ability to finance chronic bilateral deficits or surpluses with other countries. Chinese economic authorities also appear to lean toward quasi-mercantilist policies. They prefer to accumulate and not spend hard-earned foreign exchange reserves, particularly on "frivilous" imports such as consumer goods. While they recognize the role of foreign goods, technology, and capital in fostering industrial modernization, they simultaneously try to pay for them through export promotion or improved skill in international finance.[15]

The message China appears to be sending to Japan is that if it wishes to sell to China, it must also buy from that country. This emphasis on bilateral balance fits into the usual mold of trade between communist nations. Such trade is usually governed by a bilateral treaty in which trade levels are specified and long-term balance is sought.

The vanishing Chinese bilateral trade deficit with Japan, however, eases the pressure on China to reduce its large deficit in trade with the United States. China does, additionally, have a chronic trade surplus with Hong Kong, which has grown to more than $3 billion per year, that gives it some leeway to run bilateral deficits with other countries.

The bilateral trade deficit with Japan could return, especially if China uses its loans and credits to buy Japanese plant and equipment. For the first half of 1984, for example, China incurred a trade deficit with Japan of $770 million. Japan's exports of machinery rose by 71 percent over the same period in the previous year.[16]

V. Commodity Composition of Trade: Machines for Oil

The commodity composition of trade between the PRC and Japan attests to the complementarity of the two economies. Chinese exports to Japan consist primarily of energy, raw materials, food, and light manufacturers. Japanese exports to China, on the other hand, consist mainly of products of heavy industry and high technology.

Exports to Japan.—As shown in table 2, in 1983 over half of China's merchandise exports to Japan consisted of mineral products, with crude oil alone accounting for 40.9 percent of the total. Coal exports, while only about a tenth of the value of oil, tripled between 1979 and 1983. Imports from China make up 4.4 percent of Japan's total imports of coal and 5.2 percent of its total imports of crude and refined petroleum.

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[15] Helou, Angelina. Sino-Japanese Trade. Journal of World Trade Law, v. 16, March-April 1982. p. 99.

[16] China. Nomura Investment Review, v. 9, September 1984. p. 44.

Textiles and textile articles, accounting for 15.9 percent of total Chinese exports to Japan, reflect China's comparative advantage in labor-intensive and traditional silk products. Note, however, that garments have supplemented silk as China's major textile export to Japan, partly because China has agreed to restrain the growth of its silk exports to ease the competitive pressures on silk producers there.

The remainder of the Chinese exports consist of agricultural products, meats, fish, shellfish, and miscellaneous articles, such as antiques, art work, building materials, and fireworks.

TABLE 2.—CHINA'S MERCHANDISE EXPORTS TO JAPAN BY COMMODITY, 1980–83

[In thousands of dollars]

Commodity	1980	1981	1982	1983	1983 [1] share (percent)
Animal products	297,108	316,311	272,910	262,467	5.2
Fish shellfish	181,979	188,042	138,042	131,314	2.6
Vegetable products	321,623	407,377	377,977	484,236	9.5
Mineral products	2,514,233	3,060,980	3,212,072	2,926,877	57.5
Coal	116,519	188,676	212,536	212,958	4.2
Crude oil	1,949,172	2,332,960	2,340,918	2,080,959	40.9
Textiles and textile articles	682,967	691,504	722,582	806,577	15.9
Silk/silk fabrics	171,611	116,587	153,262	158,487	3.1
Cotton/cotton fabrics	92,180	115,865	118,248	140,121	2.8
Garments	230,704	242,748	263,896	270,895	5.3
Others	507,443	815,628	766,876	607,200	11.9
Total	4,323,374	5,291,800	5,352,417	5,087,356	100.0

[1] The share of that commodity in China's total exports to Japan.

Sources: Japan External Trade Organization. China Newsletter. Japan-China Trade: 1980 Statistics, March–April, p. 35; Japan-China Trade, January–December 1982, March–April 1983, p. 25; Prospects for China-Japan Trade in 1984: A "Leap" Year?, March–April 1984, p. 24.

Japanese Exports.—As shown in table 3, Japanese exports to the PRC consist primarily of products of heavy industry and high technology. In 1983, machinery and mechanical apparatus amounted to 28.5 percent of the exports, with nearly half of that accounted for by general machinery. Metals and metallic articles made up 49.6 percent of Japanese exports to China. Iron and steel products alone accounted for nearly all of these exports, with a value of $2.3 billion. It is little wonder, therefore, that projects such as the Baoshan Steel complex hold such appeal to Chinese planners.

Chemical goods accounted for another 11.0 percent of Japanese exports to China, textiles and textile articles 5.8 percent, and miscellaneous items 5.2 percent. Japanese textile exports to China consist almost entirely of synthetic fibers or yarns, not finished garments.

VI. United States-Japanese Competition in the China Market

Japan currently exports about twice as much to China as does the United States, even though the American economy is twice the size of the Japanese. While some of the Japanese success in the China market can be attributed to natural advantages, some also can be attributed to governmental policies and private business practices.

In certain products, such as iron and steel, Japan holds a major cost advantage over the United States, but in agricultural goods and certain items of high technology, such as aircraft and computers, the United States holds an advantage over Japan. In other manufactured products, however, American and Japanese firms compete head-on for sales in China.

In 1983, the United States sold $2,163.2 million in merchandise to China. About one-fourth of those exports ($540.7 million) was food and live animals, and another fourth ($583.7 billion) was machinery and mechanical apparatus. During the same year, Japan exported almost no food products to China but sold $1,399.7 in machinery, including general, electric, and transport machinery and scientific, optical, and precision apparatus. In iron and steel products, the United States exported $6.1 million to China in 1983 compared with $2,253.3 million from Japan.

Of course, trade between the United States and China is expanding rapidly from a small base. In 1983, U.S. exports to China were approximately the level of Japan's in 1977.

Still, a comparison of U.S. and Japanese sales to China indicates that Japan currently holds a sizable economic advantage over the United States in selling many types of non-agricultural goods to China. The reasons are many, not the least of which is geographical proximity and cultural affinity. Other important reasons include the aggressiveness of Japanese exporters, Japanese government assistance, the strength of the dollar, Japanese trading companies, and the Japanese ability to coordinate its development and trade policies.

TABLE 3.—JAPAN'S MERCHANDISE EXPORTS TO CHINA BY COMMODITY, 1980–83

[In thousands of dollars and percent]

Commodity	1980	1981	1982	1983	1983 [1] share (percent)
Chemical goods	575,416	559,599	512,139	539,674	11.0
Chemical fertilizers	244,476	213,120	84,712	17,509	0.4
Metals and articles thereof	1,686,655	1,255,421	1,355,788	2,434,133	49.6
Iron and steel and articles thereof	1,618,233	1,197,407	1,292,616	2,253,334	45.9
Machinery and mechanized apparatus	2,154,309	2,440,450	1,007,491	1,399,656	28.5
General machinery	1,164,226	1,440,696	399,967	545,107	11.1
Electrical machinery	422,428	554,861	203,868	264,502	5.4
Transport machinery	426,746	225,294	309,836	320,580	6.5
Scientific, optical, and precision apparatus	140,909	219,599	163,820	269,466	5.5
Textiles and textile articles	403,900	599,233	368,220	286,567	5.8
Man-made fibers	156,127	201,815	115,869	81,977	1.7
Others	258,055	242,486	197,817	252,304	5.2
Total exports	5,078,335	5,097,189	3,510,825	4,912,334	100.0

[1] The share of that commodity in total exports to China.

Source: Japan External Trade Organization. China Newsletter. Japan-China Trade: 1980 Statistics. March-April 1981. p. 33; Japan China Trade, January-December 1982; March-April 1983; p. 24; Prospects for China Japan-Trade in 1984: A "Leap" Year?, March-April 1984, p. 23.

Geographic and Cultural Ties.—While geographic proximity does not always insure an extensive trading relationship (e.g. North and South Korea), it usually does insure tht culture, history, and life styles will have some common denominators. Clearly, some of the success of Japan in China can be attributed to its location. Shanghai is 5,000 miles closer to Tokyo than to San Francisco.

Nevertheless, since Japan is an island nation, every exported or imported product must be transported by air or sea. Since costs of loading and port facilities will be the same regardless of the length of the journey, geographical proximity does not offer the same advantages to China and Japan that are available to the nations of Europe or United States and Canada, who are connected by land transportation.

In terms of *culture,* the two peoples are superficially similar yet differ greatly in terms of language, education, political and economic institutions, and standard of living. Japanese, however, are familiar with the Chinese life style. One reason for their success in selling in China is their reported willingness to go on to factory floors, down into coal mines, and also to meet with lower echelon officials. They also lobby the Chinese bureaucracy extensively.

Aggressive Business People.—Anyone who has had to compete with Japanese international traders knows that they are highly aggressive, particularly in terms of price competition.[17] Japanese business executives are willing to go to great lengths to close deals. They also coordinate sales with training and finance, adapt products to the local culture, and pay close attention to even minute details.[18]

Japanese Government Assistance.—The Japanese government has fostered trade with China through two major routes. The first has been to develop institutions and a political climate conducive to such trade. The Chinese have long used trade as an instrument of political power. They can direct their purchases toward countries they wish to reward or away from those to whom they wish to express their displeasure. Tokyo has been careful to avoid potential disruptions in cultivating friendly political relations.

The second method by which the government has encouraged trade has been to offer direct financial and other support to the trade. In 1980, Japan granted China *preferential tariff rates* for its exports under what is referred to as the Generalized System of Preferences (GSP).[19] Japan had previously granted China most-favored-nation (MFN) status. (The United States still has not granted China similar preferential tariff treatment.)[20]

A major factor in the expansion of trade between China and Japan has been the willingness of Tokyo to provide *yen credits* from their Overseas Economic Cooperation Fund (foreign aid fund) and loans, particularly from their Export-Import Bank, for certain large projects.

Yen credits are yen-denominated loans given on favorable terms. Between 1979 and 1983, Japan extended a total of Y 300 billion

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[17] Telephone conversation with Martin Weil, National Council for U.S.-China Trade, Washington, D.C., October 3, 1984.

[18] For a discussion of similar factors in trade with the Middle East, see: U.S. Department of Commerce. International Trade Administration. Japan is Displacing the United States as Saudi Arabia's Leading Supplier; Many Possible Reasons are Cited. Business America, June 25, 1984. P. 15-15.

[19] Japan Extends GSP Tariff Treatment to China. China Newsletter, June 1980. Pp. 21-22.

[20] U.S. Library of Congress. Congressional Research Service. U.S. Commercial Relations with Communist Countries: Chronology of Significant Actions Since World War II, and Their Present Status. Report No. 84-67 E, by Vladimir N. Pregelj. Washington, 1984. P. 17.

(approximately $1.5 billion) in yen credits to China. During Prime Minister Nakasone's visit to China in March 1984, he formally offered a second major yen credit of Y 470 billion (approximately $2.1 billion) to help finance key projects in China's modernization program. The projects include modernizing railways, ports, telephone equipment, and construction of a hydroelectric power station.[21] The terms were the same as the previous yen credits, except the interest rate was to rise from 3 to 3.5 percent.

In addition to yen credits, Japan's Export-Import Bank has financed trade with China. It does so on terms that are less favorable than the yen credits, but the loans still can play a significant role in directing purchases toward Japan.

In the United States, China also qualifies for loans from the U.S. Export-Import Bank. In addition, under the 1983 Trade and Development Enhancement Act (P.L. 98-181), the U.S. EXIM Bank is required to provide services at rates and terms which are fully competitive with those available to foreign competitors of U.S. exporters. As for foreign aid, currently China receives foreign aid from the United States only indirectly through international agencies.

Strong Dollar.—Since 1978, the dollar has gained in strength in terms of both the Japanese yen and Chinese yuan. This dollar appreciation not only worsens the competitive position of U.S. producers in domestic markets but hurts them when selling in foreign markets, such as China. The recent surge in the strength of the dollar, coming precisely at a time when China has been expanding its imports rapidly, must take some of the blame for difficulties American exporters have in competing on the basis of price in selling to China.[22]

Currently about 56 percent of Japan's exports to and 76 percent of Japan's imports from China are denominated in dollars. Only 41 percent of Japan's exports to and 12 percent of Japan's imports from China are denominated in yen. The rest are denominated in yuan or other currencies.[23]

For exports from Japan to China, denominating prices in dollars will have little effect on Japanese prices in yen, as long as both the yen and yuan are moving in concert relative to the dollar. Between 1978 and late 1982, changes in the yen/yuan rate moved in the opposite direction of changes in the dollar. In other words, as the yen weakened against the dollar, it also weakened against the yuan. Japanese exports to China, therefore, became more price competitive compared with the American each time the dollar strengthened.

Since 1982, however, both the yen and the dollar have been appreciating relative to the yuan. The unusual strength of the dollar in 1983 and the first half of 1984, therefore, has not given Japanese exporters a particular price advantage in China.[24]

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[21] 1981 Yen Credit Agreement Signed. China Newsletter, No. 38, May-June 1982. P. 21. Nakasone Offers China Second Major Yen Credit. China Newsletter, No. 49, March-April 1984. P. 11.

[22] One should note, however, that as recently as March 1977, the exchange rate was 285 yen per dollar. Compared with 1977, therefore, the yen, not the dollar has appreciated.

[23] Umemura, Kenji. Settlement Procedure in Japan-China Trade. China Newsletter, No. 50, May-June 1984. p. 18.

[24] The yen/yuan exchange rate in second quarter 1984 at 106.25 was even lower (implying a strong yen) than the 113.36 recorded in third quarter 1978 when the dollar was very weak and the yen very strong.

Trading Companies.—A commonly heard reason for the success of Japan is selling to China has been the important role of Japanese trading companies. These companies specialize in sales of standardized commodities, such as steel, which accounts for more than 40 percent of Japan's exports to China. Given the current slump in world demand for steel and other standardized commodities, moreover, trading companies have been diversifying into high technology products, trade between third countries, marketing in developing and Communist countries, and project development.[25]

Particularly after the oil crisis in 1973, trading houses managed to keep their operations growing by exporting complete plants to oil-producing nations. The trading companies would coordinate all phases of the project, including shipping, construction, finance, insurance, and providing technical training. With this wealth of experience, they now are able to offer similar services to China.

The Chinese reportedly like dealing with trading companies, because they are required to deal with only one foreign company for a particular project. Trading companies also can offer some economies of scale, since they coordinate all aspects of a project. When the trading company actually purchases the equipment for the plant, it is likely to buy from suppliers in Japan. It is also able to argue the case with the Japanese Government that loans from Japan's Export-Import Bank or other financial incentives should be provided for the project.

Coordinated Development.—Another reason for Japan's success in China has been its willingness to coordinate development of all aspects of a market. This means that it not only sells products to China, but it develops the Chinese exports needed to generate the foreign exchange necessary for the PRC to buy imports from Japan.

Consider coal. China has proven reserves of over 600 billion tons of coal, while Japan buys over $4 billion worth of coal each year. A fundamental assumption of the trade agreements between the two countries has been that China would export energy resources to Japan in exchange for needed manufactured goods.

Initially, the question was how much the Japanese were willing to buy. The binding constraint, however, turned out to be how much the Chinese were able to supply. The Chinese have not been able to increase shipment of high quality coal fast enough to meet their commitments under their trade agreements.[26]

Since what Japan is able to sell to China depends in part on what it is able to buy, Japan has agreed to assist the Chinese in developing their coal export industry. Japan's Export-Import Bank is providing loans to improve seven coal mines to be repaid through exports of coal to Japanese customers. In addition, the Japanese government is granting yen credits to assist in developing railroads and port facilities to insure that the coal will actually be transported to Japan.

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[25] For current information, see: The Japan Economic Journal. Trading Companies. Industrial Review of Japan/1984. Tokyo, 1984. p. 155. The Bechtel or Fluor Corporations in the United States are able to manage projects about as comprehensively as a trading company.

[26] Hattori, Kenji. Sino-Japanese Coal Cooperation. China Newsletter, No. 36, January-February 1982. p. 2–5.

VII. Japan's Role in China's Modernization

The primary goal of Beijing's Four Modernizations program has been to transform China into a "powerful, modern socialist country by the end of the century." [27] In order to accomplish this objective, China has relied heavily on Japan for high technology (non-military) and financial assistance to underwrite the expensive programs.

A. TECHNOLOGY

The Chinese recognize that technological change contributes significantly to economic growth and that such technology can be acquired by importing whole plants and equipment. Since 1978, most of China's funds for technology acquisition have gone for whole plant purchases.

From 1978-83, China selected Japan as the source of more than 56 percent of its imports of whole plants and high technology. According to the Japan-China Economic Association (JCEA), of the $10.7 billion in such contracts China signed with foreign firms, Japan's share amounted to over $6 billion (or 56.2 percent). By contrast, the U.S. share was a mere 6.7 percent during the same period, while the Western European countries accounted for 35.2 percent of the total.[28]

The magnitude of Japan's involvement in China's industrial modernization can be demonstrated by the 97 contracts that it had signed with China for plant exports. By 1983, construction on 54 of these plants either had been completed or were about to be completed. Of the 97 contracts, 74 contracts for the plant exports were signed under the terms of the 1978 Long-Term Trade Agreement, whereas the remaining 23 contracts were signed through other arrangements.

By exporting a number of important modern, sophisticated, turnkey plants to China, Japan has played a leading role in the development of several key industries in China, such as steel, petrochemical, synthetic textile, chemical fertilizer, and consumer electrical appliances industries.

(1) *Steel Industry:* In conjunction with the development of the Chinese steel industry, Japan has agreed to build a major steel complex at Baoshan near Shanghai. The first phase of the construction is expected to be completed by September 1985 and is expected to provide capacity to produce three million tons of steel per year. The second phase is expected to double the production capacity of the steel complex.

In addition to providing highly advanced machinery and equipment for the project, over 200 Japanese technicians and supervisors have been assisting the 50,000 Chinese workers in the construction of the complex. Furthermore, in order to train Chinese technicians to operate the complex, the Nippon Steel Corporation is to send 320 technicians to China and will train 1,000 Chinese steel workers and

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[27] Baum, Richard, ed. China's Four Modernizations. Boulder, Colorado, Westview Press, 1980. p. 1.

[28] Nitchu Keizai Kyokai, ed. Nitchu Keizai 1983 nen. Tokyo, Nitchu Keizai Kyokai, 1984. p. 197.

technicians at its production facilities in Japan. The Baoshan steel mill is regarded as the most advanced steel complex in China. As such, it is expected to set new standards of excellence.

(2) *Petrochemical Industry:* Japanese firms have been also involved in the construction of various petrochemical plants for China. In addition to providing technical assistance to 13 major petrochemical corporations, they have also played an important role in the construction and development of petrochemical complexes in Beijing, Lanzhou, Nanjing, Daqing, and Jilin. Japan has been actively involved in the construction of ethylene and polyethylene manufacturing plants in Daqing, a vinylon plant in Sichuan, and the expansion of petrochemical fiber plants in Shanghai, Tianjin and Jiangsu provinces.

The Japanese have also provided principal machinery and equipment for the construction of an ethylene manufacturing plant in Jilin. Involved in these petrochemical projects were some of the leading Japanese industrial firms, such as Toyo Engineering, Mitsui Petrochemical, and Ishikawajima Harima Heavy Industry.

(3) *Synthetic Textiles:* Various Japanese firms have also been involved in the construction of a number of Chinese synthetic textile factories. Some of Japan's leading firms, such as Toyo Textile, Teijin, Mitsui Petrochemical, Murada Machinery, Nikki, and Kanebo, have been providing plants and technical assistance to the Chinese. As a result, China is rapidly emerging as a major manufacturer of synthetic textiles and fiber in the world.

(4) *Chemical Fertilizer:* Several Japanese firms have been participating in the construction of chemical fertilizer plants in China. For example, the Ube Kosan Company built the Jinhai Ammonia Fertilizer complex, which with its annual capacity of 300,000 tons is one of the largest of its type in the world. The firm is also engaged in the construction of a similar ammonia fertilizer plant at Urumchi in Xinjiang province and is expected to help build a third plant in the Ningxiahui autonomous region. Another Japanese firm, Toyo Engineering, is involved in the construction of the Shanxi Petrochemical complex which will contain a factory with the capacity of manufacturing 900,000 tons of nitric-phosphorous-ammonia fertilizer per year.

(5) *Others:* Japan has assisted in building a nylon tire cord manufacturing plant in Honan province. In addition, they have also built (or are building) a synthetic leather manufacturing plant in Shanxi province, a resin manufacturing plant in Ranjou, and an acrylic paint manufacturing plant in Beijing.

(6) *Technical Assistance for Plant Renovation:* Since 1981, Beijing has been also counting heavily on Japanese help in renovating China's factories. Factory renovation has become important, as Beijing has decided to place more emphasis on improving existing industrial plants and facilities, rather than constructing new ones. China's plans call for renovation of 3,000 key factories by 1985, of which 300 have already been earmarked for Japanese guidance. (By 1983, 43 projects with Japanese firms were underway.) The usual procedure for a Japanese firm selected for the renovation of a particular Chinese factory would be first to evaluate the facility involved and then transmit a factory renovation plan to the Chinese government through the Japan-China Economic Association

or the Japan International Cooperation Agency. Representatives of the Chinese factory then go to Japan to assess the technical resources and capability of the firm selected for the renovation work. When the renovation plan is approved by the Chinese government, the Japanese firm makes specific recommendations, including the purchase of needed machinery and equipment (usually from Japan).

Between 1981 and 1983, most of the Chinese factories placed under Japanese guidance for renovation produced consumer goods: radios, television receivers, tape recorders, refrigerators, sewing machines, bicycles, cameras, toothpaste, underwear, and pharmaceuticals. Also included where plants making plywood, chemicals, and machinery.

(7) *Technical Assistance:* Japan has concluded various agreements on technical assistance for railway modernization and coal liquefaction, the exchange of media specialists, publications and ideas on electronic communications technology, and mutual cooperation for training technicians for commercial airlines.

According to a Japanese source, Japanese firms signed 26 agreements in both 1982 and 1983 providing for technical assistance and cooperation with China. (If those connected with whole plant exports are included, there were 59 agreements in 1982 and 79 in 1983.) The recipients included several key Chinese industries, including steel, electric power, chemicals, plastics, machinery, computers, electrical appliances, transport machinery (e.g. motorbikes), printing, and pollution control. Technology has been provided by leading Japanese firms, such as Mitsui, Honda, Hitachi, and Matsushita.[29]

B. FINANCE

China's modernization program requires massive capital investments. Initially, capital needs were estimated officially at $630 billion (or one trillion yuan) for the 10-year plan (1976–1985), although this plan has been scaled down somewhat. As China's ability to generate investment capital is limited, it has accepted financial assistance and loans at concessionary rates from many foreign sources, including Japan.

By 1984, Japan had become the largest supplier of foreign capital to China. Principal Japanese financial commitments to China have included the following:

1. Official Development Assistance (ODA), Yen Credits.—In 1979, Japan promised to extend 300 billion yen ($1.5 billion) in development loans for 6 major modernization projects proposed by Beijing (e.g. ports, railways, and power projects). Funds for two of these six projects were converted in late 1981 to commodity credits to aid Baoshan Steel Complex and Daqing Petrochemical Complex projects. In March 1984, Japanese Prime Minister Nakasone Yasushiro promised China to provide a second development loan package totaling 470 yen ($2.08 billion) for the construction of seven key modernization projects over the 1984–1990 period.

[29] Ibid., pp. 206–210. See also, Nitchu Keizai Kyokai, ed., Nitchu Keizai Koryu 1982 nen. Tokyo, Nitchu Keizai Kyokai, 1983, pp. 308–312.

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2. *Japanese EXIM Bank Loans.*—Loans from Japan's Export-Import Bank have played a significant role in financing the development of energy resources in China. In 1979, the Bank agreed to provide $2 billion in credits to China for the development of coal and oil resources. At least $940 million was earmarked for coal development and the remainder for oil. The maximum life of the loans was 15 years with an annual interest rate of 6.25 percent.[30] The EXIM Bank credits for coal have been financing the development of 7 new coal mines which may produce 22 million tons of coal by 1986. EXIM Bank loans have also helped Sino-Japanese joint ventures in off-shore drilling in the Bohai Gulf. By 1983, approximately $500 million has been committed for joint ventures in oil exploration.

In addition, in an attempt to diversify sources of vital oil supplies, Japan has actively cooperated with the Chinese to develop their oil resources. In 1980, the Japanese National Oil Corporation concluded a contract with China to explore and develop jointly the southern and western sections of the Bohai Gulf. The Japanese side assumed the cost of geographic prospecting and other exploration activities and 49 percent of the development cost. In return, Japan was to receive 42.5 percent of the total oil output during the 15 year production period. The Chinese would receive an equal 42.5 percent of the oil output, while setting aside the remaining 15 percent to pay for production costs. The EXIM Bank of Japan agreed to finance the joint venture, including $520 million for China's share of the development cost.

According to a Japanese source, there is a distinct possibility that daily production of crude oil from these wells may reach 200,000 barrels per day when the wells are fully developed by 1986.[31] Riding on the crest of the successful oil exploration venture in the Bohai Gulf, Japanese firms are expected to expand their activities elsewhere on China's continental shelf.

C. DIRECT INVESTMENT AND JOINT VENTURES

The Japanese share of joint ventures in China has been relatively small. By the end of 1983, Japanese firms were participating in 11 joint ventures with the equity divided roughly in half, and Japanese investments of about $28 million. Included are such enterprises as a color television assembly, pharmaceuticals, cement, a hotel, home electrical appliances, electronic software, and shipping services, and off-shore oil exploration. In terms of numbers as well as scale, and off-shore Japanese participation in joint equity ventures has been much smaller than that of the United States, which amounted to over $100 million in 22 joint ventures by 1983. Despite considerable Chinese interest in attracting more Japanese investment in joint ventures, unless Beijing can satisfy Japanese demands for the enactment of necessary legislation to protect foreign investment in China, it is not likely to increase rapidly either in number or in scale in the near future.

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[30] Nitchu Keizai Kyokai, ed. Nitchu Keizai Koryu 1983 nen. p. 108. See also, Tamio Shimakura. Nitchu Keizai Kankei. Chugoku Soran 1980 nen. Tokyo, Kazankai, 1980. p. 356–357.

[31] Nitchu Keizai, Kyokai, ed. Nitchu Keizai Koryu 1983 nen, p. 108.

D. TRAINING AND EDUCATION

Recognizing the need to develop China's skilled manpower as rapidly as possible, the Chinese government adopted a multifaceted approach to solving the problem. Biejing now appears genuinely to recognize that it will not be sufficient to buy plants and that in order to modernize they must rapidly improve their research capabilities, expand their training of skilled personnel, and acquire knowledge for foreign managerial and production methods, as well as new scientific and technical information.

As of December 1983, there were about 1,200 government-sponsored Chinese students and researchers studying in Japan, most of whom were enrolled in courses and research programs in the natural sciences and engineering.

Beijing has also sent a large number of technicians to receive training in Japan. For instance, from 1978 to 1982 the Japanese International Cooperation Agency sponsored 557 Chinese technical trainees, and in 1983 agreed to receive an additional 202 Chinese trainees. Their fields of specialization included transportation, communications, agriculture, mining, engineering, health and medicine, social welfare, and business administration and management.

Beginning in 1980, Chinee trainees have gone to Japan to learn managerial skills. From 1980 to 1982, the Japan-China Economic Association and other agencies accepted 69 managerial trainees for six-month periods and 58 for a shorter, three-month course. An additional 52 managerial trainees were accepted in 1982 for a one-year stay at possibly 17 different Japanese small and medium industrial firms. In 1983, 120 additional trainees were accepted for the same program.

Another significant development in 1983 was the signing of an agreement between the Nippon Steel Corporation and the Baoshan Steel Mills for the training of Chinese steel workers and technicians.

Finally, beginning in 1979, Japan has also dispatched numerous technical advisers and managerial specialists to serve as consultants to various Chinese firms and projects. For example, from 1979 to 1982, approximately 20 Japanese experts were sent to help improve the operations of the Chinese railway system, while some 70 Japnaese specialists were sent to help improve the productivity of various Chinese industries. The expertise of these Japanese specialists ranged from transportation, communications, business management, and engineering to medicine and health service.

ECONOMIC ADVANTAGES TO THE PRC FROM ACCESS TO THE U.S. GENERALIZED SYSTEM OF PREFERENCES

By Joseph Pelzman*

CONTENTS

I. Introduction

The U.S. Generalized System of Preferences (GSP) was introduced as Title V of the Trade Act of 1974. Under this program the U.S. grants temporary duty free treatment to eligible product imports from beneficiary developing countries (BDCs). The program, initially authorized for a period of ten years beginning on January 3, 1975, has since the enactment of the Trade Act of 1984, been extended, with some modification, for an additional eight and one half years.

The basic objective of the program is to promote and diversify the exports of developing countries thus freeing them from heavy dependence on primary product exports and providing the necessary stimulus for growth and development. The basic economic justification for such a system of generalized, non-reciprocal preferences, was the infant-industry argument. By lowering the duties assessed by developed countries on developing country exports, it was hoped that developing country producers would benefit from a price advantage over other foreign producers, whose goods would continue to be assessed at the normal MFN duty rates. This price advantage was expected to lead, in the long run, to an expansion in developing country exports of both GSP eligible and non-GSP eligible products.

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The experience to date shows that the U.S. GSP program has helped a limited number of advanced developing countries,[1] while providing marginal assistance to the bulk of GSP beneficiaries. In 1983, U.S. imports from all countries amounted to $256.7 billion. Imports from GSP eligible countries amounted to $89.5 billion or approximately 34.9 percent of total imports. Imports of GSP eligible goods from GSP eligible countries amounted to $22.5 billion or 8.8 percent of total imports. Duty free imports under the GSP program amounted to $10.7 billion or 4.2 percent of total imports. Over 85 percent of this $10.7 billion GSP free imports came from 15 advanced GSP beneficiaries.[2]

As a non-beneficiary, the PRC exported to the United States $419.8 million in GSP eligible products in 1983. This represents approximately 18.7 percent of its total 1983 exports to the U.S. If granted beneficiary developing country (BDC) status this trade figure would rank the PRC, in terms of 1983 data, as the 8th largest beneficiary of the U.S. program. Furthermore, with the enactment of the Trade Act of 1984 the U.S. GSP program has been renewed with a series of tightening amendments both to the product and country eligibility criteria. As a result of these changes, it is likely that the GSP free exports of Hong Kong, Taiwan and South Korea will be substantially reduced, thereby providing greater opportunities to PRC exports under the U.S. GSP program. Under these new circumstances the PRC stands to gain even further by becoming a designated BDC.[3]

The PRC has, since 1979, indicated its desire to be designated a beneficiary developing country under the U.S. GSP program. Prior to making that designation the U.S. must determine the probable impact on U.S. industries of introducing a large developing country into this preference program. From the point of view of the PRC the crucial issue is its benefits from participating in the program. More specifically, what are the current benefits of the U.S. GSP program given that the former major beneficiaries are likely to be adversely affected by the revised U.S. GSP program?

Estimates of the impact on the U.S. of granting the PRC beneficiary developing country status have already been presented in two earlier JEC volunes on the PRC. In the first, Raffel, Teal and McQueen (1978) estimated that granting the PRC GSP status would have increased its exports to the U.S. in 1976 by 4 percent. In a later volume, Bayard, Orr, Pelzman and Perez-Lopez (1982) estimated that granting the PRC GSP beneficiary status in 1979 would have increased PRC exports of GSP eligible goods by $14 million or

[1] In terms of 1983 GSP free trade the top 15 BDCs were: Taiwan, Krea, Hong Kong, Mexico, Brazil, Singapore, Israel, Philippines, Venezuela, Argentina, India, Yugoslavia, Peru, Thailand, and Portugal.

[2] This paper was written while I was on sabbatical leave in Jerusalem, Israel. Although 1984 trade data on the PRC became available in the Spring of 1985, it was not available in Israel. Consequently, this report is based on trade data up through 1983. While there has been a significant increase in PRC exports to the U.S. during 1984, the results presented here should not be affected by the increase in the volume of PRC exports.

[3] While the PRC has been designated a "developing country" in Article II of the U.S.-China Trade Agreement, it is not a signatory of the GATT and hence does not qualify for being designated a beneficiary developing country under the U.S. GSP program. The PRC is, however, a GSP beneficiary of the programs provided by all the industrialized countries with the exception of the U.S.

by less than 4 percent.[4] While both of these studies conclude that the adverse impact on the U.S. is relatively minor, the benefits to the PRC could not be determined given the short history of "normalized" U.S.-PRC trade. It is this latter issue which this paper addresses.

Since 1981 the PRC has annually exported to the U.S. in excess of $400 million in GSP eligible goods. In terms of 1983 performance, PRC exports to the U.S. of $419.8 million GSP eligible goods would rank her as the 8th largest beneficiary.[5] It is therefore appropriate, at this point, to raise again the question of the benefits to the PRC of the U.S. GSP program. Consequently, the intent of this paper is to present estimates of the economic benefits to the PRC of becoming a beneficiary of the U.S. GSP program. Furthermore, given that the GSP program has been renewed with some tightening amendments, this paper also presents estimates of the impact of the major revisions on the PRC and its major Asian competitors, if they were implemented in 1983.

The plan of the paper is as follows: In section II the structure of the U.S. GSP program is presented. The methodology chosen to estimate the economic benefit of the U.S. GSP program to the PRC is presented in Section III. An evaluation of the impact of the U.S. GSP program on the GSP eligible exports of the PRC to the U.S. is presented in Section IV. An examination of the impact of the major revisions in the U.S. GSP program are presented in Section V. Summary and conclusions are presented in Section VI. Data sources and variable definitions are listed in an Appendix.

II. The Structure of the U.S. GSP Program

The U.S. Generalized System of Preferences (GSP)[6] was introduced as Title V of the Trade Act of 1974. Under this program the U.S. grants temporary duty free treatment to eligible product imports from BDCs. The program, initially authorized for a period of ten years beginning on January 3, 1975, has since the enactment of the Trade Act of 1984, been extended, with some modification, for an additional eight and one half years. In establishing the GSP program, the United States reacted to the long-standing claim by developing countries that their inability to compete in a single-tier trading system was a major impediment to their development and followed the lead of most of the developed countries who had already instituted generalized preference schemes benefitting the developing countries.

Historically the GSP concept originated with a paper presented by Raul Prebisch, the first Secretary-General of UNCTAD (UN Conference on Trade and Development) in 1964. His basic thesis was that a multi-tier tariff system—one with lower tariffs for LDCs could provide the impetus for the industrial development of the Third World. That is growth from an expansion in manufactured

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[4] An additional study of the impact on the U.S. of granting the PRC beneficiary developing country status was published by the USITC in June 1981.

[5] This ranking is based on the 1983 level of PRC exports of GSP eligible exports minus the reduction attributable to the competive need limits.

[6] For a comprehensive review of the first five years of the U.S. GSP program see U.S. Congress (1980). A later review is provided in Pelzman (1983).

exports. The basic economic justification for such a system of generalized, non-reciprocal, non-discriminatory preferences was the contention that without assisting developing countries to overcome difficulties in export markets arising from high initial costs, they would be unable to develop and grow. Consequently, the U.S. along with nineteen other Western developed countries have instituted GSP schemes.[7]

The objective of the U.S. GSP program like that of the other European countries was to increase LDC exports, promote domestic industrialization and to accelerate economic growth. As a development program, the GSP was designed to be free of reciprocity demands and of discrimination across LDCs. At the same time the U.S. GSP program as that of the other developed countries contains certain restrictions on the product coverage of eligible GSP goods. In the case of the U.S. program the product coverage was and still is limited to primarily manufactured goods.[8] Consequently, the U.S. GSP program was and still is most accessible to a very few advanced developing countries. The great majority of developing countries do not possess the required resource base to take advantage of the present list of 3100 TSUS items included in the U.S. GSP program.

In designating products eligible under the GSP program, Section 503(c) of the Trade Act of 1974 specifically excluded the following items: (1) textile and apparel articles subject to textile agreements; (2) watches; (3) import-sensitive electronic articles; (4) import-sensitive steel articles; (5) virtually all footwear imports, except zoris; (6) import-sensitive semimanufactured and manufactured glass products; (7) any other articles which the President determines to be import-sensitive in the context of the GSP; and (8) any article subject to action under Section 203 of the Trade Act of 1974 or Section 351 of the Trade Expansion Act of 1962 (import relief resulting from escape clause) or Section 232 of the Trade Expansion Act of 1962 (national security).[9] With the passage of the Trade Act of 1984, Section 503 (c) has been amended to exclude in addition to the above list, footwear, handbags, luggage, flat goods, work gloves, and leather wearing apparel.

In order to promote a wide distribution of GSP benefits among beneficiary countries, Section 504 of the Trade Act of 1974 established specific criteria by which preferential treatment for particular products from certain BDCs would be withdrawn. According to these criteria, a BDC's exports to the U.S. in a given category would cease to benefit from the preferential treatment in a calendar year if in a previous year: (1) they exceeded in value an abso-

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[7] As of 1981 the list of developed countries granting GSP preferences include: Australia, Austria, Canada, Finland, Japan, New Zealand, Norway, Sweden, Switzerland, the U.S., and the member states of the EEC. In addition to these countries, Bulgaria, Czechoslovakia, Poland, and the USSR provide GSP programs.

[8] A check of the TSUS items eligible for GSP status will show that many primary products as well as some agricultural products are also on the eligible list. However, the overwhelming majority of the eligible products are manufactured goods.

[9] Initially a total of 2729 items in the Tariff Schedules of the United States (TSUS) were eligible for GSP treatment. As a result of a series of product reviews the list of eligible items in 1983 stood at approximately 3000 TSUS items. Over the entire life of the GSP program a total of 3187 TSUS items have been eligible for duty free status.

lute dollar limit [10] or (2) they accounted for 50 percent or more of the value of U.S. imports in that category. A country which ceases to be treated as a BDC for a given product as a result of these competitive need limits may be redesignated if its imports fall below the limits in a subsequent year.

In March 1981 the U.S. Administration modified the above statutory limitation by adding a "discretionary" graduation [11] scheme to the competitive need limits. Decisions to remove products from GSP eligibility or not to reinstate the eligibility to products which have lost it under the competitive need limits but have, in a subsequent year, fallen below the limits, under this "discretionary" graduation scheme are based on: (1) the level of economic development of the specific BDC; (2) its competitiveness in the product concerned; and (3) the overall economic interests of the United States, including the import sensitivity of the domestic industry.

With the passage of the Trade Act of 1984, Section 504 has been amended such that, the present competitive need limits will hold for the majority of BDCs till January 4, 1987, After a review of all products eligible under the program, to be completed by January 4, 1987, the President is now authorized to lower by 50 percent the competitive need limits on a product specific basis if he determines that a specific BDC has demonstrated "a sufficient degree of competitiveness (relative to other BDCs) with respect to any eligible article". Furthermore, the new legislation adds a "statutory" country graduation whereby the President is required to "graduate" any country with a per-capita GNP of $8,500 or more (indexed annually to 50 percent of the change in the U.S. GNP), phased out over a two year period.

In addition to the general requirements noted above, the People's Republic of China as a Communist country must meet additional criteria established in Section 502(b) (1) of the Trade Act of 1974 in order to be designated a beneficiary developing country eligible for the U.S. GSP program. These requirements are: (a) its exports to the United States are subject to most-favored-nation (MFN) tariff treatment; (b) it is a contracting party to the General Agreement on Tariffs and Trade (GATT) and a member of the International Monetary Fund (IMF); and (c) it is not dominated or controlled by international communism.

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[10] The statute set the limit at $25 million for 1975. After that, the limit was to increase each year by indexing the original limit by the ratio of the GNP for the preceding year to that of 1974, and multiplying it by $25 million. In the administration of this ceiling, the Office of the USTR has established the dollar value competitive need limit as $26.6 million for 1975, $29.9 million for 1976, $33.4 million for 1977, $37.3 million for 1978, $41.9 million for 1979, $45.8 million for 1980, $50.9 million for 1981, $53 million for 1982 and $57.7 million in 1983. Section 1111 of the Trade Agreement Act of 1979 amended the statute to waive the 50 percent competitive need rule for categories in which U.S. imports were valued at less than $1 million in 1979. This absolute de-minimis level is adjusted annually to reflect the growth in GNP. For 1983 the de-minimis level was set at $1,371,017. With the Trade Act of 1984 the de-minimis limit has been increased to $5 million and the base year used for indexing the limit has been changed to 1979

[11] The Administration considers product-country exclusions under the competitive need limits as just that—product exclusions based on dollar or percent share limitations, not "graduation." To them the term "graduation" refers only to the "discretionary" portion introduced in March 1981. Given revisions in the U.S. program which include both a lowering of the dollar and percent limits and statutory country specific graduation, we take the liberty in calling the entire set of schemes as "graduation" schemes. For more detail see the discussion in U.S. Congress (1980), p. 68.

To date the PRC fulfills most of these conditions but is not a signatory of the GATT. Consequently, it does not qualify for being designated a BDC under the U.S. Generalized System of Preferences.

III. Estimating the Economic Benefits to the PRC of Participation in the U.S. GSP Program

Any ex-ante evaluation of the probable economic benefits to the PRC of participating in a preference program like the U.S. GSP program is beset with problems. First, despite the fact that PRC exports of GSP eligible goods to the U.S. has over the past three years reached $400 million, it remains unclear whether this trade performance is the long-run norm. Secondly, while the U.S. prescribes the set of eligible products under its GSP program, it is unclear whether the present commodity distribution is the long-run norm of the PRC. What is clear, however, is the fact that the benefits to the PRC depend both on the magnitude of its future GSP exports and on its sectoral distribution. Nevertheless, one can, despite these constraints, estimate the order of magnitude of these benefits. This section briefly discusses how these policy questions might be addressed and presents the methodology used in this paper.

A. Methodological Issues

An elimination of U.S. tariffs on GSP eligible goods from the PRC will, ceteris paribus, cause U.S. imports from the PRC to increase as buyers substitute the now lower-priced GSP goods for: (1) domestic goods (trade creation); and (2) imports from other countries (trade diversion). The total expansion of U.S. imports from the PRC would be the sum of the trade creation and trade diversion effects. Since our concern lies in determining the changes in the dollar earnings of the PRC from expanded exports to the United States under the GSP program, the total trade expansion is the appropriate measure.

The most commonly used method of measuring this trade expansion is the elasticity approach. This approach requires the use of U.S. import demand and PRC export supply elasticities to determine the responsiveness of U.S. buyers and PRC exporters to changes in U.S. import duties on goods imported from the PRC. In addition to the appropriate elasticities, it is necessary to make assumptions or inferences about the potential price response by the PRC to a change in U.S. import duties. Subject to supply constraints, the PRC may pass through all, some, or none of the duty reduction to U.S. buyers by maintaining export prices unchanged, raising them by a fraction of the tariff reduction, or raising them by the full amount of the tariff change. In sum, the total trade expansion will depend on the U.S. import demand elasticity, the export supply elasticity, the pricing strategy of the PRC, the magnitude of the change in U.S. tariffs, and the current volume of U.S. imports of GSP eligible goods from the PRC.

Although the methodology just outlined is conceptually fairly straighforward, attempts to implement it are clouded by a number of methodological and data problems.[12] The most severe methodological constraint arises from data limitations. The elasticity approach requires information on the U.S. elasticity of demand for imports from the PRC. Given the lack of disaggregated import price data, it is almost impossible to estimate the appropriate U.S. import demand elasticity with respect to imports from the PRC. Data limitations also preclude reliable estimates of PRC export supply responsiveness and of the elasticity of substitution between imports from different sources within as well as outside of the GSP countries.

A number of different methodologies are available for evaluating the impact of a preference program like GSP. These approaches range from an estimation of a counterfactual set of trade flows thus measuring the hypothetical trade creation to an examination of the benefits available with the current level of exports. No one methodology, however, is free of empirical or theoretical drawbacks. Consequently, in order to provide a range of estimates of the benefits of the U.S. GSP program to the PRC, a number of different approaches are used here. A brief description of each methodology, along with its drawbacks, is presented below.

B. METHODOLOGY

The simplest approach used to estimate the trade creating effect of the U.S. GSP program on the GSP eligible exports of the PRC relies on estimating a counterfactual set of trade flows based on the assumption that removal of U.S. tariffs on GSP eligible goods will substantially increase PRC exports to the U.S. This approach relies on estimating the following equation:

$$\Delta M = M_0 \, (\Delta t/1+t) \, E \qquad (1)$$

Where M_0= the f.a.s. value of dutiable imports from the PRC; $\Delta t/1+t$= the change in the U.S. import price due to the GSP preference; and E is the elasticity of U.S. import demand.

This model assumes complete pass through along with perfect elasticity in PRC supply. It does, however, take into account the competitive need limits.[13] This approach should therefore provide a reasonable estimate of trade expansion due to the GSP tariff reductions.

As an alternative to the above methodology which relies on counterfactual evidence, the extent to which the U.S. GSP program can provide economic benefits to the PRC can be determined by examing the margin of preferences provided by the program, the degree of utilization and the tariff revenue gained by the PRC, on its present level of GSP eligible exports to the U.S.

One could argue that the existence of a margin of preference could, subject to competitive pressure, allow the PRC to charge a

[12] Some of the earlier studies using this methodology include: Baldwin (1983), Baldwin and Murray (1977), Pelzman and Rousslang (1981), Pelzman (1982), Pelzman (1983), Sellekaerts (1973), and Sapir (1981 and 1983). In all of these studies one generally assumes that GSP provides the developing countries with a margin of preference equal to the U.S. MFN tariff which is assumed to be passed through to U.S. buyers in the form of lower prices.

[13] The GSP trade data used here has been adjusted for the annual product graduation.

higher price on their GSP exports, up to the amount of the MFN tariff rate. In this case, the tariff revenue foregone by the U.S., since it would not be reflected in lower U.S. import prices, could be viewed as a transfer from the U.S. Treasury to the PRC.

Apart from the value of GSP in terms of tariff revenue foregone, the question of benefits accruing to the PRC depends on its ability to utilize the program. That is, to be able to export a large number of eligible products. This can be determined by focusing on two pieces of information. First, the commodity coverage of the PRC's exports under the program can be measured as the percentage of 5-digit TSUS items exported by the PRC relative to the entire list of eligible GSP items in any one year. The second piece of information presents the relative value of the top 10 5-digit TSUS items in the PRC's total GSP eligible exports to the U.S. in any given year. One would expect that if the PRC can utilize the GSP program effectively, the commodity coverage would rise and the share of the top 10 commodities would decline over time.

Based on these various measures we intend in the next section to present ex-ante estimates of the benefits to the PRC of participating in the U.S. GSP program.

IV. An Evaluation of the Benefits of the U.S. GSP Program to the PRC

In evaluating the effectiveness of the U.S. GSP program in inducing PRC export growth to the U.S. a number of different measures were employed. No one measure is superior. Therefore, we present in this section a number of estimates of the benefits to the PRC of participating in the U.S. GSP program. The first estimate is based on a counterfactual projection of the 1983 GSP free exports of the PRC; the second is based on the benefits which would accrue if the current set of GSP eligible goods would have entered the U.S. duty free.

A. CONTERFACTUAL APPROACH

The simplest methodology by which one can estimate the impact of GSP on BDC exports rests on the assumption that the entire benefits accrue from the tariff difference between GSP and the MFN duty. The changes in GSP exports, arising from this preference are measured as changes in U.S. imports due to a complete elimination of U.S. duties. Estimates of this gross trade creation for 1983 PRC GSP free trade are presented for both total exports and for selected commodities in Table 1. If the PRC were eligible for GSP free status in 1983 it would have resulted in a gross trade creation of $55.6 million in GSP free exports after one adjusts for the competitive need limits.[14] This represents 13.2 of the PRC's total 1983 GSP eligible exports to the United States.

This expansion in GSP duty free trade was due, primarily, to increased exports of such items as feathers and downs, bamboo bas-

[14] In 1983 had the PRC been granted GSP free status the competitive need limits would have reduced its duty free exports by $92.6 million. These items would have been eliminated not by the dollar limits but rather by the 50 percent rule.

kets, natural barium, nonbone chinaware, jewelry, toy animals, artificial flowers and fur wearing apparel.

B. STATIC APPROACH

Our estimates of the trade expansion which would arise from a reduction in the MFN duty to the GSP level (i.e. zero) represent the short-term gains to the PRC. In the long-term, the benefits of the U.S. GSP program to the PRC depend on its ability to utilize the program. The more it can utilize the U.S. GSP program the more likely is it to benefit from an expansion in its exports to both the United States and to third markets. Similarly, the more these products are in the technology area or in the basic manufactures area the more likely they are to provide the PRC with both forward and backward linkages. In order to examine these question we proceed to focus on the top ten GSP eligible exports of the PRC.

The question of long-term benefits accruing to the PRC depends on its ability to export a large and varied number of eligible products. Table 2 presents the top ten PRC GSP eligible exports, ranked by 1983 performance, for each year of the 1980–83 period. One notes that the PRC has over the recent four years reduced its dependence on a small basket of goods. Whereas in the early period its GSP eligible exports were concentrated in such minerals as ammonium molybdate, tungsten ore and natural barium, by 1983 it had shifted into light manufacturing. Furthermore, in 1983 the top ten GSP eligible items constituted 28.0 percent of the PRC's total GSP eligible exports, a substantial drop from its 1980 level of 49.2 percent. In fact, over the 1980–83 period the PRC increased the number of items on its GSP list from 751 to 1043. Presently it exports one third of the items on the U.S. GSP eligible list.

Under certain competitive conditions, as noted above, the PRC could, if granted duty free status under the GSP program, proceed to raise its export prices by the full amount of the duty reduction. Under the static approach, where we assume that the volume of PRC GSP exports doesn't increase, but rather the price of these GSP items rises by the full amount of the duty reduction, the PRC could show a GSP export increase of $37.3 million, after one adjusts for the competitive need limits, if it were eligible for the U.S. GSP program in 1983.

In sum, based on these two approaches, one could argue, on the one hand, that the current U.S. GSP program would have allowed the PRC to expand its GSP exports to the U.S. by $55.6 if the PRC was able to expand its domestic production in response to increased U.S. demand, originating from a price reduction on PRC GSP eligible exports. On the other hand, if it could not expand domestic production of GSP eligible exports, but instead chose to maintain its prices at the previous MFN level, it could show an increase in its GSP free exports equalling $37.3 million. This latter estimate reflects the value of the U.S. tariffs on the 1983 PRC GSP exports to the United States.

V. THE IMPACT OF THE CHANGES IN THE U.S. GSP PROGRAM

Thus far our discussion has focused on the impact of the U.S. GSP program on PRC exports to the U.S. in 1983. Our primary conclusion is that the GSP program, as it stood prior to the enacted amendments contained in the Trade Act of 1984, has the potential of providing a substantial benefit to the PRC. The U.S. GSP program has, however, undergone some major changes with the new legislation. It is therefore appropriate to ask what will be the impact on the PRC of the major modifications in the U.S. GSP program. In particular, what would be the impact of reducing the competitive need limits by 50 percent. The empirical results presented below attempt to respond to this issue by analyzing the impact of a reduction in dollar and percent limits to $25 million and 25 percent.

In order to evaluate whether or not this change in the GSP law would have a substantial impact on PRC exports, we estimated the impact of reducing both the dollar and the percent ceilings for 1983 trade data, from the 1983 limit of $57.7 million to $25 million and from 50% to 25% for its major Asian competitors, Hong Kong, Taiwan and South Korea.[15] A joint estimate of the GSP free and total trade affected by this scheme for these three BDCs is reported in Table 3.[16] Had this rule been in effect in 1983, Taiwan would have reduced its GSP free exports to the U.S. by $2.1 billion, Hong Kong by $674.7 million and South Korea by $892.1 million.

The product composition of the affected goods under this scenario include the exports of waterchestnuts, wood doors, articles of rattan, marble, locks, hand tools, electrical power equipment and toys from Taiwan, switchboard panels, toy animals and jewelry from Hong Kong and CB radios, baseball gloves, golf equipment and games from South Korea. The majority of these products are on the 1983 GSP export list of the PRC. Should the GSP exports of these three major exporters be reduced to the level outlined in Table 3, the PRC stands to be a clear winner. A comparison of these products with those of the PRC based on the Finger-Kreinin index of similarity (1979) indicates that between 60 and 68 percent of the affected goods in Table 3 can be substituted by the PRC.[17]

These results suggest that out estimates of the benefits to the PRC presented in the earlier section may, given the modifications in the U.S. GSP program, be a substantial understatement.

VI. Summary and Conclusion

The purpose of this paper was to analyze the significance of the U.S. GSP program to the People's Republic of China (PRC) and to examine the economic significance to the PRC of the enacted changes in the U.S. GSP program.

The findings lead to the conclusion that, the U.S. GSP program as it stood prior to the Trade Act of 1984, had the potential of being of substantial benefit to the PRC, if it were designated a beneficiary. Using the counterfactual approach it was estimated that the PRC could have increased its GSP duty free exports to the U.S.

[15] While it is true that the current enacted limits will not apply on all the GSP free exports of these countries, it was impossible to differentiate between the affected and not-affected items. These estimates, should, therefore be viewed as a "worst case" scenario.

[16] Elimination from GSP eligibility for a given product is based on exceeding either the dollar limit or the percent limit for a given total trade in a 5-digit TSUS product.

[17] A detailed examination of the Finger-Kreinin index is presented in Bayard, et. al. (1982).

by \$55.6 million in 1983. If th PRC were unable to expand its GSP eligible exports to the U.S. and chose instead to maintain its GSP export prices at the previous MFN level, that is, increase its export prices by the amount of the reduced U.S. tariffs, then it could show an increase in GSP free exports equal to \$37.3 million. Furthermore, under the revised GSP program the PRC may benefit in the long run by substituting for some of the GSP exports of the other major Asian exporters—Hong Kong, Taiwan and South Korea.

APPENDIX

The GSP trade data base for the PRC consists of 3187 GSP eligible 5-digit TSUS numbers for the years 1979-83. This data base was provided by the Office of the U.S. Trade Representative.

The U.S. import demand elasticities are taken from Baldwin (1976) and from Stern, Deardorff and Shiells (1982). These elasticities are for total U.S. import demand rather than for imports from the PRC. The elasticities from Baldwin are at the 5 digit TSUS level. The elasticities found in Stern, Deardorff and Shiells are at the three-digit Standard Industrial Classification (SIC) level. These latter elasticities were allocated to the 5 digit TSUS level by means of the BLS TSUS-SIC concordance. As was noted in the text, using these elasticities does create distortions in that they are not specific to U.S. imports from the PRC. However, since the latter data is unavailable, using these elasticities presents the best solution. The only other solution is to use an arbitrary range of elasticities. It was decided that this latter alternative was not feasible.

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TABLE 1
INCREASES IN PRC EXPORTS OF GSP COMMODITIES
ATTRIBUTABLE TO A COMPLETE TARIFF ELIMINATION
(Selected commodities in thousands of dollars)

TSUS ITEM	COMMODITY DESCRIPTION	ACTUAL 1983 EXPORTS OF GSP ELIGIBLE ITEMS	INCREASES IN 1983 EXPORTS UNDER GSP
18615	FEATHERS AND DOWNS	7,776.5	405.7
18630	BRISTLES, CRUDE OR PROCESSED	6,475.8	838.4
18850	TURPENTINE, SPIRITS AND GUM OF, AND RO	4,613.5	362.5
20700	ARTICLES NSPF, OF WOOD	2,073.3	215.0
22240	BASKETS A BAGS, BAMBOO	16,242.1	4,547.8
22241	BASKETS A BAGS OF WILLOW	7,281.7	2,710.3
22244	BSKTS AND BAGS OF UNSPUN VEG MATERIALS	12,697.0	1,392.6
22260	ARTICLES NES,OF BAMBOO RATTAN,WILLOW O	8,728.8	1,357.8
22264	ARTICLES NES, OF UNSPUN FIBROUS MATERI	6,301.5	420.1
43720	ALKALOIDS AND THEIR COMPOUNDS, SYNTHET	3,989.9	313.5
43764	MENTHOL	6,178.2	363.7
47210	NATURAL BARIUM SULFATE OR BARYTES, CRU	26,199.7	3,064.2
49368	POLYSACCHARIDES, RARE SACCHARIDES	2,280.9	342.1
52061	SEMI PRECIOUS STONES AND ARTICLES OF	1,359.0	889.2
53494	NONBONE CHINAWARE	3,465.5	2,927.9
64630	BRADS NAILS SPIKES STAPLES AND TACKS	2,066.5	218.6
64897	PIPE TOOLS, WRENCHES	2,410.6	308.9
64937	VISES AND CLAMPS	1,889.1	341.8
64943	CUTTING TOOLS WITH CUTTING PARTS	2,056.9	858.5
65375	GOLD-PLATED HOUSEHOLD AND SANITARY ART	1,779.2	1,117.9
66410	ELEVATOR, HOIST, WINCHES ETC	7,166.7	273.7
67850	MACHINES, NOT SPECIALLY PROVIDED FOR	3,079.6	410.6
68370	FLASHLIGHTS AND PARTS	225.8	317.3
68524	SOLID STATE RADIO RECEIVERS, NES	3,935.9	1,038.2
70214	HEADWEAR,NT KNIT,OF COT,FLAX OR BOTH	1,123.2	705.8
70237	HEADWEAR,NT CAP,VEG FIBER	1,938.5	664.3
70240	HEADWEAR,EXC CAPS,OF VEG FIBER BLEACHE	1,579.6	315.8
72735	FURNITURE, WOOD NSPF	8,192.9	2,340.9
73730	STUFFED TOY ANIMALS, VALUED OVER $.10	5,783.2	1,800.2
74038	JEWELRY ETC AND PARTS NSPF	1,634.5	1,329.0
74821	ARTIFICIAL FLOWERS, FRUIT ETC	3,316.4	3,728.9
75065	PAINT BRUSHES NES, EXCLUDING ARTIST BR	3,958.3	1,356.6
75525	CANDLES AND TAPERS	7,206.8	2,470.0
77297	RELIGIOUS ARTICLES OF RUBBER	2,636.5	1,239.3
79115	FUR WEARING APPAREL, NSPF, OF FUR SKINS	2,974.4	1,019.4
TOTAL ALL COMMODITIES		419,856.3	55,628.9

Source: Calculated from trade statistics obtained from the Office of the U.S. Trade Representative.

TABLE 2

TOP 10 GSP ELIGIBLE ITEMS FROM THE PRC, 1980 - 1983
(THOUSANDS OF DOLLARS)

TSUS	DESCRIPTION	1980	1981	1982	1983
47210	NATURAL BARIUM SULFATE OR BARYTES	18,561	27,431	27,135	26,200
22240	BASKETS AND BAGS, BAMBOO	12,781	17,862	15,694	16,242
33720	SILK WOVEN NOT-JACQUARD FIGURE		9,897	10,304	13,003
22244	BASKETS AND BAGS OF UNSPUN VEG MATERIAL		9,455	11,274	12,697
43782	SYNTHETIC VITAMINS				10,287
22260	ARTICLES NES OF BAMBOO RATTAN	7,084	9,396	9,382	8,729
72735	FURNITURE, WOOD NSPF				8,193
18615	FEATHERS AND DOWNS	24,155	24,377	11,060	7,777
75525	CANDLES AND TAPERS				7,207
66410	ELEVATOR, HOIST, WINCHES, ETC				7,167
14170	WATERCHESTNUTS IN SALT, OICKLED			9,239	
22264	ARTICLES NES OF UNSPUN FIBROUS			7,810	
18630	BRISTLES, CRUDE OR PROCESSED	9,074			
22257	FLOOR COVERINGS, UNSPUN VEGT MTRL	8,701	9,659		
41728	AMMONIUM MOLYBDATE	22,503	15,379	7,736	
60154	TUNGSTEN ORE	16,130	20,674	7,343	
66097	SUBMERSIBLE PUMPS		17,223		
70237	HEADWEAR, NT CAP, VEG FIBER	7,332			
74840	FEATHERS AND ORNAMENTAL ARTICLES	9,279			
	TOTAL OF TOP 10 GSP ELIGIBLE EXPORTS	135,605	161,353	116,976	117,501
	TOP 10 AS A PERCENT OF TOTAL GSP ELIGIBLE	49.20%	38.60%	26.60%	23.00%
	NUMBER OF TSUS CATEGORIES EXPORTED BY THE PRC	751	910	978	1043
	TOTAL TARIFF REVENUE FOREGONE BY U.S.	26,055	37,665	36,477	37,367

Source: Calculated from trade statistics obtained from the Office of the U.S. Trade Representative.

TABLE 3

GSP ARTICLES FOR WHICH 1983 TAIWAN, HONG KONG,
AND SOUTH KOREA EXPORTS EXCEEDED
EITHER $25 MILLION OR 25% OF TOTAL U. S. IMPORTS

($ Thousands)

----------- COUNTRY=TAIWAN -------------

TSUS ITEM	COMMODITY DESCRIPTION	EXCLUDED FROM GSP-FREE EXPORTS
13784	WATER CHESTNUTS, FROZEN	42
13840	BAMBOO SHOOTS OR WATER CHESTNUTS, FROZ	472
13841	MIXTURES OF PEAPODS AND WATER CHESTNUT	62
14170	WATERCHESTNUTS,IN SALT, PICKLED OR OTH	4956
14178	BAMBOO SHOOTS IN AIRTIGHT CONTAINERS	6654
14565	LITCHI (LYCHEE) OR LONGAN NUTS,NOT SHE	2009
14570	EDIBLE NUTS,NSPF,NOT SHELLED OR BLANCH	126
14865	PAPAYAS, PREPARED OR PRESERVED	882
15440	GINGER ROOT, CANDIED, CRYSTALLIZED OR	321
15453	FRUIT,NSPF,CANDIED CRYSTALLIZED,OR GLA	858
15460	CANDIED CRYSTALLIZED OR GLCE VEGETABLE	94
16947	SPIRITS FOR BEVERAGES,NSPF,IN CONTAINE	6
18465	ANIMAL FEED MEAT, NES INCL OFFAL, PREP	194
20266	WOOD MOLDINGS, CARVINGS AND ORNAMENTS	6287
20405	BASKETS,OF WOOD	162
20440	WOOD BOXES, CHESTS,CASES FOR JEWLS ETC	1962
20630	WOOD DOORS, INCL FLUSH, WITH OR WITHOU	11520
20645	MAHOGANY FORKS AND SPOONS	2
20647	FORKS AND SPOONS, OF WOOD EXCEPT MAHOG	40
20654	WOOD TOOLS, TOOL BODIES AND TOOL HANDL	769
20660	WOOD FRAMES, PICTURE AND MIRROR	12045
20665	WOOD BLINDS WITH CENTER OF FIXED LOUVE	561
20695	MAHOGANY HOUSEHOLD UTENSILS AND PARTS,	43
20698	OTHER WOODEN HOUSEHOLD UTENSILS A PART	461
20700	ARTICLES NSPF, OF WOOD	56763
22232	WOVEN MATERIAL OF CHIP FOR BLINDS,SHUT	46
22236	WOVEN FIBROUS MATERIAL, NES FOR BLINDS	183
22250	BLINDS,SHUTTERS,CURTAINS,ETC. OF UNSPU	33
22260	ARTICLES NES,OF BAMBOO RATTAN,WILLOW	11382
24014	PLYWOOD,BIRCH FACE PLY, NO FACE FINSH,	31745
24019	PLYWOOD,WALNUT FACE,NO FACE FINISH,OR	697
24054	WOOD-VENEER PANELS, BIRCH 1 FACE CLEAR	8
24060	WOOD-VENEER PANELS, 1 VENEER FACE PLY,	168
24560	CELLULAR PANELS	39
25125	STRAWBOARD AND STRAWPAPER, 0.008 INCH	1
25658	BOUND BLANK BOOKS EXCEPT DIARIES, NOTE	627

25675	PAPIER-MACHE ARTICLES, NSPF	1571
31670	CORDAGE OTHER FIBER NES	64
35542	FISH NETTING AND FISH NETS VEG FIB EXC	1
35625	WOVEN OR KNIT FABRICS,NES,OF VEGETABLE	283
38613	OTHER LACE OR NET ARTICLES AND OT ART	7451
38961	ARTIFICIAL FLOWERS, NSPF, NT ORN	429
40910	POLYESTER RESINS,UNSATURATED,THERMOSET	1414
41645	INORGANIC ACIDS, NES	1764
41922	MAGNESIUM CARBONATES PRECIPITATED	59
42106	SODIUM HYDROSULFITE	1333
42500	ACRYLONITRILE	39
48520	AZIDES, FULMINATES, ETC.	16
49404	BEESWAX, BLEACHED	13
51244	PLASTER OF PARIS ARTICLES EX STATUES,	269
51434	CHALK ARTICLES NSPF	3
51444	LIMESTONE AND ARTICLES OF LIMESTONE,	9
51481	MARBLE, BRECCIA AND ONYX ARTICLES, NES	10929
51564	STONE AND ARTICLES OF STONE NES, DECOR	376
52351	CARBONATE OF MAGNESIA ARTICLES, NES	3
53311	EARTHENWARE OR STONEWARE, COARSE-GRAIN	177
53315	FINE-GRAINED EARTHENWARE,REDDISH-COLOR	421
53421	CERAMIC TILE SMOKERS AND HOUSEHOLD ART	1251
53431	EARTHENWARE,ETC,COARSE-GRND SMOKERS	609
53476	EARTHENWARE,FINE-GRND,ETC SMOKERS,ETC	342
53481	EARTHENWARE OR STONEWARE,FG, SMOKERS	2495
53484	EARTHENWARE OR STONEWARE,FG SMOKERS,ET	12300
53491	BONE CHINAWARE STATUES, VASES A HOUSEH	6042
53494	NONBONE CHINAWARE OR SUBPOR- CELAIN	411
53497	CERAMIC SMOKERS A HOUSEHOLD ART, STATU	1629
54411	GLASS STRIPS, NOV 6 IN WIDE OV 1602 SQ	311
54534	GLASS INNERS FOR VACUUM FLASKS, ETC	8
54535	GLASS INNERS FOR VACUUM FLASKS ETC	34
54553	GLASS GLOBES AND SHADES	7722
54567	GLASS ILLUMINATING AND RE- FLECTING	10047
54585	GLASS CHRISTMAS ORNAMENTS, EXC BEADS,	919
54587	GLASS CHRISTMAS ORNAMENTS, EXC BEADS,	4792
54623	GLASSWARE NES, METAL FLECKS EMBEDDED	54
54647	PERFUME BOTTLES FITTED WITH GROUND GLA	470
54731	BULBS,WITHOUT FITTINGS, FOR INCANDESCE	205
54737	GLASS ENVELOPES W/O FITTINGS ELECT LAM	6427
54741	GLASS ELECTRIC INSULATORS WITH METAL	74
60675	BARS OF WROUGHT IRON OTHER THAN ALLOY	15
61070	PIPE FITTINGS MALL CAST IRON NOT ALLOY	743
61243	COPPER ALLOY- PLATES AND SHEETS CLAD N	121
61315	COPPER, NICKEL-SILVER AND CUPRO-NICKEL	137
61318	PIPE AND TUBE FITTINGS OF COPPER ALLOY	2818
64270	WIRE CLOTH ETC UNCUT NES WOV MESH 30-9	12
64285	COPPER WIRE CLOTH ETC CUT TO SHAPE	19
64464	ALUMINUM POWDER OR FLAKES IN LEAF, ARE	2
64606	THUMB TACKS, NES	122
64634	BRADS NAILS SPIKES STAPLES AND TACKS	43

64647	FURNITURE GLIDES OF BASE METAL NES	190
64672	ASSEMBLED BOLTS, SCREW EYES HOOKS,RING	1720
64675	BOLTS,NUTS ETC OF BASE METAL NES,WITH	955
64676	BOLTS,NUTS OF BASE METAL,NES WITH SHAN	818
64678	ASSEMBLED BLTS,SCREW EYES HOOKS RINGS	192
64682	PADLOCKS OF BASE METAL NOT CYLINDER	78
64685	PADLOCKS OF BASE METAL CYLINDER OVER 2	596
64687	CABINET LOCKS, BASE METAL NT CYLINDER	29
64688	CABINET LOCK OF BASE METAL NOT CYLINDE	10
64692	LOCKS AND PADLOCKS OF BASE METAL, NES	23066
64695	DOOR CLOSERS AND PARTS THEREOF OF BASE	2970
64703	BUTT HINGES OF IRON STL NES	18741
64705	HINGES,FITTNGS A MOUNTNGS OF BASE MTL,	5258
64851	DRAINAGE TOOLS, SCOOPS AND SPADES AND	824
64855	AGRICULTURE OR HORTICULTURE TOOLS AND	1785
64857	HOES AND RAKES AND PARTS NES	243
64867	AXES,ADZES,HATCHETS,ASIMILAR HEWNG TOO	1246
64885	PLIERS, NIPPERS, ETC. NES TO HOLD AND	8134
64891	TIN SNIPS AND PARTS	1554
64895	BOLT AND CHAIN CLIPPERS ETC,NES. AND	1940
64897	PIPE TOOLS,WRENCHES,A SPANNERS AND PAR	470
64911	NON-MECHANICAL SAWS	1598
64927	METAL FRAME HANDLES AND OTHR PARTS FOR	245
64937	VISES AND CLAMPS EX PTS OF OR ACCESSOR	4867
64957	FOOD SLICERS,CHOPPERS,ETC. N/O 25 LB.,	3472
64971	PEN, ETC, KNIVES WITH FOLD, BLADES, NO	2
64989	BLADES,HANDLES A OTH PARTS FOR BUDING	18
65007	KNIVES N.S.P.F. WITH SILVER PLATED HAN	605
65037	KITCHEN OR TABLE FORKS WITH SILVER PLA	317
65047	FORKS WITH RUBBER OR PLASTIC HANDLES	256
65056	SPOONS A LADLES WITH BASE METAL	1099
65073	SAFETY RAZORS, HANDLES, AND FRAMES OVE	488
65079	RAZORS, NOT SAFETY, NOT OVER 3 DOLLARS	34
65089	SCISSORS A SHEARS A BLADES NES OV 50C	5
65113	SEWING,PEDICURE/MANICURE SETS AND COMB	1403
65115	CAMPING PICNIC SETS W MTL KNIFE FORK S	277
65121	HAMMERS AND SLEDGES WITH HEADS NOT OVE	154
65125	CROWBARS,TRACK TOOLS,WEDGES OF IRON OR	666
65137	SCREWDRIVERS	183
65146	CAULKING GUNS OF IRON OR STEEL	1324
65148	HAND TOOLS INC TABLE ETC,NSPF OF IRON	23282
65149	HAND TOOLS NES OF BRASS	78
65151	HAND TOOLS,NES OF COPPER	127
65153	ALUMINUM HAND TOOLS NES	73
65213	BICYCLE CHAINS AND PARTS VALUED UNDER	1
65214	CHAINS AND PARTS VALUED UNDER 40% PER	36
65224	CHAIN AND PARTS OF IRON OR STEEL UNDER	2255
65236	COPPER CHAINS AND PARTS	15
65255	BICYCLE AND VELOCIPEDE BELLS AND PARTS	124
65260	BELLS OF BASE METAL NON ELECTRIC AND	74
65293	COLUMNS, POSTS, ETC, OF CAST IRON, ROU	16

65335	PORTABLE INDOOR TABLE, FLOOR AND OTHER	8055
65337	ILLUMINATING ARTICLES, OF BRASS --	14216
65339	ILLUMINATING ARTICLES OF BASE METAL	57565
65345	PORTABLE STOVES ETC, GAS O COMP AIR A	6557
65347	FIREPLACE GRATES A PARTS THEREOF,WHOLL	1479
65348	STOVES AND PARTS EXCEPT HIBACHIS,ALL	58
65385	CAST ARTICLES,COATED,OF IRON OR STEEL,	11
65393	COOKING WARE,AND PARTS THEREOF,WHOLLY	53
65396	TOILET AND SANITARY WARE IRON OR STEEL	5584
65399	IRON OR STEEL COOKING WARE(NOT STAINLE	36
65400	ARTICLES OF IRON OR STEEL, NOT COATED,	24206
65402	ARTICLES,WARES,AND PARTS,OF IRON OR ST	11361
65403	BRASS ARTICLES,WARES,AND PARTS OF COPP	31766
65404	COOKING AND KITCHEN WARE OF COPPER	2985
65407	CAST ALUMINUM COOKING AND KITCHEN WARE	29
65409	ALUMINUM COOKING AND KITCHEN WARE NOT	6482
65411	ARTICLES,WARES,ETC,OF ALUMINUM,NOT ENA	2733
65413	ALUMINUM COOKING AND KITCHEN WARE,NSPF	3971
65420	HOUSEHOLD AND SANITARY WARES OF BASE	6118
65724	PAPER CLIPS	71
65725	ARTICLES OF IRON OR STEEL,NT COATED	57571
65730	ARTICLES OF COPPER NO ALLOY, NIKL SILV	687
65735	ARTICLES OF COPPER NT COATED O PLATED	36840
65775	LEAD ARTICLES NSPF NOT PREC MET PLT OV	1425
65780	ZINC ARTICLES NSPF NOT COATD OR PLT WI	1896
66080	SPRING-OPERATED AND WEIGHT OPERATED NO	319
66106	FANS AND BLOWERS,AND PARTS,NSPF,WHETHE	453
66410	ELEVATOR,HOIST,WINCHES,ETC AND CONVEYO	62428
67432	BORING,DRILLING A MILLING MACHINE FOR	39745
67435	METAL-WORKING MACHINE TOOL,NES	837
67620	CALCULATING MACHINES FOR MULTIPLYING A	375
67630	OFFICE MACHINES,NSPF	122495
67652	OFFICE MACHINE PARTS NES	42165
67850	MACHINES, NOT SPECIALLY PROVIDED FOR,	230
68014	TAPS,COCKS,VALVES,AND SIMILAR DEVICES;	24557
68025	BALLCOCK MECHANISMS AND PARTS	172
68260	GENERATOR,MOTOR GENERATOR CONVERTERS	26971
68280	MAGNETIC WORK HOLDERS, AND PARTS	309
68410	ELECTRIC FLATIRON, TRAVEL TYPE	160
68448	OTHER ELECTRIC APPLIANCES, NSPF	33776
68453	TUBULAR ELECTRICAL HEATING ELEMENTS	25
68462	TELEPHONIC APPARATUS AND INSTRUMENTS	176558
68470	MICROPHONES,LOUDSPEAKER,HEAD PHONES ET	942
68524	SOLID STATE RADIO RECEIVERS,NES	422
68526	LOW-POWER RADIOTELEPHONIC TRANSCEIVERS	3926
68529	AND-HELD CITIZENS BAND(CB) RADIO TRAN	36276
68590	SWITCHBOARDS PANELS, ETC FOR MAKG CONN	32314
68624	AUTOMATIC VOLTAGE A VOLTAGE- CURRENT	.3278
68630	CHRISTMAS TREE LAMPS ELECTRIC FILAMENT	87
68742	TV PICTURE TUBES,NT COL,FACEPLATE OV 1	80
68810	CHRISTMAS TREE LIGHTING SETS W OR WO B	335

68812	IGNITION WIRING SETS A WIRNG SETS FOR	39672
68815	INSULATED ELECTRICAL CONDUCTORS WITH F	32398
68843	OTHER ELECTRICAL ARTICLES AND ELECTRIC	36129
69232	PARTS NSPF OF MOTOR VEHICLES,NOT ALLOY	60269
69260	VEHICLES, INCL TRAILERS, NOT SELF-PROP	27365
69610	YACHTS, OR PLEASURE BOATS VALUED OVER	61
69635	PNEUMATIC CRAFT	46
69640	RACING SHELLS, PLEASURE BOATS, ETC, NE	1197
70225	HEADWEAR NOT CAP STRAW SEWED NOT BLOCK	45
70228	HEADWEAR,NOT CAP,STRAW,SEWED, BLOCK.OR	114
70372	HEADWEAR,OF RUBBER OR PLASTICS NES	3929
70434	GLOVES AND GLOVE LININGS OF MAT OTH TH	41
70495	GLOVES AND GLOVE LININGS TEXTILE MAT N	119
70583	SEAMLESS GLOVES OF RUBBER OR PLASTICS,	10415
70637	FLAT GOODS OF VEGETABLE FIBERS EXC COT	55
70639	FLAT GOODS OF TEXTILE MATERIAL EXC COT	7
70642	FLAT GOODS OF REINFORCED OR LAMINATED	105
70650	FLAT GOODS, METAL, VALUED NOT OVER $5	389
70661	FLAT GOODS OF MATERIALS, NES	48
70843	EYEGLASSES, SUNGLASSES, AND GOGGLES, N	692
70845	EYEGLASSES,GOGGLE,ETC EX FRAME ETC OVE	79632
70871	COMPOUND OPTICAL MICROSCOPES NES, VALU	484
70875	COMPOUND OPTICAL MICROSCOPES IMAGE PRO	483
70891	FRAMES, MOUNTINGS AND PARTS, FOR HAND	40
71067	FOLDING RULES AND PARTS THEREOF, OF AL	32
71070	FOLDING RULES AND PARTS THEREOF, NSPF	204
71130	HYDROMETERS AND SIMILAR FLOATING INSTR	530
71149	BAROMETERS, NSPF	69
71307	METERS, ELECTRICITY SUPPLY ETC, OVER $	100
71319	PARTS FOR STROBOSCOPES	501
72092	PARTS NSPF FOR STAND. MARINE CHRONOMET	4
72214	PHOTOGRAPHIC CAMERAS, OTHER THAN FIXED	1267
72216	PHOTOGRAPHIC CAMERAS,OTHER THAN FIXED-	6088
72290	PHOTO DEVELOPING TANKS, NES.	189
72292	PHOTO ENLARGING EASELS	90
72505	GUITARS VALUED NOT OVER $100	3800
72532	DRUMS	107
72540	PERCUSSION MUSICAL INSTRUMENTS NSPF	686
72550	MUSIC BOXES	5198
72552	MUSICAL INSTRUMENTS, NES	1202
72625	MUTES,PEDALS,DAMPERS STANDS ETC, FOR M	4932
72715	FURNITURE AND PARTS OF BENTWOOD	4558
72723	FOLDING DIRECTOR'S CHAIRS OF WOOD	105
72725	FOLDING WOOD CHAIRS,NSPF	4785
72729	NON-FOLDING CHAIRS OF WOOD OTHER THAN	59777
72735	FURNITURE, WOOD NSPF	1205
72740	FURNITURE PARTS OF WOOD,NSPF	24254
72750	FURNITURE,AND PARTS THEREOF,OF RUBBER	24783
72752	FURNITURE AND PARTS OF COPPER NSPF	6061
72755	OTHER FURNITURE NES	814
72786	PILLOWS,MATTRSS,STUFFED ETC,NT COTTON	2881

72822	VINYL TILE	3584
73105	SNELLED HOOKS	391
73110	FISH BASKETS, OR CREELS	446
73150	FISH LANDING NETS	286
73170	FISHING TACKLE AND EQUIP,NSPF,A PTS TH	3749
73250	CHAIN-DRIVEN WHEELED GOODS FOR CHILDRE	1046
73252	WHEELED GOODS EXCEPT SKATES AND CHAIN-	3269
73260	BABY CARRIAGES,STROLLERS AND PARTS OF	14655
73410	BAGATELLE,BILLIARD AND POOL EQUIPMENT	35
73415	DICE, CHESSMEN ETC.	116
73420	GAME MACHINES INCLUDING COIN AND DISC	326
73442	TABLES ESPECIALLY DESIGNED FOR GAMES N	253
73451	BADMINTON EQUIPMENT A PARTS THEREOF,EX	48
73454	BASEBALL AND SOFTBALL GLOVES AND MITTS	18041
73460	CROQUET EQUIPMENT AND PARTS THEREOF	201
73471	POLO MALLETS AND SOCCER GUARDS	311
73472	FOOTBALL SOCCER AND POLO EQUIPMENT NES	1265
73477	GOLF EQUIPMENT NSPF AND PARTS THEREOF	19445
73485	LAWN TENNIS BALLS	213
73486	LAWN TENNIS RACKETS NOT STRUNG	53
73487	LAWN-TENNIS RACKETS, STRUNG	15
73488	LAWN-TENNIS EQUIPMENT AND PARTS NSPF	4081
73490	ROLLER SKATES AND PARTS	5
73509	INFLATABLE BALLS NSPF	171
73510	NONINFLATABLE HOLLOW BALLS NSPF, DIA N	424
73511	SPONGE RUBBER BALLS NSPF	258
73512	BALLS FOR GAMES OR SPORTS NSPF	38
73515	UNDERWATER BREATHING DEVICES COMPLETE	153
73520	GAME, SPORT, PLAYGROUND ETC EQUIPMENT	755
73723	STUFFED DOLLS	2362
73726	DOLL SKINS FOR STUFFED DOLLS	1539
73728	STUFFED TOY ANIMALS VALUED NOT OV $.10	3364
73730	STUFFED TOY ANIMALS, VALUED OVER $.10	30619
73735	METAL TOY ANIMALS ETC, NOT HAVING A SP	5256
73742	METAL TOY ANIMALS ETC., HAVING A SPRIN	2760
73750	TOY ANIMALS ETC. NSPF, HAVING A SPRING	50
73760	TOY MUSICAL INSTRUMENTS	1621
73765	MAGIC TRICKS, AND PRACTICAL JOKE ARTIC	4404
73770	CONFETTI, PAPER DECORATIONS, PARTY FAV	1280
73795	TOYS AND PARTS, NSPF, NOT HAVING A SPR	724
74038	JEWELRY ETC AND PARTS NSPF, VALUED OVE	45030
74115	CORAL, CAMEOS, CUT NOT SET FOR USE IN	1055
74510	METAL BUTTON NSPF,OVER 20 CENTS PER DO	126
74545	BUCKLES, BUCKLE SLIDES AND PARTS THERE	6154
74568	CLASPS, FASTENERS ETC NSPF, OVER $.20	1761
74570	SLIDE FASTENERS VALUED NOT OVER $.04 E	392
74815	CHRISTMAS TREE DECORATIONS ETC. OF LAM	459
74820	ARTIFICIAL FLOWERS, FRUIT, FOLIAGE ETC	2921
74821	ARTIFICIAL FLOWERS, FRUIT ETC, NSPF	12516
74836	ORNAMENTAL ARTICLES OF COLORED ETC NAT	148
74850	DOWN FILLED WEARING APPAREL, OTHER THA	264

74855	ARTICLES OF FEATHERS, NES	2623
75020	HAIR ORNAMENTS, NOT COMBS, RUBBER OR P	6931
75022	HAIR ORNAMENTS EXCEPT COMBS NSPF	897
75032	BROOMS AND BRUSHES OF VEG. MATERIALS,	271
75035	FEATHER DUSTERS	49
75070	BROOMS AND BRUSHES NSPF	7299
75080	PAINT ROLLERS	269
75105	UMBRELLAS AND PARASOLS	217
75110	CANES, SEAT STICKS, RIDING CROPS ETC,	35
75111	CANES, SEAT STICKS, RIDING CROPS ETC,	1076
75115	UMBRELLA HANDLES ETC OF WOOD NOT OVER	22
75120	METAL PARTS OF UMBRELLAS,CANES SEAT ST	1929
75125	PARTS OF UMBRELLAS, CANES RIDING CROP	141
75510	MATCHES NSPF	101
75630	TOBACCO PIPES AND BOWLS OF CLAY AND PI	33
76050	LEADS ETC NOT OVER .06 INCH THICK, NOT	36
76056	LEADS ETC OVER .06 UNDER .25 INCH THIC	349
77140	PLASTIC IMITATION PATENT LEATHER NOT C	916
77141	FLEXIBLE FILM,STRIPS,SHEETS,NOT OF CEL	15182
77143	FLEXIBLE FILM,STRIPS,AND SHEETS,NOT IN	264
77145	ACRYLIC RESIN PLASTIC PROFILE SHAPES N	59
77203	DISPENSERS, SALT, PEPPER, MUSTARD ETC.	716
77215	HOUSEHOLD ARTICLES NSPF OF RUBBER OR P	44840
77235	HOUSE FURNISHINGS, CURTAINS COVERS ETC	142
77270	WALL COVERINGS NSPF, INCLD- ING TILES,	1141
77295	CHRISTMAS TREE ORNAMENTS OF RUBBER OR	7848
77297	RELIGIOUS ARTICLES OF RUBBER OR PLASTI	7465
77305	TOYS FOR PETS OF RUBBER OR PLASTICS	2992
77310	PLAQUES AND FIGURINES, OF RUBBER OR PL	2176
77440	ARTICLES OF VULCANIZED FIBER NSPF	70
77450	PARTS OF FOOTWEAR,NSPF,OF RUBBER OR PL	19579
77455	ARTICLES,NSPF,OF RUBBER OR PLASTICS	74413
79000	ARTIFICIAL EYES, EXCEPT PROSTHETIC ART	480
79003	CASTERS	28
79007	CLOTHESPINS, EXCEPT SPRING TYPE, OF PL	3
79010	DOG LEADS, COLLARS, MUZZLES ETC. AND S	4590
79039	PNEUMATIC MATTRESSES AND OTHER INFLATA	219
79055	SHEETS, STRIPS, TAPES ETC, PRESSURE SE	23943
79062	VACUUM CONTAINERS, CAPACITY OVER 4 PIN	353
79063	VACUUM CONTAINER PARTS EXCEPT GLASS IN	18
79135	LEATHER WELTING	3
79160	BELTS AND BUCKLES, LEATHER, TO BE WORN	17369
79170	WEARING APPAREL NSPF, OF REPTILE LEATH	143
79180	LEATHER ARTICLES NSPF, OF REPTILE LEAT	201
79230	ARTICLES OF BEESWAX NSPF, EXCEPT SKIWA	18
TOTAL	ALL COMMODITIES	2144892

----------- COUNTRY=HONG KONG-----------

TSUS ITEM	COMMODITY DESCRIPTION	EXCLUDED FROM GSP-FREE EXPORTS
11455	OYSTER JUICE IN AIRTIGHT CONTAINERS	1715
14721	LEMONS, PREPARED OR PRESERVED	140
14852	OLIVES, DRIED, NOT RIPE	2
18245	SOY SAUCE, THIN	2150
18249	SHRIMP CHIPS	396
25270	STEREO TYPE PAPER N/IMPRGNTD ETC, N/OV	8
27390	POSTCARDS EXCEPT OF U.S. NOT PRINTED L	113
31650	CORDAGE OF SILK	19
38961	ARTIFICIAL FLOWERS, NSPF, NT ORN, OF O	2895
52039	PRECIOUS AND SEMIPRECIOUS STONES, CUT,	10786
52061	SEMI PRECIOUS STONES AND ARTICLES OF S	1342
54451	GLASS MIRRORS, NES NOT OVER 1 SQ FT IN	14147
54741	GLASS ELECTRIC INSULATORS WITH METAL F	110
64653	WOOD SCREWS OF BAS METAL,NES HAVING SH	593
64686	CABINET LOCKS OF BASE METAL NOT CYLIND	160
64687	CABINET LOCKS, BASE METAL NT CYLINDER	59
64880	SLIP-JOINT PLIERS,NOT FORGED VAL NT OV	66
64975	PEN, ETC, KNIVES WITH FOLD BLADES, OV	66
64977	PEN/POCKET/OTHER KNIVES FOLD BLADES, O	224
65079	RAZORS, NOT SAFETY, NOT OVER 3 DOLLARS	38
65083	HAIR CLIPPERS CUTTING BLADES AND HEADS	13
65087	SCISSORS A SHEARS A BLADES NES NOT OVE	66
65103	NEEDLE BOOKS AND CASES, $1.25 OR OV DO	48
65113	SEWING,PEDICURE/MANICURE SETS AND COMB	1035
65133	PENCIL SHARPENERS, LEAD AND CRAYON POI	81
65255	BICYCLE AND VELOCIPEDE BELLS AND PARTS	84
65330	INCANDESCENT LAMPS OPER.BY GAS OR COMP	537
65370	PLATINUM-PLATED HOUSEHOLD A SANITARY A	18
65390	HOUSEHOLD AND SANITARY WARES OF UNENAM	4256
66106	FANS AND BLOWERS,AND PARTS,NSPF,WHETHE	147
67210	SEWING MACHINES VALUED NOT OVER $10 EA	319
67615	ACCOUNTING, COMPUTING, AND OTHER DATA-	7479
67652	OFFICE MACHINE PARTS NES	1026
67850	MACHINES, NOT SPECIALLY PROVIDED FOR,	9860
68260	GENERATOR,MOTOR GENERATOR CONVERTERS,E	717

68370	FLASHLIGHTS AND PARTS	59
68380	PORTABLE ELECT LAMPS AND PARTS, EXCEPT	48
68420	PORT ELEC TOASTERS WAFL IRNS OVENS COF	15625
68448	OTHER ELECTRIC APPLIANCES, NSPF	804
68462	TELEPHONIC APPARATUS AND INSTRUMENTS A	157323
68524	SOLID STATE RADIO RECEIVERS,NES	632
68526	LOW-POWER RADIOTELEPHONIC TRANSCEIVERS	6436
68529	AND-HELD CITIZENS BAND(CB) RADIO TRAN	73093
68540	TAPE RECORDERS AND DICTATION AND TRANS	34451
68590	SWITCHBOARDS PANELS, ETC FOR MAKG CONN	36545
68770	TRANSISTORS	636
68834	ELECTRICAL ARTICLES USING PRE-PROGRAMM	5051
68843	OTHER ELECTRICAL ARTICLES AND ELECTRIC	11129
70054	ZORIS (THONGED SANDALS)	1935
70208	HEADWEAR,KNIT,NT COTTON	1
70215	CAPS OF PAPER YARN	3
70320	HEADWEAR FUR NOT ON THE SKIN MENS AND	2
70642	FLAT GOODS OF REINFORCED OR LAMINATED	85
70644	HANDBAGS OF BEADS, BUGLES, SPANGLE, IM	360
70645	HANDBAGS OR POCKETBOOKS, WOMENS AND GI	1832
70661	FLAT GOODS OF MATERIALS, NES	179
70843	EYEGLASSES, SUNGLASSES, AND GOGGLES, N	1152
70940	MECHANO-THERAPY APPLIANCES, MASSAGE AP	13
71317	STROBOSCOPES	1263
72244	MOVIE PROJECTORS NSPF	1397
72445	MAGNETIC RECORDING MEDIA, NO MATERIAL	25622
73120	FISHING REELS, VALUED NOT OVER $2.70 E	1101
73142	FISHING LINE OF FLAX, PACKAGED FOR RET	89
73420	GAME MACHINES INCLUDING COIN AND DISC	52
73425	PLAYING CARDS	28
73430	TABLE TENNIS EQUIPMENT EXCEPT TABLES I	544
73434	TABLE TENNIS EQUIPMENT, EXCEPT TABLES,	22
73520	GAME, SPORT, PLAYGROUND ETC EQUIPMENT	10902
73707	SCALE MODEL RAILROAD ETC. STOCK, EQUIP	87
73715	CONSTRUCTION KITS OR SETS NES	1617
73721	DOLL CLOTHING IMPORTED SEPARATELY FROM	17
73723	STUFFED DOLLS	7011
73740	TOY ANIMALS ETC, NSPF, NOT HAVING A SP	32253
73743	TOY ANIMALS ETC. NSPF, HAVING A SPRING	77
73749	TOY FIGURES OF INANIMATE OBJECTS W/O A	74
73750	TOY ANIMALS ETC. NSPF, HAVING A SPRING	3
73760	TOY MUSICAL INSTRUMENTS	55
73780	TOYS NSPF, HAVING A SPRING MECHANISM	290
73795	TOYS AND PARTS, NSPF, NOT HAVING A SPR	1896
74014	JEWELRY, NES, OF PRECIOUS METALS	92
74015	JEWELRY, ETC, NSPF	115
74030	JEWELRY ETC. AND PARTS NSPF NOT OVER $	101
74034	WATCH BRACELETS OF MATERIALS NSPF, OVE	8
74038	JEWELRY ETC AND PARTS NSPF, VALUED OVE	29912
74060	CRUCIFIXES OR MEDALS NES	340
74120	BEADS, IVORY NOT STRUNG AND NOT SET	208

74125	BEADS, SYNTHETIC RESIN, NOT STRUNG AND	4
74150	ARTICLES NSPF OF BEADS BUGLES SPANGLES	2918
74558	PINS NSPF, NOT PLATED WITH PRECIOUS ME	896
74565	CLASPS AND SNAP FASTENERS NSPF<NOT OVE	1622
74567	JEWELRY CLASPS ETC EXCEPT OF GOLD OR P	399
75005	COMBS, NOT OVER $4.50 PER GROSS	317
75015	COMBS, NSPF, OVER $4.50 PER GROSS	2309
75025	HAIR CURLING DEVICES, NONTHERMIC AND N	42
75040	TOOTH BRUSHES	942
75075	COMBINATION TOILET ARTICLES CONTAINING	666
75525	CANDLES AND TAPERS	54
75604	CIGARET LIGHTERS NES, VALUED NOT OVER	7226
75615	POCKET AND TABLE LIGHTER PARTS	2752
75640	CIGAR AND CIGARETTE HOLDERS OF METAL	11
75645	CIGAR AND CIGARETTE HOLDERS, NSPF	173
77215	HOUSEHOLD ARTICLES NSPF OF RUBBER OR P	43663
77295	CHRISTMAS TREE ORNAMENTS OF RUBBER OR	8167
77297	RELIGIOUS ARTICLES OF RUBBER OR PLASTI	9257
77310	PLAQUES AND FIGURINES, OF RUBBER OR PL	2364
77435	ARTICLES OF CASEIN NSPF	21
77445	ARTIFICIAL FLOWERS,TREES,FOLIAGE,FRUIT	124
77455	ARTICLES,NSPF,OF RUBBER OR PLASTICS	31392
79007	CLOTHESPINS, EXCEPT SPRING TYPE, OF PL	4
79110	FUR WEARING APPAREL NSPF, OF DOG, GOAT	147
79115	FUR WEARING APPAREL NSPF, OF FUR SKINS	35870
79260	ARTICLES OF IVORY NSPF	38
79275	ARTICLES OF HAIR NSPF	61
TOTAL	ALL COMMODITIES	674753

--------------- COUNTRY=SOUTH KOREA------------

TSUS ITEM	COMMODITY DESCRIPTION	EXCLUDED FROM GSP-FREE EXPORTS
11404	BOILED CLAMS,WHOLE,MINCED,OR CHOPPED,W	1358
11406	CLAMS NES (INCLUDING PASTES AND SAUCES	103
13040	GRAIN SORGHUM	3
14414	MUSHROOM AIR DRIED OR SUN DRIED	1918
16184	CAPSICUM OR CAYENNE OR RED PEPPER, GRO	635
18834	CHICLE, REFINED, ADVANCE	6
25660	ALBMS, AUTOGPH, PHOTO ETC AND ALBUMS F	63
40696	MALEIC ANHYDRIDE	736
40934	BENZENOID PRODUCTS CHIEFLY USED AS PLA	1460
41324	SACCHARIN	4535
42506	AMINO ACID SALTS	11391
47382	PEARL ESSENCE	541
52071	SYNTHETIC MATERIALS, GEM QUALITY, CUT,	6606
53222	MOSAIC CERAMIC FLOOR AND WALL TILES,NS	37
53311	EARTHENWARE OR STONEWARE, COARSE-GRAIN	219
61065	CAST IRON PIPE FTNGS NOT ALY NOT MAL N	1783
61066	ALLOY CAST IRON PIPE FTNGS NOT MALL N	4
64208	WIRE STRAND OF STLS STEEL NOT FITTED A	621
64214	STL ST WIR RPE ETC O/T STRND 13C A OV/	43
64216	ROPES, CABLE,ETC, OF IRON OR STEEL WIR	22
64630	BRADS NAILS SPIKES STAPLES AND TACKS I	6009
64632	BRADS NAILS SPIKES STAPLES AND TACKS I	7
64636	BRADS NAILS SPIKES STAPLES AND TACKS O	342
64697	HARNESS ETC HDWR N COATED OR PLATED WI	2303
64973	PEN,ETC KNIVES WITH FOLD. BLADES, OVER	4
65045	FORKS,KITCHEN OR TABLE WITH RUBBER OR	253
65104	EMBROIDERY STILETTOS	3
65107	CROCHET NEEDLES OR HOOKS	70
65151	HAND TOOLS,NES OF COPPER	172
65203	ANCHORS GRAPNELS A PARTS OF IRON OR ST	385
65270	FRAMES A MIRRORS,O BASE METAL, NT COAT	3340
65394	STAINLESS STEEL COOKING A KITCHEN WARE	234
65404	COOKING AND KITCHEN WARE OF COPPER	3583
65409	ALUMINUM COOKING AND KITCHEN WARE NOT	4739

67630	OFFICE MACHINES,NSPF	52354
67652	OFFICE MACHINE PARTS NES	26891
67850	MACHINES, NOT SPECIALLY PROVIDED FOR,	96
68425	MICROWAVE OVENS	92761
68462	TELEPHONIC APPARATUS AND INSTRUMENTS A	37687
68470	MICROPHONES,LOUDSPEAKER,HEAD PHONES ET	109
68524	SOLID STATE RADIO RECEIVERS,NES	20
68526	LOW-POWER RADIOTELEPHONIC TRANSCEIVERS	3900
68529	AND-HELD CITIZENS BAND(CB) RADIO TRAN	120347
68540	TAPE RECORDERS AND DICTATION AND TRANS	11632
68630	CHRISTMAS TREE LAMPS ELECTRIC FILAMENT	4914
68770	TRANSISTORS	434
68843	OTHER ELECTRICAL ARTICLES AND ELECTRIC	20984
69660	BUOYS, BEACONS,LANDING STAGES ETC AND	210365
70214	HEADWEAR,NT KNIT,OF COT,FLAX O BOTH,NT	32
70228	HEADWEAR,NOT CAP,STRAW,SEWED, BLOCK.OR	126
70365	HEADWEAR OF LEATHER	88
70856	TELESCOPIC SIGHTS FOR RIFLES,NOT DESIG	4939
72501	PIANOS, ALL TYPES EXCEPT GRAND PIANOS	8325
72503	GRAND PIANOS AND OTHER KEYBOARD INSTRU	13416
72505	GUITARS VALUED NOT OVER $100	4243
72508	STRINGED MUSICAL INSTRUMENTS,NSPF	749
72546	ELECTRONIC FRETTED STRINGED MUSICAL IN	3515
73088	ARMS EXCEPT FIREARMS AND SIDE ARMS NSP	281
73094	CARTRIDGES FOR RIFLES OR PISTOLS, EXCE	4574
73105	SNELLED HOOKS	514
73110	FISH BASKETS, OR CREELS	217
73120	FISHING REELS, VALUED NOT OVER $2.70 E	2073
73130	FISHING CASTS OR LEADERS	412
73170	FISHING TACKLE AND EQUIP,NSPF,A PTS TH	3671
73454	BASEBALL AND SOFTBALL GLOVES AND MITTS	12180
73470	FOOTBALL, SOCCER AND POLO BALLS	28
73477	GOLF EQUIPMENT NSPF AND PARTS THEREOF	20272
73507	BOXING GLOVES,AND OTHER GLOVES,NSPF,SP	3061
73520	GAME, SPORT, PLAYGROUND ETC EQUIPMENT	34055
73728	STUFFED TOY ANIMALS VALUED NOT OV $.10	1545
73730	STUFFED TOY ANIMALS, VALUED OVER $.10	504
73740	TOY ANIMALS ETC, NSPF, NOT HAVING A SP	15384
73742	METAL TOY ANIMALS ETC., HAVING A SPRIN	3137
73747	STUFFED OR FILLED TOY FIGURES OF INANI	383
73751	SKINS FOR TOY FIGURES OF ANIMATE OR IN	2100
74075	CHAINS ETC, OF BASE METAL, FOR JEWELRY	255
74080	CHAINS ETC, OF BASE METAL, FOR JEWELRY	1309
74550	PINS, PLAIN,ALL KINDS,NOT JEWELRY, PRE	3
75045	TOILET BRUSHES EXCEPT TOOTH BRUSHES, N	1962
75050	ARTISTS BRUSHES AND HAIR PENCILS, NOT	46
75055	ARTIST BRUSHES AND HAIR PENCILS, OV $.	931
75075	COMBINATION TOILET ARTICLES CONTAINING	503
77251	PNEUMATIC TIRES,NES	93
77260	TUBES FOR TIRES, NSPF	3991
77320	BRUSH BRISTLES, SPECIFICALLY DEFINED,	13

77455	ARTICLES,NSPF,OF RUBBER OR PLASTICS	28087
79015	RIBBON FLY CATCHERS	453
79060	VACUUM CONTAINERS, CAPACITY OVER 1 BUT	1227
79070	WIGS, TOUPEES, CHIGNONS, AND SIMILAR A	522
79115	FUR WEARING APPAREL NSPF, OF FUR SKINS	76717
79148	BOOK COVERS, WHOLLY OR PART LEATHER	179
TOTAL	ALL COMMODITIES	892151

Source: Calculated from trade statistics obtained from the Office of the U.S. Trade Representative.

CHINA'S FOREIGN AID PROGRAM: AN ANALYSIS AND UPDATE

By John F. Copper*

CONTENTS

TABLES

I. INTRODUCTION

The People's Republic of China (PRC) is the only developing nation in the world that has established and maintained a foreign aid program that is large both in terms of the amounts of aid given and the number of recipients.[1] It started with help to North Korea in 1950 (officially announced in 1953), and was followed by aid to non-communist Asian nations and Middle Eastern nations in just a few years. African nations were soon added. China has also given assistance to European and Latin American nations.

During the early and mid-1950s the PRC's aid giving was motivated primarily by perceived or real security threats—from the West vis-a-vis friendly nations on China's border (North Korea and North Vietnam). Later it was used to break a U.S.-imposed embargo against China. Beijing at this time also sought diplomatic recognition and Chinese leaders seemed to think that aid was a natural way of conducting foreign policy, either because tribute had been

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[1] For further information on China's foreign aid, see the following works by this author: *China's Foreign Aid: An Instrument of Peking's Foreign Policy* (Lexington, Mass.: D.C. Heath and Co, 1976): "China's Foreign Aid in 1976," *Current Scene*, June-July 1977; "China's Foreign Aid in 1977," *Current Scene*, August-September 1978; "China's Foreign Aid in 1978," *Occasional Prints/Reprints Series in Contemporary Asian Studies*, University of Maryland Law School, No. 8, 1981.

For an assessment of China's military assistance, see the author's chapter in John F. Copper and Daniel S. Papp (eds.), *Communist Nation's Military Assistance* (Boulder, Colorado: Westview Press.

the basis of Chinese foreign relations historically, or not knowing of another way to initiate contacts with other nations, or both.

From 1960 on Beijing's foreign assistance program took on a strongly anti-Soviet character and its aid in most cases appeared motivated in large measure by efforts to demonstrate that the cutoff of Soviet aid (which occurred in 1960) had not hurt China—since, according to Chinese leaders, it was neither generous or large. Aid also served as a means of competing with Moscow abroad as well with the United States and other Western countries as the PRC had already been doing. Sino-Soviet aid competition escalated, culminating in a spate of aid donation by both Moscow and Beijing prior to the second Afro-Asian conference scheduled for 1965 in Algeria. Beijing sought to have Moscow excluded from the confernce; the Soviet Union wanted to attend. Neither won since the conference had to be canceled.

During the 1960s Chinese aid supported numerous wars of national liberation in the Third World. Aid was also given for the purpose of obtaining bases of operation or footholds in the Third World. In one instance Beijing financed a very large project—a railroad through Tanzania and Zambia—to demonstrate its ability with big projects (which was slightly more expensive than the Soviet's largest, the Aswan Dam) and to secure an area where Chinese influence would be permanent—after Moscow had in a number of instances eliminated a Chinese presence with bigger aid offers.

The 1970s saw China's foreign aid program expand and then decline. It was cut drastically in 1978 when the PRC stopped giving aid to its two largest recipients at the time—Vietnam and Albania. This action resulted from strained relations with both (in Vietnam's case due to growing Soviet influence there and with Albania because of its public criticism of China for establishing closer relations with the United States). Deng Xiaoping had just consolidated power at the time and may also have perceived that China needed the money at home for its modernization effort officially launched in 1978.

In the early 1980s China continued to give economic aid even though it also became a major recipient of loans, credits and soft money from Western countries and international organizations. In fact, its aid may now be viewed in part as compensation to offset the fact that the PRC has been absorbing large amounts of World Bank and U.N. money, to the chagrin and displeasure of other developing nations. The impact of Chinese borrowing on other developing countries has been considerable because of the fact that China has not received assistance from these organizations in the past and is in a sense overdue, plus the fact that most international organizations base their aid giving (in terms of nations qualifying) upon the requesting nation's per capita income and its population—both of which give China a large piece of the pie. It also came at a time when there was less aid money to give because of the world recession making Western nations less generous with their payments to international aid giving bodies.

World Bank lending to China in 1983–84 amounted to $1 billion, almost half coming from the International Development Association—which gives soft- or no-interest loans with a long repayment period and thus has a grant factor of eighty to ninety percent.[2] The PRC's borrowing from the World Bank is expected to continue and perhaps doubling by the end of the century making it possibly the world's largest borrower.

Beijing says that foreign companies have invested $5 billion in China during the 1979–82 period, including $1 billion in offshore oil prospecting and drilling.[3] The PRC has also become a competitor for private Western capital. Official Chinese sources also record that the PRC has received over $1 billion in loans from Japan, of which about half has been used.

Compared to even the recent past the Chinese government has been much more open and candid recently about its foreign aid giving, providing more information and details on the kinds of projects and their cost. Apparently Chinese leaders want to boast about their aid in the context of taking aid funds previously available to other developing countries, and/or they are more confident about China's own economic development. In the fall of 1984, official Chinese sources stated that, up to the end of 1983, the PRC had sent 400,000 technical personnel to help with 1,062 development schemes in Third World nations. Included among these projects were three iron and steel mills, 51 textile mills, 53 sugar refineries and 43 paper mills. Chinese aid, they said, made possible the building of 6,300 kilometers of new roads in developing countries, 3,762 kilometers of railroads, 24 power stations and three oil refineries, plus China built more than 100 agricultural projects in 60 countries in the past 20 years and sent 7,000 medical workers to 44 Asian and African nations over the same period. In addition, 1,500 technicians and specialists received training in China and 114 regional activities have been sponsored by China or by China jointly with the U.N.[4]

In 1984, Beijing promised, again according to official Chinese sources, 100 development projects in 60 Asian, African and Latin American countries and 70 technical aid or cooperation schemes in Third World nations.[5] Judging from the number of projects underway, the PRC will no doubt live up to this commitment. However, in terms of total amounts spent on foreign aid, due to the fact that its projects now tend to be smaller and less costly and less of its aid now is in gift form, China's aid program has grown only marginally compared to the recent past and still remains well below pre-1978 levels. Table I provides a list of the PRC's official announcements of grants or loans exceeding $1 million. (The recipient and the amount made public.) Though this constitutes only a small portion of its aid, since most of China's aid, is never officially announced with the amount of aid cited, it is generally representative of aid trends.

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[2] Robert Dells, "The Bank's Ideal Client," *Far Eastern Economic Review*, September 27, 1984, p. 98.

[3] *New York Times*, August 9, 1983, Sect. IV, p. 5.

[4] *China Daily* (Beijing), September 21, 1984. p. 1.

[5] *New York Times*, June 3, 1984, Sect. I, p. 3.

TABLE I.—CHINA'S OFFICIAL AID PROMISES BY YEAR

[In millions of U.S. dollars]

Year	Amount	Number of recipients
Pre-1953	75	1
1953	394.9	2
1954	12.5	1
1955	378	2
1956	112.7	6
1957	15.8	1
1958	125.6	8
1959	135.35	6
1960	298.2	7
1961	447.2	8
1962	0	0
1963	87	3
1964	344.9	14
1965	124.7	5
1966	10.5	2
1967	[1] 437.8	6
1968	56.5	3
1969	10	1
1970	[2] 1,124.3	8
1971	421.7	14
1972	922.5	15
1973	430	13
1974	282	7
1975	110	5
1976	[3] 140	5
1977	[4] 119.7–129.7	3
1978	[5] 121–177	6
1979	99–112	2
1980	[6] 89.5	4
1981	6.5 [7] (436)	2
1982	[8] 94.89 [7] (541)	6
1983	[9] 78.2	6
1984 (first 6 months)	[10] 73	2

[1] This included $400 million promised for the Tan-Zam Railroad.
[2] This included $300 million in aid to Romania which was officially promised, but the amount was not disclosed. The $300 million figure is an estimate.
[3] This includes $47 million which was a cost overrun on the Tan-Zam Railroad. It also includes an estimated $50 million in new aid to Egypt, announced without exact figures. It does not include $47 million to Chile which was a renegotiated loan originally promised to the Allende regime.
[4] This includes a $52 million loan to Pakistan and a $52 to $62 million loan to Chile which may have been promised in previous years. The latter, it was announced, was not used and was not renewed in 1977.
[5] This includes a $56 million loan to Mozambique that was renegotiated in 1978.
[6] Tanzania and Zambia together received a grant for the Tan-Zam Railroad.
[7] This is the total figure announced by the Chinese government in contrast to other figures based on the total individually announced donations.
[8] This includes an agreement for $30 million announced in 1982 that was apparently concluded in 1980.
[9] This does not include a mentioned, but not officially confirmed, $40 million loan to Kenya; also it does not include two loans totalling $57 million whose repayment was extended.
[10] This includes a $3 million promise of development aid to several African nations, though they are not listed in the number of recipients. Total does not include a sale of 140 million in oil to the Philippines on credit.

While China's foreign aid is still generous in terms of the interest on loans and the conditions of repayment (though it has never been in terms of the obligation to purchase Chinese products and their quality, availability and price), Beijing has in many countries switched from giving foreign aid to signing commercial agreements for profit when it can. In this connection aid workers that in the past gained valuable experience in road and building construction are now used in contract work. In mid-1984 it was estimated that the PRC had an estimated 40,000 workers aboard working on various projects, compared to 25,000 in 1982.[5] Most of these were engaged in commercial building projects for profit rather than aid work. Most were in the Middle East.

The PRC has also become a more important supplier of arms assistance in recent years, as will be discussed in the last section of this chapter. And it has made this profitable. China provided significant qualities of military assistance in the past; but this was chiefly to nations on China's borders that were at war and where that war threatened the PRC. Beijing has also provided arms to a sizable number of guerrilla groups; however, the aid was small in amounts or in terms of sophistication of the weapons provided. There were only two or three nations that were exceptions. Finally, almost all of China's arms aid was free or transferred through credits that were later cancelled. Now China is in the arms trade game as a commercial venture.

In summary, while Chinese aid remains generous and generally efficient and helpful to the recipient countries, the PRC now seeks commercial agreements with more nations that can afford to buy Chinese help and is in the business of selling arms to help pay for its own weapons development—both quite unlike China's past aid policies. One might say that China's foreign aid program is now complimentary to construction and other work for pay and commercial export efforts, including arms. Generous aid is almost exclusively for very poor countries and is intended to offset at least psychologically the PRC's own borrowing. Political influence and maintaining China's image as a global power are important; but Beijing ostensibly now perceives it can now accomplish that with commercial agreements and trade as well as aid.

II. Aid by Bloc or Region

China's foreign aid program has been and remains global in scope. The PRC has given assistance to nations in every part of the world and to non-communist as well as communist nations. Nevertheless, most of its aid has gone to three areas or groups of nations. An analysis of the PRC's aid giving by bloc is revealing both in terms of Beijing's objectives and interests. It also says something of the nature of its aid. Below China's aid program will be examined by bloc or region: Communist nations, non-communist Asian nations, African nations and an "other" category.

A. COMMUNIST NATIONS

China gave both economic and military aid to communist nations first. It has also given more aid to date in terms of value to communist "fraternal" countries than to any other category of countries. Table II presents a list of communist nations that have received aid from the PRC. The reader is cautioned that little of China's aid to communist countries has been announced and it is difficult to discern the difference between economic and military aid; moreover, estimates of the value of this aid are only guesses, even more so than of aid to other categories of nations. Finally, since 1978 communist nations have received little aid from China: since then Beijing has given aid to only two or three communist bloc nations and its total aid giving to bloc nations has been less than to non-communist Asian nations or to African nations.

TABLE II.—CHINA'S FOREIGN AID TO COMMUNIST BLOC NATIONS[1]

[In millions of U.S. dollars]

Recipient	Low estimate	High estimate
North Korea	$1,000	[2] $8,000
North Vietnam	3,000	[3] 20,000
Albania	500	[3] 5,000
Outer Mongolia	100	115
Cuba	40	60
Rumania	100	300
Poland	10	[4] 16
Hungary	50	65

[1] Up to mid-1984.

[2] This includes arms aid given during the Korean War plus economic aid given at that time and to rehabilitiate the country after the war and military assistance during the 1960s, 1970s and recently (the most recent which was almost certainly sales through perhaps at discounted prices).

[3] This high estimate is based upon the top figure that Chinese officials have mentioned.

[4] This aid promise is so recent that it is likely that some of it has not been used yet. That is why the low estimate is lower than the official announcement.

North Korea was the first communist nation to receive financial aid from China, followed by Outer Mongolia and Vietnam. Hungary was also the benefactor of a small donation from the Chinese government in the 1950s. Albania became a large recipient—in fact, one of the few nations to become dependent upon Chinese aid—after it broke from the Soviet Union in 1961. Cuba was a recipient of Chinese financial help immediately after the revolution, apparently because Castro had based his revolutionary strategy on the Maoist model and sought close ties with China. Not long after, however, Castro criticized China at the bequest of the Kremlin, and as a consequence Chinese aid was terminated.[6] Rumania was a recipient of Chinese aid in the 1970s, but it is not certain how important this was or how much aid was actually delivered. Poland has been the most recent recipient.

North Korea received a large amount of aid from the PRC during the Korean War in the form of weapons and "volunteers" and economic help for reconstruction after the war was over. This aid was very generous and helped establish close ties between the two countries that have lasted to the present. However, in the late 1960s and 1970s China's economic growth fell below North Korea's and the aid connection ceased to be very meaningful. Subsequently Beijing gave little aid to North Korea and that took the form primarily of military assistance.[7]

In the last few years things have changed. The PRC has recently provided North Korea with more aid, though figures on the amounts of this aid are not available. Primarily it is arms aid, which in North Korea's case is the same as providing economic assistance since Pyongyang feels it must maintain a large military. It has also been given in the context of North Korea's economic difficulties. It appears to be motivated on China's part and to keep North Korea from becoming too dependent upon the Soviet

[6] For further details, see Copper, *China's Foreign Aid.* This work covers China's foreign aid program up to the end of 1975. Other sources are listed in footnote 1.

[7] See Joungwon A. Kim, *Divided Korea: The Politics of Development: 1945–1972* (Cambridge: Harvard University Press, 1976), p. 329.

Union.[8] The nature of this military aid will be discussed in the next section.

China provided extensive assistance both economic and military to Hanoi from the mid-1950s up to 1978. The amount of Chinese aid was never mentioned publicly for several reasons. Particularily Chinese leaders did not want to justify greater U.S. involvement in Vietnam but also did not want comparisions made between its aid and Soviet aid. Throughout most of the was it probably equaled or exceeded Soviet assistance. And during the final two or three years of the war: Soviet aid clearly contributed more directly to Hanoi's victory in 1975.[9]

Nevertheless Vietnam was and still is the largest recipient of Chinese aid anywhere. In view of this it is ironic that the PRC in a sense "took back" its aid in 1979 when it invaded the northern part of Vietnam after Vietnamese troops invaded and occupied Kampuchea. Beijing's stated objective was to keep more Vietnamese troops from being sent to Kampuchea. But the PRC also sought to subject Vietnam to burdensome economic costs. The PRC seemed to succeed at both, even though its military did not fare very well against Vietnamese irregular forces.

Since 1979 the PRC has sustained significant economic costs to maintain tension on the Sino-Vietnamese border in order to relieve the pressure on anti-Vietnamese groups in Kampuchea and has given large amounts of aid to guerrilla forces in Kampuchea fighting Vietnamese troops there. (This point in discussed at greater length in the next section.) Chinese leaders apparently have and continue to see their economic and military assistance as a major foreign policy instrument in dealing with Vietnam—whether by aiding Vietnam or anti-Vietnamese forces in Kampuchea. Recently in the course of bargaining with Hanoi Beijing has promised to resume aid if Vietnam will withdraw its forces from Vietnam.[10]

The other major recipient of Chnese aid among communist countries is Albania. During the period 1961 to 1978, China provided large quantities of both economic and military aid to Albania, making it possible for the Albania government to declare and maintain its independence of the Soviet Union. In fact, Chinese aid was so large, and Albania being a small country, Albania literally became dependent upon China for aid to sustain its economy and maintain economic stability.

In 1978, however, the Albanian government harshly criticized the PRC for its new, friendly relationship with the United States—resulting in Beijing abruptly cutting off aid to Albania.[11] Albania,

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[8] See sections on Korea in the *Asia 1984 Yearbook* and the *Asia 1983 Yearbook* published by the Far Eastern Economic Review, Ltd.

[9] For further details, see Victor C. Funnell, "Vietnam and the Sino-Soviet Conflict," *Studies in Comparative Communism*, Spring/Summer 1978.

[10] Nayan Chanda, "Cambodia: Sihanouk Stonewalled," *Far Eastern Economic Review*, November 1, 1984, p. 30. It is also interesting to note in this connection that China claims to have spend $500 million in resettling 250,000 refugees expelled from Vietnam in 1978 and after. See Therese Obrecht, "Shattered Dreams," *Far Eastern Economic Review*, October 6, 1983, p. 46 and Alexander Casella, "Refugees: A Case of Catch 22," *Far Eastern Economic Review*, November 1, 1984, p. 33.

[11] For further details on the severing of aid to both Vietnam and Albania, see "China's Foreign Aid in 1978," cited in footnote 1.

did not, however, fall into the Soviet orbit as a result, even though it did suffer economically from Beijing's decision. Recently, it appears that Albania-PRC relations may be rebuilt, though it is uncertain whether Beijing will grant aid again, or, if it does, whether the amounts will resemble the past. If not, the Soviet Union may be offered an opportunity in dealing with the Albanian government, possibly leading to Soviet influence there.

In the mid-1950s, China offered economic assistance to Hungary, probably to quite the unrest there after Khrushchev's de-Stalinization speech. Similarily Romania was apparently offered aid in the wake of Soviet invasion of Czechoslovakia in 1968. Both of these aid offers, however, were small. The only communist East European country to obtain Chinese aid in recent years has been Poland. In early 1983 Radio Warsaw mentioned a Chinese aid offer of $15.75 million in the form of a credit to cover Polish imports of meat and other goods.[12] The PRC did not announce this donation and apparently sought to keep it quiet in view of U.S. efforts at the time to pressure the Polish government economically.

The communist movements in Cambodia and Laos also received aid from the PRC during the "second" or U.S. Vietnam War. Most of this was in arms aid, especially small arms; but other kinds of aid were also given such as food and supplies. In the case of Laos, China also provided aid to the Laotian government at the same time it aided communist forces there. However, since 1975 the PRC has been aiding only opposition forces in both countries.[13]

Beijing has and continues giving assistance to a number of communist movements. The most important of these is the Khmer Rouge in Kampuchea. (This is discussed further in the next section.) Communist insurgents in Burma have received aid from China since the 1950s, though this has been off and on in terms of promises and deliveries, and Beijing has aided the Burmese government at the same time. Chinese leaders have played both sides in Burma, and continue to do so. Meanwhile, however, Beijing has promised to cut aid to communist movements in Thailand, the Philippines and Malaysia as well as Singapore and Indonesia. In the case of Thailand this has been very meaningful, resulting in the surrender of thousands of guerrillas to the government. It has also been significant, though to an obviously lesser extent, in the Philippines and Malaysia. In the latter case it remains to be seen if this promise is genuine or not. In the case of Singapore and Indonesia the PRC's aid to Communist groups there has not been significant so neither is a promise to terminate this aid.

B. NON-COMMUNIST ASIAN NATIONS

The PRC first granted aid to a non-communist nation in 1956 when it offered a non-interest loan to the government of Cambodia. This was followed later by agreements with Nepal, Indonesia, Sri Lanka, Burma, Laos, Pakistan, Afghanistan and Bangladesh, and very recently to Thailand and the Philippines. See Table III for estimates of Chinese aid to non-communist Asian countries.

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[12] *KDK Information* (Tokyo), March 1, 1983.
[13] See the sources cited in footnote 1 for further details.

TABLE III.—CHINA'S FOREIGN AID TO NON-COMMUNIST ASIAN NATIONS,[1]

[In millions of U.S. dollars]

Recipient	Low estimate	High estimate
Cambodia	40	[2] 90
Laos	15	[2] 80
Indonesia	30	[3] 60
Burma	50	[4] 100
Nepal	60	130
Sri Lanka	70	[5] 120
Bangladesh	50	[5] [6] 120
Pakistan	400	[5] 1,000
Thailand	30	[7] 50
Philippines	30	[8] 60

[1] Up to mid-1984.
[2] This includes aid given when this country was not a communist country and does not include aid given to insurgents in that country.
[3] Estimates are lower than official promises of aid because an Army coup overthrew the pro-PRC government before all of the aid announced could have been delivered.
[4] This does not include aid given to communist insurgents in this country.
[5] This includes military aid.
[6] This includes a commercial loan at regular rates of interest.
[7] Aid to Thailand has not been officially announced.
[8] Estimates are below the official amount announced because it is likely that not all of the loan has been used yet. Aid estimates to the Philippines do not include credits extended for the purchase of petroleum.

During the 1950s Beijing's main objective in its relations with non-communist Asian countries was to break out of its isolated position resulting from U.S. (and United Nations) embargo and China's hard line policies in the early 1950s. The PRC sought to win a sphere of influence in Southeast Asia as a more long-range goal. As competition with the Soviet Union and India increased in the 1960s and 1970s, China became more interested in balancing India's potentially dominant position on the subcontinent and offsetting Moscow's growing naval presence in the Indian Ocean—problems which were seen as very much related.

Until 1965 when a communist coup there was foiled by the Army, Indonesia was China's largest Asian non-communist aid recipient, though clearly it was never dependent on Chinese aid for its economic health. Since that time Pakistan has been China's favorite—but again, due to many other sources of aid no dependency has developed. In fact, no nation in non-communist Asia has become reliant upon China for economic help exclusively. It is also worthy of note that even as early as 1960 or 1961 Beijing (in the case of Pakistan particularily) revealed a willingness to aid nations that also received aid from Western countries, and this generally remains its policy. In total aid received, the non-communist Asian bloc has gotten considerably less aid than communist nations. On the other hand, since 1978 this group of nations has constituted the largest bloc in terms of the value of Chinese aid transfers. The explanation is Beijing's concern about being "surrounded and contained" by Soviet military forces. That being the case it seems likely this trend will continue.

During the 1970s the PRC's foreign policy saw a shift to South Asia and as a consequence its aid has been given in larger quantities to Pakistan than to any other country in Asia. Much of this aid has been in the form of military assistance, which will be discussed in the following section. Much, however, has been in the form of non-military loans and projects. China's biggest and most expensive project in Pakistan is an all-weather road which passes through disputed areas in Kashmir and which in the event of an emergency would give China better access to the region. China has also provided Pakistan with a number of other development projects, such as a foundry, power plants, a glass factory, and munitions factories. By 1980 Chinese assistance to Pakistan had reportedly reached nearly $400 million.[14] China has continued to provide Pakistan with aid in large amounts since—probably putting its total aid to Pakistan at double that amount.

Bangladesh and to a lesser extent Sri Lanka have also received both military and economic aid from China in sizeable amounts over the years. Nepal has received only economic help, probably because no outside power has sought to gain influence there through arms transfers and Beijing has been successful in keeping Nepal from becoming dependent upon India for economic aid, trade and a transportation link for its commerce with other countries. China has also been active in building roads in Nepal, which, like Pakistan, gives it greater access (especially meaningful in the event of war to the area) while facilitating stronger trade ties and weaning Nepal away from India economically.

China's most recent large aid promises or announcements to noncommunist Asian countries include a $10 million interest-free loan to Bangladesh and a $60 million loan (plus a $140 million sale of oil on a deferred payments arrangement) to the Philippines—a recipient of Chinese foreign assistance for the first time. Thailand has also become a new benefactor of Chinese foreign aid recently. The $10 million loan to Bangladesh in early 1984 was the first such commercial loan made by the PRC through the Bank of China and carried an interest rate just below the market rate. The loan was for five years with a 2½ year grace period—conditions much less generous than most of China's aid loans.[15] Beijing's generosity, however, was demonstrated by the fact that other commercial banks refused to grant the loan.

The PRC's loan to the Philippines was designed to help the Marcos government during a time of both financial and political crisis. Mrs. Marcos visited China in mid-1984 ostensibly for the purpose of getting economic help. Apparently Chinese leaders perceived that stability in the Philippines and the continued presence of U.S. bases there was in the interest of China in view of Soviet bases in Vietnam.[16]

China's aid to Thailand, which has not been given publicity by either nation (and therefore the date or amount of any promise is uncertain) apparently served the purpose of maintaining the PRC's access to anti-Vietnamese forces in Kampuchea. Also Thailand is threatened by Vietnamese forces in Kampuchea and Chinese leaders wished to demonstrate their commitment to Thailand both to impress Thai leaders and to win support and cooperation against Vietnam from the other ASEAN nations.[17]

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[14] See Copper, "China's Foreign Aid in 1979-80," p. 15 for further details.

[15] S. Kamaluddin, "Dhaka Goes Commercial," *Far Eastern Economic Review*, March 29, 1984, p. 29.

[16] See *USA Today*, June 11, 1984, p. 4.

[17] See John F. Copper, "China and Southeast Asia," *Current History*, December 1984 for further details.

C. AFRICAN NATIONS

Compared to other regions of the world, China has aided more nations in Africa than anywhere else. And its aid to African nations has been generous. Almost all has been given in the form of non-interest bearing loans repayable over a period of twenty years or more. On the other hand, Chinese grants to African nations have been much smaller than elsewhere and have been more frequently tied to Chinese purchases or the use of Chinese technicians and experts and frequently Chinese labor.

By the end of 1975, the PRC had aided a dozen African nations. Since then Beijing has added nearly three times that number. Aid to African nations in terms of the number of recipients is several times larger than non-communist Asian nations; the total amount of aid given to African nations, however, is about the same or somewhat less. Beijing's initial objectives were to win diplomatic recognition from the newly independent nations and to win support for the China seat in the United Nations. Since then African countries have been important in supporting China in the United Nations especially on Third World and economic issues. China early on tried to establish a base of operations in East Africa and concentrated most of its aid there. When the Soviet Union, after Sino-Soviet relations soured in 1960, sought to undermine Chinese influence there—and generally succeeded—Chinese leaders switched the focus of aid to East Africa. In the process the nature of China's economic aid policies in Africa changed.

In 1967 the PRC made an important exception to its policy of providing small, easy to complete projects when it agreed to help build a railroad through Tanzania to Zambia, primarily for the shipment of Zambian copper to Tanzanian ports when the alternatives made Zambia vulnerable to South African control or interference. The cost of the project was initially $400 million. It was a difficult project and one that several Western countries rejected because it lacked economic feasibility.[18]

China completed the 1,160 mile long railroad in 1973, ahead of schedule. At the time the project redounded to the credit of China's foreign aid program and its foreign policy toward African nations. The railroad, however, did not turn out to make a profit, and with the drop in copper prices went through difficult times. Several times Beijing had to sign additional agreements to do repair on the line or to furnish additional equipment. In 1983 repayment on the loan was extended and China separately extended another loan to Zambia worth $7 million.[19] In the meantime the PRC gave large amounts of assistance, both economic and military to Tanzania (making it the only other country other than Albania to become dependent upon Chinese financial aid), and lesser guaranties of aid to Zambia.

Tanzania has been the only very large recipient of Chinese aid on the continent and the Tan-Zam Railroad is China's only big project in Africa. Beijing, however, has given significant aid to about a dozen other African nations over the years. China's total

[18] See Copper, *China's Foreign Aid,* pp. 103–08 for further details.
[19] "Quarterly Chronicle and Documentation," *China Quarterly,* December 1983, p. 774.

aid commitment to African nations (not counting Northern Africa, which is categorized as Middle Eastern nations) up to 1975 was somewhere in the range of $1½ to $2 billion. It peaked in the mid 1970s and declined to hit a low point in 1981 for which Chinese officials publicly apologized.[20]

During 1981 China granted aid to a total of 21 African nations. During 1982 the number was 25. In 1983 the PRC aided 30 countries in some form, not counting military aid. In the last two or three years African nations have been the benefactors of 10 to 20 medical missions each year, a dozen or so agricultural projects and about the same amount of construction projects—including mostly buildings and roads.[21]

In 1982 China made a commitment totalling over $50 million to African nations: a $30 million sugar mill to Liberia, a $15.9 million airport to Mauritania and $3 million for wells in Senegal and $1.4 million (paid for in part by the United Nations) for agricultural aid. In 1983 China's aid giving kept pace: $32 million in the form of an interest free loan to Zimbabwe, just under $6 million to Lesotho in the same form, approximately $15 million to Tanzania and Zambia for parts and technical assistance for the Tan-Zam Railroad. Plus the PRC extended a $47 million loan to Chad for five years.[22]

In the last few years the PRC has also provided a sizeable number of small, gratis grants of aid to African nations in the form of relief help for drought and other disaster victims. Most of these have been for amounts ranging from $20,000 to $50,000. China has given more disaster relief aid in recent years, and Africa has been the area where more than half of it has gone. In early 1984 China's official news agency announced that it was giving an additional $3 million to African countries in the form of food aid to relieve starvation conditions over a sizeable area and affecting several African countries.[23]

D. OTHER NATIONS

In addition to the communist bloc nations and the two regional categories discussed, China has given aid to a number of nations in the Middle East, Latin American and Europe. The most important region is the Middle East. The PRC began providing economic aid to nations in the Middle East in the mid-1950s and by 1975 had given meaningful aid to six nations there: United Arab Republic, Algeria, Syria, Yemen, Southern Yeman and Sudan. Bejing's initial purpose was to obtain diplomatic recognition and to support wars of national liberation as well as internal conflicts in specified nations.

The PRC granted aid to three Latin American nations before 1975: Chile, Peru and Guyana. And it aided one European nation: Malta. In the case of Chile, Beijing hoped to influence the commu-

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[20] Such remarks were made by Chinese Premier Zhao Ziyang during his trip to several Africans nations in early 1983. See "Quarterly Chronicle and Documentation," *China Quarterly*, June 1983, pp. 407–08.

[21] See sources cited in footnote 1 for further details.

[22] See "Quarterly Chronicle and Documentation," *China Quarterly*, June 1983, p. 407, September 1983, p. 591 and December 1983, p. 774.

[23] New China News Agency, June 14, 1984.

nist movement there. After Allende's demise, when that was no longer possible, the PRC sided with the new military government which was at odds with Moscow. Meanwhile, China found Peru and Guyana friendly govenments which were experimenting with socialism and were not pro-Soviet. In the case of Malta, the PRC sought to establish a base of operations in the Mediterranean to enhance its global influence and to challenge the Soviet Union from Europe. China still maintains a presence in Malta.

In the last several years, China's aid to the "other" category has diminished, in large part as a result of converting its aid to commercial transactions (mainly construction projects and arms sales in the Middle East). A number of Middle East nations can now buy Chinese help. Others receive financial help from oil rich nations in the area and in this way pay for Chinese projects and arms.

Elsewhere—in Europe and Latin America—China has not found the gains of its foreign aid program justify the costs. Or Chinese leaders perceived that given other instruments of foreign policy it can use and competition from the United States or the Soviet Union, or both, aid had little promise of enhancing Chinese influence.

During 1979–81 the number of nations in the "other" category decline from nine to eight and to five. It increased in 1982 to seven and in 1983 to twelve or thirteen—though in no case was there any new official aid promised. China's foreign aid program consisted mainly of reports on projects in progress or reports about medical or agricultural teams working abroad. The only large project the PRC was working on was a dock in Malta.

Nations that have recently been added in the category of "other" include Fiji, Columbia, the Solomon Islands, Vanatu and Equador. In all of these nations, aid donations were small. Only in the case of Equador was aid officially announced with the amount of aid and the conditions specified: two million dollars interest-free to build a hydroelectric plant in 1983.[24]

China's total aid to the other category is only a fraction of its economic to non-communist Asian nations or to African nations—probably five to ten percent. On the other hand, if arms transfers are defined as aid, which they frequently are, the Middle East still counts large as an area in terms of Chinese assistance. Most of this, however, is in reality arms sales as will be elaborated on in the next section.

III. China's Arms Aid

In addition to giving economic assistance, China is also one of the largest nations in the world in terms of purveying military or arms aid, both in grants and sales. The PRC has provided arms to more guerrilla and insurgency groups then any other nation in the world. Beijing has engaged in two major wars by proxy through arms assistance—in Korea and Vietnam. And China is unique in that it is the only country seriously charged with supplying nuclear weapons and/or know-how to another country—Indonesia in the mid-1960s and Pakistan more recently.

[24] *China Aktuell*, August 1983, p. 623.

At the present time the PRC is supporting military forces in two civil conflicts or wars of national liberation—in Kampuchea and Afghanistan. Furthermore, it is a prime supplier of weapons to several countries in the Middle East. In fact, it is generally known that to be a major supplier of arms to both sides in the Iran-Iraq War.

Notwithstanding these facts, China for a long time eschewed giving military assistance, seeing it as bolstering rightist regimes, especially military governments, and creating uncollectable debts which would embarrass Beijing and injure relations with recipient nations. Chinese leaders also realized that they could not compete with the United States and the Soviet Union in supplying arms aid and that both would use Chinese arms as justification for providing more and bigger arms to the other side. Finally they wanted to criticize the superpowers as arms merchants.

For these reasons the PRC did not give significant arms aid to any countries other than North Korea and North Vietnam in the 1950s, and during the 1960s (with the exception of several insurgency groups) only Albania, Tanzania and to a lesser extent Pakistan became dependent upon China for arms. Then, in the 1970s, China's arms aid declined due to giving higher priorities to agriculture and consumer industries and because of breaks with Vietnam and Albania.

In total value the PRC's major recipients in the category of military aid are North Korea and Vietnam. In both cases the value of Chinese aid is inestimable. In the case of North Korea, China sent "volunteers" to fight during the Korean War and suffered casualties totaling as many as one million.[25] Little was said about the amount of arms aid China provided North Korea, but one published statement gives some indication of its magnitude: In early October 1951 a Chinese general reported that China had "pledged" 897 planes, among other weapons it provided to North Korea.[26] Another measure of its generosity: most of its military aid China purchased from the Soviet Union and provided to North Korea free of charge.

Since the Korean War the PRC has supplied North Korea with extensive military assistance, including ships, tanks and jet aircraft. North Korean uses almost exclusively Chinese-built vessels and it is estimated that the North Korean army has around 225 Chinese T-59 and T-62 tanks in use.[27] In the spring of 1982 the PRC reportedly delivered 20 to 40 Chinese-built MiG-21s to North Korea.[28] More recently the PRC is said to have sold North Korea MiG-21 and MiG-19 aircraft, which it in turn sold to Iran. The total of these sales may reach as high as $1 billion over the last two or three years.[29] The arrangements in terms of payments is

[25] For further details see Copper, "China's Military Assistance,' in Copper and Papp (eds.), *Communist Nations' Military Assistance,* PP. 103–05.

[26] *People's Daily,* November 27, 1951.

[27] Dilip Hiro, "As Gulf War Enters Year 4, Iran Plays a China Card," *Asian Wall Street Journal,* September 22, 1983, p. 7 and Clarence Roberson, Jr., "Iraq, Iran Acquiring Chinese-Built Fighters," *Aviation Week and Space Technology,* April 11, 1983, pp. 16–17.

[28] Finn-Sup Shinn, "North Korea in 1982: Continuing Revolution Under Kim Jong Il," *Asian Survey,* January 1983, p. 105.

[29] See Nack An and Rose An, "North Korean Military Assistance," in Copper and Papp (eds.), *Communist Nations' Military Assistance,* p. 174.

uncertain; probably North Korea takes a profit as a middleman, but pays the PRC sufficiently that it makes money on the deal (with the advantage of transferring weapons to Iran directly in view of the fact that it is also selling weapons to Iraq).

In the case of Vietnam, China began providing arms to Hanoi in 1949 or 1950, and as the war there expanded provided more and larger weapons. Chinese aid, according to a number of Western analyists, was responsible for the French defeat in 1954. Subsequently, when the U.S. Vietnam War escalated in 1964, China sent troops numbering around 35,000 to 40,000—though they were used primarily as engineering corps and for air defense.[30] China continued to arm and supply Hanoi during the war, though not with the kind of large weapons the Soviet Union sent in the final months of the war. Consequently the Kremlin is given more credit for facilitating Hanoi's victory. Beijing, in fact, may have sought to slow down the war due to its new friendly relationship with the United States, or in an effort to keep Southeast Asia divided, and this accounts for the greater impact of Soviet aid and China's break with Hanoi in 1978.

In any event Chinese leaders have put the amount of help to Hanoi during this period—all of which may be categorized as military assistance, since it was given during a period of war or immediately after—at between $14 and $20 billion.[31] Beijing also extended aid to Laos and Cambodia during the same period, mostly small weapons, artillery and supplies. The monetary value of this aid was much less and a large portion of it may have been given through Vietnam and was thus counted in the figures Chinese officials have given on aid to Hanoi.

The non-border, or nations not perceived as threatened in a way related to China's security, that have received significant quantities of Chinese military assistance are Albania, Pakistan (which does have a small common border with China) Tanzania and Egypt. Of these four only two, Albania and Tanzania, became dependent upon China for arms, though this is no longer true of Albania and is certainly less true of Tanzania. Pakistan and Egypt have both received significant and critically timed arms assistance. Pakistan is the largest arms recipient of the four nations just mentioned. Nevertheless, both Pakistan and Egypt have continued to receive arms from Western nations while taking Chinese military assistance.

The PRC began to provide Pakistan with military aid in the early 1960s and after the Indian-Pakistan hostilities in 1965 and the temporary cutoff of U.S. arms aid. Beijing sent Pakistan T-34 and T-59 tanks as well as MiG-19 jet fighters, plus large quantities of small weapons.[32] In 1970 China purveyed patrol boats and submarines to Pakistan, and in 1971 threatened to open a "second front" against India in the event of hostilities with Pakistan.[33]

[30] See Copper, "China's Military Assistance," in Copper and Papp (eds.), *Communist Nations' Military Asistance*, pp. 105–07.

[31] Both figures were cited by Chinese leaders. See Copper, "China's Foreign Aid in 1978," p. 8.

[32] See Copper, "China's Military Asssistance," in Copper and Papp (eds.) *Communist, Nations' Military Assistance*, for further details.

[33] Ibid.

During the ensuing conflict that gave Bangladesh its independence, however, the PRC did not act. Apparently, at least in part in compensation, plus to prevent Indian dominance in the region, China sent still more military aid in 1972, including more planes and patrol boats, and helped build munitions factories, military bases and strategic roads.[34] After India tested its "nuclear device" in 1974 there were reports that China was helping Pakistan develop nuclear weapons. A number of countries besides India, including the United States and the Soviet Union, have taken these reports seriously.[35]

In 1979 and 1980 in response to tensions on the border with Afghanistan and the Soviet invasion of that country, China provided even more arms aid to Pakistan—mostly in the form of small arms and ground-to-air missiles. Beijing, however, showed reluctance to get too involved in aiding Afghan rebels without a commitment from the United States and other countries, apparently fearing Soviet retaliation.[36] And because China's twenty-mile border with Afghanistan was closed by Soviet troops it could not provide arms directly.

The amount of arms aid the PRC has given Pakistan is difficult to assess since neither side has given any figures. An Indian source in 1980 put the total at $2 billion, which may be an exaggeration though probably not a large one.[37]

In the case of Tanzania the PRC initiated military aid in 1966 when it delivered four patrol boats to the Tanzanian navy.[38] This move was probably initiated by China to protect its investment in the Chinese-aided railroad mentioned above and to ensure that the Soviet Union could not eliminate its base of influence from East Africa. In the 1970s China built a naval base in Tanzania and provided weapons training to Tanzanian soldiers. Subsequently Beijing provided a squadron of Chinese-built MiG fighter planes.[39]

Since 1975 China has provided little arms aid to Tanzania, primarily because it had already provided what that nation needed. Also Chinese leaders haven't perceive an immediate threat there and have in other nations in the region. Over the last several years China's arms aid, including MiG-fighters, has gone primarily to neighboring Sudan, Somalia and Zambia.[40]

Beijing began providing Albania with some arms assistance probably as early as 1961. Significant arms deliveries, however, came after the Soviet invasion of Czechoslovakia in 1968. China forthwith leased four naval bases in Albania for 66 years and stationed vessels there. Later it was reported that China built several missile

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[34] Ibid

[35] See Robert Manning, "China's Nuclear Boom," *Far Eastern Economic Review*, November 26, 1982, p. 19 and Marvin G. Weibaum and Stephen P. Cohen, "Pakistan in 1982: Holding On," in *Asian Survey*, February 1983, p. 130. There have been even more recent reports of the PRC providing nuclear weapons technology to Pakistan; see "In Short," *Christian Science Monitor*, January 31, 1983, p.6.

[36] Carl Bernstein, "Arms for Afghanistan," *New Republic*, July 18, 1981, p. 8.

[37] *Asian Wall Street Journal*, February 27, 1981, p. 1.

[38] Copper, "China's Military Assistance," in Copper and Papp (eds.) *Communist Nations' Military Assistance*, p. 111.

[39] Ibid, p. 112.

[40] Ibid.

bases in Albania and equipped the Albanian armed forces with missiles, jet fighters and submarines.[41]

In the mid-1970s, however, Chinese-Albanian relations soured as a result of what Albania perceived as Beijing's sellout in seeking a new relationship with the United States and Albanian complaints about the PRC in that connection. A break occurred in 1978. Shortly after Beijing announced that it had given Albania a total of $5 billion in aid and that all of its military assistance—which may be estimated at about one-half or one-third of that amount—was free.[42]

In 1977 when Egypt broke with the Soviet Union, China immediately stepped in and offered Egypt spare parts for its Soviet-built weapons and other military aid. In 1979 President Sadat reported that Egypt had 40 F-6 Chinese-built fighters and that more were coming.[43] Later more aircraft were reportedly delivered and in 1980 Egypt received a quantity of SAM missiles. In 1982 Beijing delivered two submarines to Egypt and in December of that year Egypt ordered 60 to 90 more F-7 jet aircraft under a local assembly agreement with China—apparently the only such agreement ever made by the PRC.[44] In 1983 Beijing reportedly sold $80 million more in military hardware to Egypt and agreed to reschedule a debt for earlier weapons purchases amounting to $100 million.[45] At the same time two Chinese-built ships were commissioned by the Egyptian navy and two Chinese-built anti-submarine warfare ships were received by Cairo.[46]

Apparently a sizeable quantity of the aircraft sold to Egypt were transshipped to Iraq, in addition to aircraft made in Egypt under license with China. One author has estimated the value of Chinese weapons sent to Iraq through Egypt and Jordan at $4 billion.[47] In this way China has been able to supply weapons to both combatants in the Iran-Iraq War—the former through North Korea and the latter through Egypt and Jordon. In large part because of the Iran-Iraq war, the PRC has thus been able to turn its military aid program into a profitable venture and become a meaningful competitor in the arms business in the Middle East.[48]

The most meaningful support China is now giving to support a "war of national liberation" is in Kampuchea and is ironically against a communist regime—the Vietnamese puppet government of Heng Samrin. The PRC aided the forces of Pol Pot when it was fighting against Sihanouk and later the Lon Nol government. It continued to support Pol Pot when he was in power. But even more extensive aid was given by China after he was forced back to the countryside after an invasion by Vietnamese forces in 1978. Beijing had already (in 1975) promised Pol Pot $1 billion in aid, but delivered most of that after 1978—providing the Khmer Rouge with virtually all of the arms and supplies they could use.[49] This aid prom-

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[41] Ibid.

[42] China News Agency, July 13, 1978: see Ibid for further details.

[43] Copper, "China's Military Assistance," in Copper and Papp (eds.), *Communist Nations' Military Assistance*, p. 113.

[44] Ibid.

[45] *Defense and Foreign Affairs*, May 1983, p. 1.

[46] Ibid, December 1983, p. 1.

[47] "China's Defense: Swap-Shop," *Economist*, May 14, 1983, p. 56.

[48] For further details, see "China Joins the Arms Merchants," *Asiaweek*, October 26, 1984, p. 9.

[49] See Copper, *China's Foreign Aid*, p. 151 for further details regarding the $1 billion promise.

ise continues to supply the Khmer Rouge. After Son Sann and Sihanouk's forces formed a "coalition" with the Khmer Rouge against the Vietnamese occupation forces, China also supplied the other two groups beginning with a sizeable shipment of weapons to Sihanouk in March 1982. Meanwhile China aided anti-government insurgency groups in Laos and in Vietnam itself (apparently former soldiers of the South Vietnamese army) in opposition to Vietnamese "hegemonism." [50]

In late 1982 and through 1983 there were rumors that China was sending bigger weapons, including tanks, anti-tank guns and even advisors to Pol Pot.[51] In short, the PRC was apparently living up to an earlier promise to make it too costly for Vietnam to continue to occupy Kampuchea. Since then there have been more promises of Chinese arms and supplies and dependable deliveries. Recent indications are that China's arms aid has been successful in that Heng Samrin and the Vietnamese occupation forces are losing control of more and more of the country.

As mentioned above, the PRC has supplied Afghan rebel forces fighting Soviet occupation forces in Afghanistan. But this has not been nearly as large as its aid to anti-Vietnam forces in Kampuchea. Nor has it had the impact. Nevertheless, Chinese arms aid, along with U.S. help and assistance from several Middle Eastern countries, is apparently sustaining the Afghan rebel forces. During 1982 it was reported that in the Afghan struggle Egypt provided the training facilities, China the staging area and weapons, Pakistan the infiltration routes and Saudi Arabia, and several other Middle Eastern nations and the U.S. the funding for the guerrillas.[52] Late in the year Chinese anti-tank mines and anti-aircraft missiles seemed to have changed the nature of the war, forcing the Soviet Union to use different tactics including more terror and high altitude bombing.[53] This situation continues.

In the Middle East, the PRC continues to support the Palestine Liberation Organization, which it has supplied some arms to for many years. In mid-1982 China promised $1 million to the PLO in emergency aid to help in the wake of the Israeli invasion.[54] In 1983 more "emergency aid" was promised to offset Soviet weapons delivered to the Syrian-backed faction of the PLO.[55]

Elsewhere China continues to aid the Southwest Africa People's Organization (SWAPO) and the African National Conference. During 1981 and 1982 promises of aid were made by Beijing, but it is uncertain if any new deliveries of weapons were made. When Premier Zhao visited Africa in 1983 these promises were renewed.[55] Beijing has, and continues, to supply these organizations with arms aid, but does not want it officially announced.

Chinese-made weapons have been found in the hand of guerrillas in El Salvador and in use by the army of Nicaragua. Beijing, however, denies that it has supplied them and there is no evidence it

[50] See Ibid.
[51] "Intelligence," *Far Eastern Economic Review*, March 34, 1983, p. 9.
[52] Bernstein, "Arms for Afghanistan," p. 8.
[53] See "Who is Winning," *Asiaweek*, January 29, 1982, p. 27.
[54] Christopher S. Wren, "China Offers PLO Aid of $1 million," *New York Times*, June 20, 1982, p. 20.
[55] "Chronicle and Documentation," *China Quarterly*, March 1984, p. 177.

has. Probably these weapons were sent by Vietnam or were weapons sold to another country that then sold them to the Soviet Union or Cuba who sent them to Central America.

IV. Conclusions

China has been in the foreign aid business in a substantial way for more than thirty years and should be expected to remain an aid giving nation in the foreseeable future. That, however, does not mean that the PRC's foreign aid program will not change. As indicated above it has and is undergoing rather marked changes. It has shifted in geographical emphasis from communist border nations to non-communist Asian nations and African nations. It has recently used aid to build commercial ties and has turned aid into construction and other projects for profit in a number of countries, especially in the Middle East. China has gotten into the arms transfer business in a major way and for profits. Finally, Beijing is now coordinating its aid with U.N. projects and is trying to use aid to dampen criticism about China taking large amounts of aid and investment capital to the disadvantage of other developing nations.

Until very recently, China has been a capital-exporting nation (with the exception of the 1950s when it imported large sums of money from the Soviet Union). And it did not receive aid from other nations or international organizations. Now the situation has changed. The PRC will soon—assuming its modernization program continues to succeed and it can use foreign capital effectively—become a capital-importing nation of a large magnitude. In fact, in the next several years China will probably absorb, by any definition, huge amounts of capital from the World Bank, the United Nations and from Western nations, including the United States. In this context one can ask: Why doesn't Beijing end its foreign aid giving and use the needed capital at home?

The answer is political. Chinese leaders want to avoid the impression that they are taking an unjustly large portion of the aid and capital available from international institutions and Western countries and in so doing are hurting other developing nations. China wants to give the impression it is cooperating with other developing nations in an effort to win leadership of the so-called Third World bloc. This is not entirely illogical in view of the fact that the PRC is experienced in doing the kind of aid projects that many poor nations need and does serve as a model of generosity for helping other developing nations (in the sense it is a developing country giving aid).

Chinese leaders also find foreign aid a useful and effective instrument of diplomacy. It fosters other contacts, builds friendly, person-to-person ties and gives China a presence in the recipient country it would not otherwise have. It is also an effective tool to counter Soviet influence. It is no doubt for that reason that Western countries have not broached the contradiction in China's aid giving in view of it also absorbing large amounts of Western investment capital and, in fact, frequently laud Chinese aid. From the Western point of view Beijing is in many respects better able to counter Soviet penetration in the Third World than the West. Aid giving for the PRC also carries little risk of direct confrontation with the Kremlin and for that reason is another plus as an instrument for its foreign policy.

Hence it can be expected that the PRC will continue to receive aid from the various international lending and aid institutions while at the same time (though in smaller amounts) financing U.N. and its own aid projects in Third World countries. Counterpointwise, Beijing can be expected to continue to try to graduate many nations from aid recipient status and sign contracts with them for projects that are very similar to aid projects—for profit. Meanwhile China will concentrate its aid on poorer nations, doing small projects that are certain to be completed on time, and successfully, and which will realize an immediate economic benefit for the recipient and thereby build a reputation for the PRC. Beijing can also be expected to continue to expand its military assistance and seek to make money on its weapons sales. The PRC over the last three or four years has succeeded in making its military aid pay for part of its military modernization. Thus military aid makes sense in terms of its own military needs. Beijing also seems less apprehensive of helping or even creating right-wing military governments. As long as these two factors remain China can be expected to continue to be a major competitor in international arms trade.

The PRC in recent years has only infrequently used its aid to realize foreign policy objectives at odds with the United States and this seems likely to remain true. Poland is a recent exception. The Middle East may also be an exception. Arms aid to the PLO certainly is. Otherwise Chinese aid has had the effect of supporting American foreign policy objectives, i.e. in Kampuchea and Afghanistan, and to a lesser extent in a number of other places as well. Beijing's new economic relationship with the United States is very important—even crucial—to China's modernization and this should continue to affect its foreign policy as it has done in the last few years.

The geographical focus of the PRC's foreign aid is likely to remain about as it is now, with the possible exception that some communist nations could once again become important recipients. Albania is one example. Aid to Vietnam is also possible; but that would depend upon Hanoi changing its relationship with the Soviet Union rather drastically. China's strategic interest in Southeast and South Asia will no doubt remain. Its bid for leadership of the Third World will probably continue to be demonstrated through its foreign aid program, especially in its relationship with African nations. Chinese leaders probably preceive that the PRC cannot gain much influence in Latin America and will continue to concede this region to the United States. Beijing may make some exceptions to this policy occassionally—though this will hardly be a problem for the U.S., especially if Chinese aid giving is motivated by anti-Soviet policies as it has been recently.

Chinese aid will no doubt continue to concentrate on small projects that it can complete quickly and which emphasize agriculture and construction projects and medical teams, and, where appropriate, Chinese expertise and labor. The generous conditions in aid giving in terms of mostly no-interest loans and long repayment periods will probably continue at least in aid giving to very poor countries. Free arms aid will no doubt continue to be given to selected guerrilla groups especially anti-Soviet and anti-Vietnamese ones. China getting into the commercial loan business in the case of Bangladesh is probably an exception and is not a prescedent that will be followed.

Finally, the PRC can be expected to remain a foreign aid donor model and try to enhance both its international image and influence using foreign aid. After all aid is the mark of a big power. Historically China gave aid and this kind of relationship proved its virtue and its universality. This will probably continue to be true in the foreseeable future.

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