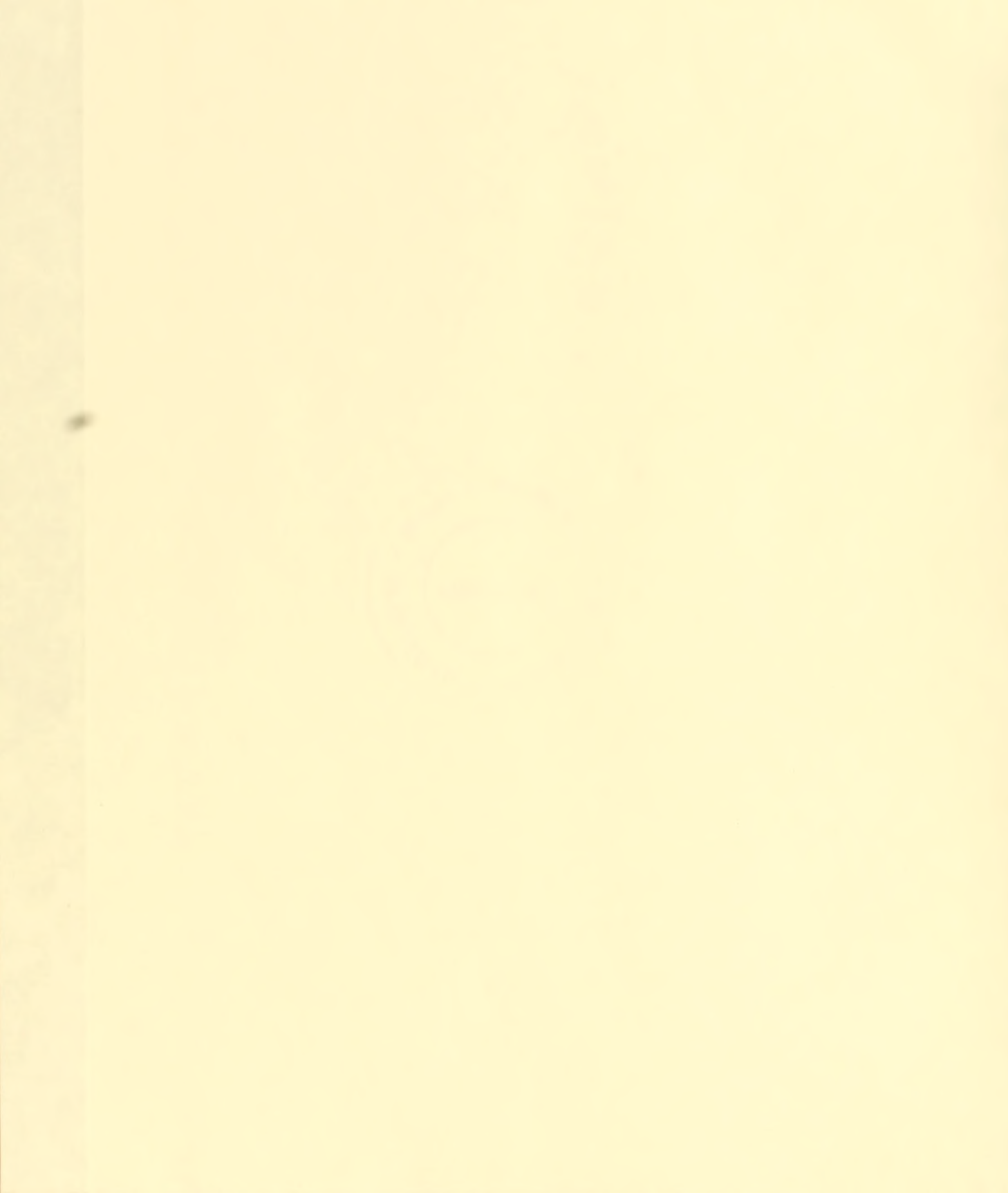


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Some Thoughts on
The Challenge of Modernizing Industrial Technology
in China
Implications for Sino-U.S. Relations

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Introduction

Beginning with the announcement of the Sixth Five Year Plan (1981-85), China has sought a quadrupling of the gross value of its industrial and agricultural output by the year 2000. To achieve this goal, Chinese economists have indicated that the economy must register a 7.2% yearly increase in value. In many respects, this is not an overly-ambitious goal, particularly in view of the numerous opportunities for increasing overall output in certain sectors with only modest improvements in inputs and organization. Yet, while from a physical point of view quantitative increases in growth can be attained, a more important measure of assessing China's potential comes from examining the composition of growth. As both foreign and Chinese observers indicate, the problem of China's economic development is as much a qualitative one as a quantitative one. Without significant improvements in the technological and managerial base of the economy, China's ability to follow a path of sustained economic growth on a long term basis will be severely constrained.

In recognition of this fact, Chinese leaders have paid increasing attention to the role of technology development in their modernization program. The upgrading of domestic technology capabilities has continued to be one of the regime's highest

priorities--even though the PRC leadership, for the most part, has moved away from its over-exaggerated expectations for modern technology. Chinese leaders have realized that their modernization problems stem not merely from China's own technological backwardness--which is a serious bottleneck in itself--but also from a combination of factors that are more frequently associated with the so-called "software" aspects of production. These factors include factory management and industrial organization, the nature of the links between research and production, the age and mixture of equipment in Chinese enterprises, attitudes towards and the treatment of scientific and technical personnel, and the overall structure of incentives within the economic system.

In an effort to rectify the present situation and improve overall productivity in the industrial sector, Chinese leaders in Beijing have placed special emphasis on the technical renovation and upgrading of plant and facilities. In fact, one of the most salient aspects of the entire modernization program is the attention and resources that are being devoted to the "technical transformation of enterprises (jixu gaizao)." While many of the renovation efforts underway in China's provinces and municipalities do not seem to stand out from the perspective of size or scope, there remains little doubt that collectively they constitute one of the most important features of the modernization program.

The issue of technical transformation takes on special importance for the outside world in view of the fact that the Chinese hope to accomplish much of their technical upgrading and plant modernization through expanded contacts with foreign firms and industrial specialists. In fact, one of the primary reasons for adopting the open door policies now in place has been to attract foreign involvement in the Chinese economy. By relying on a variety of forms of foreign involvement, the Chinese have hoped that foreign participants would contribute their know-how, their production technology, and their managerial expertise to assist local manufacturers become more efficient and effective producers.

This paper will discuss various aspects of China's science and technology modernization program, focusing on the program for technical transformation of enterprises. It will suggest that from the perspective of China's relations with the US, this program stands out as a critical area where cooperation and expanded consultation could be mutually beneficial. The potential for equipment sales, technical cooperation, and technology transfer appears to be particularly great in this regard. In this context, the US Government should do a better job of using its various bilateral cooperation programs with China in the so-called "science and technology" to include the US private sector. And, it should also clarify its political expectations vis-a-vis the US-China relationship so that trade promotion-

related activities in such areas as funding and credits and technical assistance can receive appropriate levels of political and economic support.

The paper also will highlight a number of key bottlenecks affecting China's efforts to achieve the goals set out in this program. Improvements in the Chinese management of technology transfer and foreign investment will be necessary if China is to successfully harness foreign technology and capital to serve its development goals. It will also argue that perhaps one of the reasons why the technology transfer issue between the two countries has been clouded in controversy is because of communication problems. Too often, both American and Chinese firms have aimed too high in their expectations. Significant levels of trade and economic exchange could take place in areas vital to China's modernization without coming into direct confrontation with prevailing export controls and COCOM restrictions.

The Program for Technology Modernization in Industry

Since 1978 Chinese leaders have been grappling with two principal forms of promoting technological advance. On the one hand, one school of thought has advocated a gradual approach through modest improvements in the technology and management of production. Another school has advocated a much more rapid pace of advance, stressing the importance of making major leaps forward

through fundamental change of the country's technological base. For the most part, the viewpoint of the "gradualist" school has predominated and is still in ascendance. Periodically, however, the Chinese scene has been confronted by a series of debates between the two groups, the latest example coming in late 1983-84 over the implications of what Toffler has called "the third wave" and others have called "the new technological revolution."

The essence of the debate concerns what China's response should be to the growing importance of four key technologies in the economic, social, and military affairs of the industrialized nations: biotechnology, microelectronics, information technology, and new materials. Following the line of thinking put forth by Toffler, the Chinese see a qualitative change occurring in the basis of industrial strength and competitiveness,. Several leaders have argued that unless China is able to make significant advances in these four key areas, the technological gap between China and the West will grow even wider. In view of the fact that the present leadership has based its credibility, in many ways, on its ability to close the gap and establish China as a major force in global economic and technology affairs, such a development would be politically unacceptable. Thus, while China's stated policy is to attain by the year 2000 Western technological levels of the 1970s and 1980s, many in China believe that this goal is too modest as it would still leave China 20 years behind the industrialized nations.

The merits of this latter viewpoint continue to be debated in China today. During a recent visit to Shanghai in July, numerous journal and newspaper articles addressed the issue of China's ability to make progress in these four areas. Yet, the fact remains that most economic and technology leaders have continued to pursue the tempered approach for fear of the risks inherent in adopting a more ambitious path. In the industrial sector, this has meant that promotion of incremental technological change has become the generally accepted strategy. During the 6th Five Year Plan, technology transformation has been implemented in selected enterprises; during the 7th FYP the program will be expanded and carried out in a more extensive fashion. Gradual advance through incremental technical improvement encompasses several major objectives: a)renovation of the lineup and functions of machinery and equipment, b)improvements in product and process technologies, and c)more efficient use and substitution of raw and processed materials.

The task of updating production equipment, product designs, processing technologies, and testing and measurement capabilities constitutes a major undertaking. A survey taken in 1983 revealed that 20% of the equipment in industrial enterprises was from before the 1950s, 75% was from the 1950s and 1960s, and only 5% was from the 1970s and 1980s. Estimates suggest that 25% of the state-owned enterprises in the industrial sector require complete

renovation. Moreover, due to the combined impact of Western export controls and China's own trade policies, much of the equipment has been sourced from different countries, leaving many factories with problems of equipment compatibility. These factors, combined with the disincentives inherent in the planning system, have lead to the production of finished and semi-finished products of low quality--most of which would not be competitive in world markets.

The idea of promoting technological transformation as a major policy initiative was first put forth at the 3rd Plenum in December 1978. It was at this plenum that China introduced the program of economic readjustment--one consequence of which was the decision to move away from excessive reliance on whole plant imports as a major form of technology acquisition. However, it was not until the 12th Party Congress in late 1982 that the strategic guidelines for the plan were articulated. Four main elements were identified at the time: 1)a change in the previous policy of emphasizing extension of factory as the primary mean to increase output; 2)an admonition to approach the problems of industrial modernization in a gradual fashion through unified planning and focusing on "key" projects; 3)a stress on the improved and expanded application of science and technology in industry; and 4)a greater reliance on non-centrally derived funding sources, including private funding, bank loans, and enterprise funds for accomplishing transformation goals.

The problems within the industrial sector during the pre-1978 period have been well-documented by both Western Sinologists and Chinese scholars and policymakers. Under the old system of emphasizing factory extension and additional capital construction, the main focus was on output; quality considerations were often neglected. Attention was paid solely to increasing the number of machines at the original technical level without markedly changing the backwardness of enterprises. Introduction of the concept of unified planning is designed to ensure that technological transformation is an integral part of economic reform. This notion has been carried forward in the October 1984 Central Committee Decision on Economic Reform of the Economy. Special importance is to be given to conservation of energy, reduction in the consumption of materials, improvement in product quality and diversity, improvements in the utilization of equipment and personnel, promotion of safety measures, and greater attention to environmental protection.

The expanded use of new technology is essential if the above goals are to be achieved. China's leaders have acknowledged that at least one-half the gains towards the achievement of the quadrupling goal will have to come from expanded use of science and technology. In 1984, China manufactured over 130,000 machine tools, second in the world. Yet, 87% of the tools were vintage

1950s and 1960s.¹ Production of advanced computerized machine tools accounted for only 2% of national production. Replacement of most of the obsolete equipment over the next decade would require an outlay of at least US\$10 billion--a large part of which would have to come in the form of foreign exchange.

In some cases, Chinese leaders realize that the most practical answer is to make better use of existing equipment through improvements in plant layout, better maintenance, and use of more skilled operators. In other cases, however, there is no alternative but replacement. This does not mean that China must procure new, state-of-the-art machine tools from Cincinnati Milicron or other firms to meet all its needs; in many cases, the international market for used machine tools is an excellent source. It does indicate, however, that if China is to enter world export markets, it must be able to attain the higher levels of precision and quality required by the competitive dynamics of these foreign markets.

The emphasis on obtaining funding from local level sources and through bank loans is designed to reduce the financial pressures on the central government. As it is, the central government has provided substantial funding for technical trans-

¹China has roughly the same number of machine-building enterprises as the US, about 100,000. Yet, while the number of employees in China's industry is 50% more than the number of American workers, the output of the Chinese machine-building industry is about 1/10 of that of the US.

formation projects. According to the State Economic Commission, between 1985-87, 90 billion yuan will be spent on technical renovation, with 14.2 billion yuan in the form of foreign exchange for imported technology and equipment acquisition. Part of the problem is that a considerable percentage of the investment designated for so-called "technical transformation" is not actually used for that purpose. In some areas, as much as 40% of these funds have gone for new capital construction and expansion of existing facilities. A related problem is that there has not been an incentive or desire to use some of the available funds. In Tianjin in 1983, for example, only 32% of the planned loan funds made available for technical renovation and upgrading purposes were used. A combination of poor management and inappropriate economic signals, e.g. prices, may be the cause in such an instance.

In assessing China's technical transformation program, it is important to appreciate the difference between actual technological upgrading and simple equipment renewal. During a visit to several electronics and computer factories in Shanghai, it became apparent that for many factory managers, this distinction is not very clear. In the case of technical transformation, the foundation of the original equipment is used in choosing advanced technology to transform the organization of the equipment or improve its capabilities. In some cases, key parts are modified to increase precision and improve production ef-

efficiency. Equipment renewal refers mainly to the replacement of old equipment and machinery with more modern, new equipment. In certain instances, new equipment has been acquired, but has resulted in little actual production improvement or has resulted in increased consumption of energy and raw materials. Based on policy directives from Beijing, as well as cost considerations, the emphasis should be on effecting a refinement or basic shift in the orientation and organization of the entire production process. If the old equipment can be repaired and operate efficiently within the context of a new and better production framework, then large numbers of new purchases should be avoided.

Within the prevailing tax framework and system of depreciation, it has been difficult to determine when so-called "older equipment" should be discarded. In the past, inadequate attention was paid to the question of how to make better use of technological progress in equipment maintenance to attain greater economic benefit. In general, technical innovation was given a low priority, especially in state-owned firms. According to one Chinese source, most of the renewal efforts in the past were directed at "the replication of antiques." Major overhauls were done three, four and even five times on some machine tools due to the fact that large sums of funds were made available for equipment repairs, but it was difficult to secure funds for renovation or replacing existing equipment. The fact that there has been and remains a very large contingent of repair personnel within Chinese

industry attests to the widespread presence of old, backward equipment that continues to be repaired rather than replaced.

In April 1983, a leading official of the SEC addressed the problems of technical transformation at a National Work Conference on Technological Advance in the Machine Building and Electronics Industries. He enunciated 12 points that have come to form the crux of the current technical transformation policy. Summarizing, he indicated that the guiding ideology of economic work should be to rely on technical advance for achieving greater productivity. Substantial efforts will be directed at strengthening the research and development of new products and building up research and design capabilities. In order to motivate, and if necessary, pressure enterprises into paying more attention to the value of technical advance. there will be greater stress placed on implementation of the "production responsibility system" in the industrial sector. Chinese leaders believe that this will help speed up the pace of technology introduction, improve linkages with the research sector, and promote more rational utilization of resources.

According to the present guidelines, the main thrust of the technical transformation efforts will be in the machine building and electronics industries. The main goals, which were set in the "Trial Regulations for the Technical Transformation of the Machine Building and Electronics Industries" announced in 1983,

include a speedup in the updating of products, greater reliance on international standards, improvements in the quality of products, and attainment of the 1970s and 1980s technical levels of the West--except for the electronics industry--which is to reach these levels by 1990 instead of 2000.

Research and technology-related activities constitute the core of the entire program for technical transformation. The "Trial Regulations" list the five following methods to achieve the above goals: 1)strengthen R&D, constantly improve old products, and develop new products; 2)improve existing technologies, adopt new technological methods and processes, and achieve better product quality and economic results; 3)transform and update equipment according to priorities, adding key production equipment and testing/measuring facilities as required for improving product standards and adopting new technologies; 4)readjust work sites and transform the necessary plant buildings and facilities according to modern technological layouts and the requirements of environmental protection and technical safety; and 5)introduce corresponding improvements in management and plant operation and improve the training of technical personnel.

The initial items designated by the "Trial Regulations" for technical transformation include the following:

a)products of fundamental importance that have a bearing on the technical levels of the machine building and electronics

industries as whole, such as basic parts of machines, electronic devices, machine tools, instruments, testing equipment, and key semi-finished products.

b)key products urgently needed in the national economy and defense construction such as machines and electronic products needed to develop agriculture, light and textile industries, save and develop energy, strengthen communications and transportation, and develop the raw materials industry.

c)machines and electronics products for daily use which have a direct bearing on the improvement of the people's material and cultural life and which can meet market demand and increase state revenues.

d)machines and electronic products which urgently need to be developed in order to increase exports and reduce imports.

The Role of Technology Transfer

Chinese leaders have indicated that imported technology and equipment will be used to support the technical transformation program. According to Bo Yibo, "in technical transformation of our national economy we mainly rely on our own strength, yet this does not exclude the introduction of advanced technology from abroad for the purpose of making ourselves able to produce what we need." In most cases, primary stress is being placed on acquisition of know-how and selected pieces of equipment rather than whole plants or large quantities of foreign-made equipment. One

immediate beneficiary so far has been China's textiles industry, which through numerous technical improvements, is now attempting, albeit gradually, to move into higher value-added segments of the international textile market.

The emphasis on know-how is designed to reduce potential long-term dependence on foreign sources and promote China's goal of greater technological self-reliance. Technology transfers are no longer viewed as an end in themselves but rather as a means to enhance China's own capabilities. In spite of the leadership's assurances about the staying-power of the open-door, there remains a firm commitment to the principle of increased national self-reliance. Between 1950-1980, over 90% of China's so-called "technology imports" were in the form of whole plant purchases rather than licensing and acquisition of know-how. Chinese leaders believe that while these whole plant purchases did assist in increasing output in certain critical areas, e.g. fertilizer production, they resulted in little actual technology transfer. Accordingly, China's leadership believes that the primary emphasis in current import policy should be on "software" rather than hardware.

Chinese leaders see foreign technology having six principal benefits: 1)contribute to greater national technological self-reliance; 2)help accelerate technical transformation of enterprises; 3)assist in the expansion of exports; 4)shorten the time,

risk, and cost of domestic research programs; 5) provide opportunities for gaining management experience; and 6) serve as a context for training technical workers. An indication of the importance attached to importing technology is reflected in the fact that in 1984, transactions for 1,620 items were completed with a value of US\$1.56 billion--2.5 times the quantity and value in 1983.

As a complement to the purchase of selected pieces of key equipment, there also has been an upgrading and proliferation of S&T and management training programs. Enhanced management skills are needed at both the upper and middle levels to ensure that various projects are carried through to completion in an effective and efficient manner. Accordingly, along with the re-training of factory and R&D managers that is taking place domestically, overseas management training programs as well as bilateral programs are being expanded. China now has cooperative management training activities with the US, FRG, Sweden, Japan, Canada, the EEC, and Hong Kong. Commercial agreements usually also include a provision for training Chinese managers, engineers and technicians. A major task will be sorting out the major features of each of these programs in order to develop what Deng Xiaoping has called "a Chinese-style of management."

Essentially, the Chinese are trying to improve the use of imported technologies so that the expenditure of foreign exchange

can show some tangible results. Past mistakes concerning the import of technology were numerous, especially in terms of the selection of technology. In addition, in many instances spare parts could not be obtained or domestically manufactured, raw materials necessary to operate the imported plants and machinery were often inadequate, there were not sufficient numbers of qualified personnel to operate the imported items, and maintenance was very poor. Serious duplication problems also existed. And, as mentioned, there was little diffusion within China once the "technology" crossed Chinese borders.

In 1983, the State Council adopted two major steps to improve the system of technology imports. First, in conjunction with the SEC, SPC, and SSTC, a list of 3,000 key items was identified as priorities for import during the 6th FYP. The majority of these items were aimed at supporting the technical transformation efforts. Second, several cities, including Shanghai and Tianjin, were given expanded decision-making power regarding the import of technology as well as engaging in cooperative agreements with foreign companies. Persons responsible for overseeing technology imports also were admonished to do a better job in selecting appropriate recipients of foreign technology. In contrast to previous policies, only enterprises with relatively high technical and management levels are eligible to acquire foreign technology and equipment. This has been done to avoid the problems of "indigestion" that frequently plagued China in the

past.

In 1985, the State Economic Commission announced that it will be expanding the list of 3,000 key items, the main objective of which will be to further the technical transformation of local small and medium enterprises. The key industrial sectors targeted in this announcement--which also have been emphasized in the 7th FYP--include textiles, food processing and packaging, electronics, machinery, fine chemicals and pharmaceuticals, new building materials, and energy-related technology, especially in the area of conservation. The Chinese have indicated that Western firms providing expanded amounts of technology will be given preferential treatment in the development of commercial relations. In particular, Zhang Jingfu, former head of the SEC, indicated that such firms would be provided increased access to the Chinese market in the case of joint ventures, co-production, and other forms of foreign investment.

In this respect, China sees foreign investment as a major mechanism to acquire foreign technology and know-how. In fact, Western lawyers attest to the fact that negotiations over the "technology component" constitute the most controversial component of most foreign investment/joint venture agreements. According to preliminary statistics, over US\$4 billion has arrived in China since 1979 in the form of foreign investment, joint ventures, cooperative agreements, compensation trade, etc. Over

700 joint ventures worth US\$1.14 were approved in 1984 alone. While over 80% of these are from Hong Kong and Macao and tend to be rather "small" in size and scope, taken together they still constitute a potentially important source of expertise for Chinese industry. Even in cases where the Chinese are performing nothing more than assembly operations, they consider these activities to be important as preparation for meeting the quality levels necessary to enter into world markets in the future.

China's Assimilation of Foreign Technology

Through a combination of economic and S&T reforms, the Chinese have attempted to upgrade their domestic industrial and technological capabilities as well as to enhance their ability to utilize foreign technology. New policies--many of which were announced in the March 1985 Central Committee Decision on S&T Reforms--have been introduced to encourage contract R&D, establish technology markets to stimulate the diffusion of technology, and ensure better linkages between acquisition mechanisms and the end-users of technology. Factory managers, faced with the reality of having greater discretion over profits and losses, have begun to take a more realistic approach to the selection and use of technology imports. Moreover, as the capabilities of the end-users have become better matched with the available technology, China's ability to make effective use of imported items has steadily improved over the last several years.

Nonetheless, even though substantial progress has been made, especially with respect to the goals of technical transformation, serious absorption problems still remain. Studies of previous cases such as the Spey engine, the Wuhan steel mill, etc. indicate that many of these problems have a long history. Of course, it is difficult to measure "successful" assimilation and to know exactly when one can be said to have effectively assimilated a foreign technology. Additionally, as the history of countries such as Japan has shown, it is often the minor, incremental changes at the margins that make the key difference rather than the wholesale adoption of radical technical innovations.

Still, one must distinguish between case-specific problems that are inherent in the transfer process involving complex technologies and those that are more generic within the Chinese system. Interviews conducted in Shanghai in July 1985 revealed the continued existence of four key problems: 1) an excessive tendency to seek out only the most advanced technology; 2) a continued over-emphasis on hardware; 3) a lack of clarity with respect to overall technology imports; and 4) a slowness in the decision-making process, resulting in lost opportunities and/or poor preparation for assimilating the imported items. In this last regard, the system remains hampered by the lingering adherence of many individuals to a complicated bureaucracy; they remain so tied to the old system that they are unwilling to accept basic

changes. Moreover, there does not exist a formal evaluation process or feedback system to assess technology imports or the reliability of suppliers and the appropriateness of the technology.

In essence, there continues to be a great lack of uniformity throughout the economic system and a great unevenness in the quality of enterprises. Limited resources, poor organization, an undeveloped infrastructure, and inefficient use of qualified personnel are all persistent problems. All of this suggests that what will most likely emerge in the future are a series of "pockets of excellence" in China created through a combination of foreign technology and indigenous efforts. In this regard, electronics and textiles seem to stand out. In both cases, large quantities of technical, financial, and personnel resources are being made available through increased local investment as well as various forms of cooperation with foreign firms. Certain specific enterprises will develop at a rapid pace due to their higher levels of managerial competence as well as a variety of firm-specific and location-specific advantages. These will be enterprises that can take advantage of the prevailing opportunities by virtue of their great capacity to overcome the numerous organizational and managerial bottlenecks that plague their counterparts.

Implications for Sino-US Relations

Cooperation in science and technology has become a centerpiece in the Sino-US relationship. Bilateral cooperation programs, which are covered under the government-to-government umbrella agreement renewed in 1984, now number 24; over 400 separate projects have been undertaken within the framework of the overall cooperative agreement. Approximately 12,000 PRC students and scholars are studying in the US, over 90% in the fields of science and engineering. Yet, while scholarly exchanges and scientific cooperation have proceeded forward with only a few problems, commercial cooperation regarding technology transfer has continued to proceed at a relatively slower pace--especially when one considers the growing breadth and depth of the Sino-Japanese commercial relationship. Given the importance of technology transfer in the context of relations between Washington and Beijing, it is important to understand the nature of the problems and to ascertain what steps need to be taken to move ahead at a pace acceptable to both sides.

In the past, a major constraint has been the export control system and COCOM--both of which served to restrict the sale of advanced technology to China. While some believe that fairly strict export controls were necessary during the initial phases of Sino-US rapprochement, at present there is general consensus that many of these restrictions should be significantly relaxed. And, in accordance with this consensus, the US has taken several major steps since mid-1983 to loosen its previous controls. The

trade figures issued by China's Customs Bureau indicate that in 1984 Chinese imports from the US were up 67% over 1983. While items such as cereals, logs, and chemicals were imported in large quantities, there were substantial increases in the purchase of scientific instruments, telecommunications equipment, office machines and computers, and specialized machinery. For example, American firms shipped US\$101.2 million of computer-related products to China, compared with US\$50 million in 1983. Expectations are that sales of these items to China will also increase in 1985.²

Nonetheless, complaints continue to exist on both sides. From the US point of view, serious concerns remain about the possible diversion of ostensibly civilian technologies into the military sector. In spite of the greater emphasis being given to civilian economic modernization in China, it remains clear that priority programs such as strategic weapons have not been downgraded and that the demand within the Chinese military for advanced technology in such fields as computers and microelectronics remains quite great.³ Second, China's demands for greater access to the "know-how" aspects of US technology and equipment

²In the first seven months of 1985, computer sales totalled US\$69.9 million, compared with US\$43.5 in the year earlier period.

³There appears to be two factions within the military regarding so-called "technology imports," one preferring purchase of final products for immediate deployment and another that prefers to focus on acquisition of know-how so that eventually China can more produce needed weapons and military equipment itself.

occurs at a time when there is great anxiety in the United States about what some have called the hemorrhage of American technology overseas. Recent evidence of Soviet clandestine acquisition and use of American technology, growing examples of illegal diversion to non-approved countries as well as the declining competitive position of US industry in a number of areas have made both the government and private sector somewhat more cautious about releasing critical product and process-related know-how. In some cases, some American firms have expressed reservations about giving too much technology to China for fear of "creating another Japan." These attitudes and concerns in the US should not be taken too lightly because they verge on the emergence of a new era of neo-mercantilism with technology being the prized commodity.

Third, American firms willing and anxious to enter the China market and provide needed technical assistance continue to face a massive series of bureaucratic obstacles. It is still not clear who ultimately has appropriate decision-making authority even though various dollar levels of autonomy have been announced for cities such as Shanghai. If the US bureaucracy is slow concerning technology exports, the Chinese bureaucracy may be even slower and perhaps even more unpredictable. Moreover, there remain so many unanswered questions about profit repatriation, access into the local market, acceptance of restrictions on the use of the

transferred technology,⁴ and the control over labor that doing business in China remains terribly frustrating--especially when one has alternatives such as South Korea, Singapore, Hong Kong and Taiwan who are ready to accommodate foreign business community. These frustrations are compounded by the tremendous costs of doing business in China, costs that go beyond the immediate problems of language translation, etc. Foreign businessmen feel that they are being "squeezed" while in China--and this does not help develop good will.

Fourth, in spite of China's adoption of a new patent law in April of this year, American companies (and their lawyers) remain apprehensive about the protection of their proprietary information. Reports continue to reach the United States of examples of unauthorized copies of everything from petrochemical plans to integrated circuits and semiconductors. Non-approved "knockdown"

⁴China's regulations concerning technology imports preclude the inclusion of the following so-called "restrictive clauses" in business contracts: a)restrictions on the recipients options to raw materials, equipment, and accessories from different sources; b)restrictions that prevent the recipient from developing or improving imported technology; c)restrictions that prevent the recipient from receiving similar or competitive technology from other sources; d)restrictions that stipulate unequal conditions for exchange of improvements on the technology between supplier and recipient; e)restrictions on the quantity, variety and price of products manufactured by the recipient with imported technology; f)use of unreasonable restrictions on sales channels or export markets; g)restrictions on the recipient's use of imported technology after the contract expires; h)requirements that the recipient pay for or bear obligation for unused or invalid patents; and i)stipulations that force the recipient of the technology to accept requirements unrelated to the technology import such as purchase of unnecessary technology, technical services, equipment, etc.

versions and "copies" of US personal computers acquired through Hong Kong are widespread in China's largest cities. Implementation of a national patent law was clearly an appropriate step, but numerous uncertainties exist about the enforcement of the law, especially in terms of which organizations (and at what levels) will have the responsibility for making sure that violations are handled in a rapid and efficient fashion. In this regard, the new national "regulations for technology imports" issued by the Ministry of Foreign Economic Relations and Trade in May 1985 do not contain any specific stipulation of penalties for violation of proprietary information.

Lastly, there remain a host of unanswered political questions regarding China's future that continue to distress foreign businessmen as well as members of the US Government. These questions not only refer to the longevity of the present open door, but also to China's policies and intentions towards the US in various regional and international arenas. One might rightly ask how these differences affect technology transfer, which tends to be a purely commercial endeavor. The answer is to be found in the approach of the US Government vis-a-vis the Sino-US commercial relationship. Various steps in the areas of aid, concessionary financing, etc. have not yet been taken or have been late in developing because of the outstanding political questions that remain. China's notion of an independent foreign policy has led to a great deal of uncertainty among some in the

US Government, especially in the Congress, and the American scholarly community about what to expect from the Sino-US relationship over the immediate and longer term.

From the Chinese perspective, it is clear that the US is still viewed as seriously lagging behind in terms of the relaxation of export controls and the reform of the COCOM system. Yet, the US has been a principal force behind the current changes underway in the COCOM list--and while delays will continue to be a problem, the fact remains that there has been and will continue to be a significant easing of restrictions.⁵ Nonetheless, over the short-term there still will be items denied to China--mainly in the area of technologies that would demonstrably contribute to China's enhanced capabilities in the so-called "six special mission areas"--nuclear weapons, nuclear delivery systems, antisubmarine warfare, electronic warfare, intelligence gathering systems, and power projection capabilities, e.g. long-range aircraft. It is important that both sides learn to live with this reality.⁶

⁵As of late 1985, there were indications that COCOM would move to a notification system for China, thereby significantly curtailing the amount of paperwork and review time needed for processing China applications. The US was a principal force behind this relaxation.

⁶One of the major goals of US policy has been to earn China's commitment that advanced US technologies would not be diverted to non-approved military uses, nor would they be re-exported to third countries such as the Soviet Union. The recent easing of tensions between Moscow and Beijing has raised some concerns about the latter problem.

Many US industrial and management experts have argued that China should have more modest objectives vis-a-vis the acquisition of foreign technology. As suggested, significant gains in Chinese productivity could be achieved with the help of US industrial experts without major investments in expensive technologies. The experiences of other developing nations indicates that, quite often, the largest, latest or most advanced equipment is inappropriate for countries with a large labor force and a shortage of capital. In the past, some Chinese officials have interpreted these comments as a suggestion that China should settle for "second best" technology. While it is true that in some areas technologies are changing very rapidly, the fact remains that the choice of technology is a complicated process, one that is best determined on the basis of cost-benefit calculations rather than political perceptions or emotional considerations of national pride.

In China, there continues to be bewilderment about why the American business community remains behind its Japanese counterparts in responding to the emerging business opportunities in China. Given American strengths in industrial management and organization, the US corporate sector has the potential to play an important role in China's program for technical transformation of enterprises. On several occasions, Chinese officials have indicated that they prefer American technology and equipment,

especially since they find American firms more forthcoming regarding technology transfer.

In some cases, Chinese criticism is justified, especially since the Japanese have already made great strides in support of such Chinese programs as the one concerned with technical transformation. US activities seem aimed, for the most part, at bigger, more ambitious projects. At the risk of over-generalizing (and they are some important exceptions to the following remarks), American firms, in many cases, seem less prepared to do business in countries such as China, lacking the area and language expertise as well as suffering from a general lack of orientation for doing business in foreign countries. While the Japanese head out into China's interior, most US business executives remain in the big coastal cities. As several Chinese have remarked, many US firms will not take the long view, while the Japanese have taken a much more realistic approach to doing business in China. Given these factors, the American business community has probably missed some important opportunities in China. This is especially true regarding Chinese efforts to develop its light industrial sector, including industries such as packaging, food processing, paper, etc.

China also remains concerned about its export potential when countries such as the US continue to consider possible protectionist measures. If China cannot export, it cannot import the

technology and equipment it needs to modernize its industry. For some in the US whose jobs are directly threatened by the growing number and quality of Chinese textile exports, this may not seem like a major problem. However, from the perspective of the imperatives of the modernization program and earning foreign exchange, China appears unwilling to accept US reasons for present limits on expanded access to the American economy.

Both countries could realize important benefits if these problems could be equitably resolved. In many respects, China's push for technology and access into the international market is occurring at a very unpropitious time. For the US, the issue of technology transfer involves coming to terms with some very delicate multilateral issues, including the political aspects of our relations with Western Europe and Japan vis-a-vis the USSR. Additionally, concerns about potential "economic" competition from China extend beyond the United States into parts of Western Europe and Southeast Asia--and potentially involve major foreign policy questions about the emerging role and structure of the Pacific Basin. During a recent visit to Thailand, concerns about China's economic power as well as the intent of US policy toward the PRC were made quite explicit by several Thai economists. It is important for China to understand the nature of the international political and economic climate at this point in time and to indicate its willingness to work within the accepted institutional structures and agreement to resolve its disagreements.

From the perspective of overall US foreign policy, the time has come to take a closer look at our objectives vis-a-vis China. Unlike Japan, we lack a national strategy towards China. As such, our desire and ability to do business in China has suffered. One area would be to establish closer working links between our bilateral S&T programs with China and our commercial activities. This was the original goal of the Carter Administration at the time of the signing of the government-to-government agreement in 1979. However, due to the onset of China's readjustment program and continued policy uncertainties on our part, this connection did not develop. It is now time to bring the private sector into closer contact with these programs. US firms also need to become more aware of the most technologically dynamic aspects of the Chinese economy. American companies would do well to pinpoint with Chinese assistance those areas where so-called "pockets of excellence" are likely to emerge. In such cases, the potential for cooperation in R&D as well as production may exist.

Over the long term, it is clear that an active Sino-US relationship in the technology area is important to both countries. However, such a relationship can only prosper within the framework of a strong political relationship. The opportunities for cooperation are immense, but so is the potential for misconception, especially within the prevailing global environment. In this regard, it is essential that the dialogue between the two

countries be kept open, that information exchange be expanded, and that technology of communication be strengthened in the future. China and the US both have much to learn about each other; both time and patience will be needed to realize the possible rewards.



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