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TECHNOLOGY TRANSFER IN JAPAN

An Introduction to the Current State of Japanese Industry

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Foreword

I wish to thank you, Dr. Sherman Gee, Chairman of the Organizing Committee of this conference, as well as the representatives of various countries, for having accorded me this opportunity to present to you the situation currently prevailing in my country, Japan.

A variety of obervations and evaluations are today being made both at home and abroad concerning recent developments in the Japanese economy. Some of them give high marks to our nation for having appropriately dealt with the grave confusion created by the petroleum crisis that arose in the Fall of 1973. Also noticeable are the complaints that we are upsetting the economic order of various countries by increasing our exports, riding the crest of a wave, as our efforts to develop the competitiveness of our products have met with success.

Even for us who are directly involved, it is difficult to gain a correct perception of the actual state of the Japanese economy. I believe

it is because this economy is caught in a whirlpool of violent change. The result is that either or both of the two observations I have cited may be true; it is difficult to grasp the whole picture of the numerous complicated phenomena existing today.

I therefore intend to introduce to you the current situation in Japan, while keeping in mind my assigned theme of "Technology Transfer."

I. The Postwar Contributions to the Japanese Economy of Technology Transfer from America and Europe

Following the enactment of the "Law on Foreign Capital" in 1950, various Japanese enterprises made very energetic efforts to import advanced technology from the United States and Europe, seeking to catch up with the level prevailing in the industrially-advanced Western nations. One of the reasons for this was the need to manufacture domestically various required products at a time when the balance of payments followed a deficit trend because of structural reasons. This became our basic policy as a nation.

Another reason was the conculsion reached that it was more advantageous both from the financial and time-saving aspects to import advanced technology by paying for it in order to make up for the then existing dearth of advanced technology, taking into consideration the prevailing financial difficulties of individual Japanese enterprises.

A further point that must be mentioned is the special circumstances in which Japanese industry found itself before and after the Second World War. There was a tendency to deny industrial property rights to technology developed by private industry and pressure towards donating it to further the nation's industrial power. This trend developed from 1934 onward as the country moved onto a virtual war footing. As a result, even such technology as was publicly known in our country was found, after the war, to infringe upon patents of foreign enterprises. There were numerous cases where Japanese enterprises in spite of possession of their own technologies had to obtain licenses from foreign companies under their patents. Furthermore, the then existed patent rights of the Allied Nations were extended for a further period of ten years by order of the Occupied Forces. This put Japan in a very inferior position concerning technologies.

Under such circumstances, patents and know-how concerning various chemical products, electrical and electronic devices, varied transportation equipment, metallurgy and machinery were imported in rapid succession. This introduction of new technology reached its peak between 1955 and 1960 and it was absorbed and put to use in a comparatively short period of time. Products produced with this imported technology initially served to develop the domestic market consisting of 100 million inhabitants, bringing about the GNP growth exceeding 10% throughout the 1960s.

In the meantime, the government provided guidance and support to convert the existing labor-intensive industrial structure, centered on light industry, to a capital- and technology-intensive structure centered on the heavy and chemical industries. While restricting random new entries into industry on the one hand, it paid due attention to the maintenance of the market principle of free competition. The nickname for the Japanese economy, "Japan Inc.," that was bandied about some years ago, may be said to be the proper evaluation of this system of governmental and private cooperation that prevailed in the stage when Japan sought to catch up with the industrially advanced countries. The term "Japan Inc." is used still now, but in most cases, this word seems to be used through misunderstanding of a real state of Japan or for lack of sufficient information on it.

Is this leap forward of the postwar Japanese economy simply an imitation of what industrially advanced countries has already accomplished? Before answering this question, I should like to present you with a very brief description of Japanese history.

It is true that from the historic occasion of the visit of the American fleet led by Commodore Matthew C. Perry in 1853, Japan established relations with America and Europe and developed a modern civilization within a century, exactly half of the 200 years since the Industrial Revolution that were required by the Western world to reach the same goal. But this was not the first international technology transfer into Japan. It was actually the third wave.

The first instance was the technology transfer from the Chinese continent in the 7th and 8th centuries at a time when this marked its climax in Japan. This was the first wave. As you are probably aware, the original form of our written language came from the Chinese continent at this time. Later on, Japan closed its doors to the outside world, but the second wave developed in the 15th-16th centuries. At this time, technology was transferred not only from China but also from various European countries. Firearms came in during this period. In the 16th century, Portugal, where this conference is being held, established contacts with Japan. Its envoy, Saint Francis Xavier, attracted many disciples here. Many words that had their origin in Portuguese are still frequently used by the Japanese.

What should be noted is that despite this transfer, this was a period of isolation for our country. During this time, a fusion took place in Japan of things native and foreign, and unique new things thus came into being. This can serve to explain the reason why Japan, while having a certain homogeneity with the industrially advanced countries of the West, is still a country with a nature of its own. The framework of modern Japan, therefore, consists of a multi-layered structure formed by elements imported through technology transfer and elements developed on its own.

The effects of the postwar technology transfer from America and Europe were enormous, but today's products are no longer blind copies of what was imported. What must not be ignored are the alterations and improvements made to them by Japan.

II. Input and Output Factors that Are the Key to Success in Technology Transfer in the Light of Japanese Experience

We consider that Japan represents the best example of successful technology transfer in the world and throughout history. It cannot be determined immediately whether a type of technology will spred just because it is good. Judging from our experience, the following elements are essential to make a successful transfer of technology.

First, there must be an appropriate difference in levels between countries. Technology, like water, flows from high ground to low ground, but when the difference in levels is too great, it tends to flow past without stopping. There must be an educational level that is sufficiently high to absorb the technology.

I have previously referred to Japanese history. I now wish to add to my remarks, particularly with regard to education. In about the 10th Century, the ability to write was common in the higher levels of Japanese society. This included women, as shown, for example, by "The Tale of Genji" written by Lady Murasaki. This tale is one of the masterpieces in Japanese classical literature and has been introduced to abroad, too. Moreover, in the three centuries between the introduction of firearms and Perry's arrival, farmers, at the bottom of the social ladder, became able to read, write and make simple calculations.

In more recent times, the school attendance rate rose rapidly under the primary education system to reach 95% at the end of the 19th century, a proportion above that existing in European and American countries at that time. This spread of education was a major motive force in the development of Japanese industry. Consequently, attention must be paid to this point in transferring technology to developing countries, a subject I shall discuss later.

Second, the same effect of levels can be said to occur within the confines of a country. There is a need to distribute human resources. In a specific field, when human resources and funds are concentrated in one place creating a shortage in other places, technology transfer to the needy areas does not progress. That is a condition on the input side.

Third, it is important to keep in mind the potential for diffusion of technology. In concrete terms, this means that technology must be marketable and be suited to immediate use. If it is highly sophisticated, its cost becomes high, thereby reducing the inducement to use it. Such unsuitability for transfer can be seen in technology related to space exploration.

Fourth, the technology must be without restrictions. It is natural that classified technology cannot be transferred. For instance, patents, secret know-how and military technology that cannot be made public cannot be considered objects for transfer. Moreover, sophisticated

military technology, for example, is often difficult to adapt to civilian or industrial use because of the numerous problems arising from its cost and safety aspects.

The success of technology transfer is inseparable from the characteristics of technology as cited above.

Now in comparing the United States with Japan, we find that 70% of the research and development costs in the U.S. are funded by the government, with more than half devoted to military R & D. In Japan, 70% of the total amount spent on R & D is funded by private enterprise, with the major proportion of the new technology thus obtained being intended for direct civilian and industrial use. Moreover, secret military technology is almost nonexistent in Japan and our sophisticated technology pertains to the field of general private technology.

In addition, Japan's postwar military burden is light compared with that of other countries. This situation is due, in one sense, to heteronomous factors but also to Japanese desire to seek permanent world peace. Today our military budget represents less than 1% of the GNP. The comment that Japan's startling economic development could not have been achieved without taking into account this light defense burden seems appropriate, and we are well aware that we face several grave national security problems. However, to state that Japan is getting a "free ride" in defense burdens seems to me one-sided, and I do not believe, for instance, that other countries expect Japan to acquire nuclear

weapons as soon as possible. This is a complex problem that cannot be solved by ordinary means. Consequently, it must be said that there is little military technology in Japan that can be transferred to peaceful use.

What about mammoth scientific technology projects by government agencies and the transfer of their results to industry? First, in the field of space exploration, a meteorological satellite was developed this June. However, because Japan lacked the ability to launch this satellite, the operation was entrusted to the United States and it was lofted from Cape Canaveral. After being adjusted and tested by the National Space Development Agency (NASDA), the satellite is expected to be placed under the control of the Meteorological Agency. In addition, however, space exploration from a purely academic viewpoint has been carried out since 1950 with Tokyo University at its core and with the assistance of industry.

The development of nuclear power has become and urgent task. A nuclear fuel reprocessing plant has been completed and is ready to begin test operations. As is generally known, this matter has now become the subject of diplomatic negotiations between Japan and the United States. In the field of energy, the "Sunshine Project" is now being pushed for the purpose of developing alternate energy sources to replace petroleum. A "Moonlight Project" is also being prepared to devise means to save energy. Joint reasearch between governmental research organizations and private electronics companies has also started on a projcet for the very-large-scale integration of semi-

conductors (VLSI) with the government providing assistance with part of research funds. But, this is limited only to researches. Industries are pursuing the necessary development under their own funds on a competitive principle with each other.

The predominant interest now is how existing technology, even from other fields, can assist in achieving the objectives of these various development projects. It is still too early to look for its ripple effects upon the other areas. Every possible effort is now being directed rather to the development of technologies required for these projects.

A characteristic feature of the mammoth projects in Japan is that they are principally aimed at being directly utilized for civilian use. What the Apollo Project was for the U.S., and the Concorde was for France and the United Kingdom, the Shinkansen (bullet train) was for Japan. It is also common knowledge that the outstanding shipbuilding technology which produced the huge battleships Yamato and Musashi formed the foundation of the technology needed to build today's economically superior 300,000 and 500,000-ton tankers. It is significant in looking at the situation in Japan today, to note that immediately following the end of the war the wartime engineers and technicians endeavored to transfer the technologies they possessed to civilian use.

III. Technology Transfer from Japan to Developing Countries and the Emergence of Semi-Developed Asian Nations

Today, in quantitative terms, the volume of output of Japanese industrial products such as steel, ships, passenger cars and television

sets is among the largest in the world, and these products have attained a top-level worldwide reputation for quality, performance and value. They have gained the utmost confidence among consumers because of their fine finishing, low defect rate, and dependable servicing. The reason for their having achieved this high quality can be found in the unceasing efforts of the Japanese to achieve perfection. Take for example quality control. Japan did not simply import from America the principles of quality control, but contrived various improvements and launched a wide-scale movement for the application of these methods. This has contributed greatly to the excellence of Japanese products.

For instance, the ZE (Zero Defects) movement was launched in Japan 12 years ago. Today 8 million people working in 7,000 plants and factories participate in this movement. Every year, 3,000 worker delegates representing their respective workshops gather for a general meeting. This makes an impressive sight. Such ingenious measures together with the transfer of Western technology are integral factors in raising the quality of Japanese products.

From the standpoint of Japan's geographical position, it is quite natural that Japanese industrial technology is being gradually transferred to neighboring Asian countries. The greatest results achieved so far have been in the Republic of Korea, Taiwan, Thailand and Singapore, followed by Malaysia, Indonesia, the Philippines, Hong Kong and other countries. Among the types of technology transferred are those in the

fields of textiles, electrical and electronic products, chemical products and foodstuffs. There are some cases where technology for heavy industiral products of a medium scale such as steel, ships and transportation equipment has been included, but labor-intensive light industry technology is in the lead.

Most of the countries that have been provided with such technology transfers are no longer underveloped nations but have reached the stage of semi-development. The Republic of Korea takes the lead among them. Economic activity in these countries is extremely brisk, their rallying cry being "Catch up with Japan."

Basically, I believe that Japan should freely provide the technology it possesses when requested and herself develop more sophisticated techniques in new fields for her own activities. Our country today still imports more technology than it exports, but the day should not be far off when a balance will be struck in this respect.

Japanese technology is naturally also being exported to Europe and America as well as to those Latin-American countries now at the stage of semi-development and to Arab and African nations.

In the field of technological cooperation with developing countries, the need is increasing for personnel exchange and for individual training. We are learning that the results of technological transfer depend on the adaptability level of the recipient country and how well it is prepared to fulfill the required conditions.

It can thus be said that Japan, which 10 or 15 years ago was in the position of pursuer of the world economic society, is now becoming the country being pursued by these nations.

IV. Building an All-Around Security System and the International Transfer of Technology

A diversification phenomenon has been taking place in world politics in the last few years with a relaxation of international tension through detente and the return of China to international society. On the other hand, the economic environment is also undergoing major change as the result of the stagflation that developed around the time of the oil crisis, the uncertainty prevailing among international currencies and other factors. As a consequence, it appears as if the high postwar tide of technological innovation and economic growth were now ebbing. At the same time, the world and especially the industrially developed countries are facing common tasks as they are confronted with challenges of new dimensions.

The first of these is the question of how to deal with the shortages in resources and energy; second is ensuring and improving public safety through pollution-control and disaster-prevention measures; third is how to deal with the excessive population density of urban areas, and fourth is searching for measures to eliminate the gap between the northern and the southern portions of the globe.