INTRODUCTION

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THE writer would like to begin from the standpoint shaped in the UNU project proposal with regard to technology transfer, transformation, and development in early modern Japan.

Since the beginning of Japan's modernization numerous academic studies concerning these problems have been made, but most of them seem to be West European biased. In order to be free of such bias, a pluralistic approach is taken in examining the Japanese experience.

This pluralistic approach is reflected in a division of the study area into three levels: rural and urban societies, individual sectors of industries, and area studies. It is also reflected in a division of the technology into "hard" and "soft" technology.

Our studies are intended to introduce the Japanese experience into a channel of dialogue and academic interaction among those concerned with development issues, by providing materials to be examined at various levels and in various directions.

The principal methodology adopted heretofore by Japanese scholars examining the Japanese experience has been to focus attention on the gap between Japan's experience and those experiences encountered by the most advanced countries. In other words, the experiences of the West European countries have been a model to learn from and a target to be attained. What has been lacking has been a dialogue with non-European countries and an attitude of seeking to identify with them.

After World War II, there were a few who began to undertake dialogue with non-European countries. Until recently, however, they have been a minority, just as those in non-European countries who sought dialogue with Japanese have been few. Today there is an increasing concern with developing countries among Japanese scholars (concurrent with the growing interest in the developing countries on the part of scholars in the developed countries), and a similarly increasing concern with the Japanese experience among scholars of the developing countries.

Dialogue with people in the developing countries is likely to be painful for

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This paper, like other papers in this special issue (except for the article by professor Asim Sen), was originally written by the present writer as a part of the annual report to the United Nations University. The writer is the coordinator of the UNU commissioned project, and the project itself is still in progress with the help and collaboration of authoritative advisers and leading scholars. UNU publications are at this stage of limited circulation. We wish to express our deep appreciation for the kindness rendered by both the UNU and IDE editorial board and for giving the opportunity for our studies to reach more readers.

many Japanese intellectuals, since the history of modern Japan for over one hundred years has been one of hurting other nations and of being hurt. Japanese intellectuals wish to play a role in an effort to formulate a new world order. However, they are not yet confident of what they have to do, and this lack of confidence often leads to an attitude of caution and causes them to keep a distance from urgent needs of cooperation.

There are a number of intellectuals in the Third World who are of the opinion that the Japanese experience is worth examining because Japan has been successful in her industrialization. However, they should also pay attention to the cost of industrialization, such as environmental pollution.[1] Japanese intellectuals, though sympathetic enough toward the industrialization of the developing countries, cannot advocate such industrialization with confidence because they do not know how to overcome the side effects of this process.

From the viewpoint of those who are struggling for survival, the attitude of such Japanese intellectuals may appear to be irresponsible. And in fact, this tendency has been accelerated, particularly since Japan has come to be seen as a big country measured in terms of GNP. This image, however, of a great economy is far from reality for most Japanese.

The important thing is that constructive dialogue should take place, in which every nation will come to realize the fact that every national culture has equal value and that a great culture should not flourish at the expense of little cultures.

The major objective of this paper is to give a general view concerning the self-reliant development process experienced by Japan with respect to technology transfer, transformation, and development, taking account of the various development problems that the developing countries face today.

This, therefore, is a background paper, based on the writer's own understanding and interpretation of modern Japanese history, depending entirely upon past research conducted in Japan. For the sake of simplicity and readability, references and quotations are minimized.

I. BEFORE AND AFTER THE MEIJI RESTORATION

A. *Arrival of the Kurofune*

In September 1868, the Japanese governmental system changed after a period of great turmoil that had lasted for more than ten years. The Tokugawa Shogunate had remained in power for about two and a half centuries, controlling 270 feudal clans under a solid centralized administrative system. The Tokugawa Shogunate also monopolized external trade by prohibiting the subordinate feudal clans from engaging in trade activities with the outside. This prohibition was aimed at restraining the growth of military power by the clans and furthermore at checking the inflow of foreign religion and ideas that might encourage anti-Tokugawa movements.

[1] K. Tsurumi, "Man, Nature, and Technology: A Case Study of Minamata," Sophia University, Institute of International Relations, Research Paper Series A–38 (1979).

On the other hand, such policies helped not only to strengthen sociopolitical integration but also to establish a nationwide market economy in accordance with the development of local industries and cultures corresponding to the status-hierarchy system formulated during the Tokugawa period (in which the classes, ranked in order from top to bottom, were: warriors, farmers, artisans, and merchants). Thus, the basic form of Japanese culture as we recognize it today can be said to have been shaped during the Tokugawa period.

Toward the end of the Tokugawa regime, the development of the market economy had enhanced the economic power of merchants and traders to the extent that their power could no longer be controlled by the authorities. The economy of the feudal clans was maintained and activated by these merchants, and the economic status of the lower ranking warriors was already as low as that of the commoners and craftsmen.

The Tokugawa Shogunate persistently penalized rebellious clans by either abolishing or reducing the fiefs and many *rōnin* ("unemployed warriors") were produced on each occasion. However, the discontented state of these *rōnin* did not lead them to take action against the Tokugawa regime. Instead, a crisis in the feudal system was felt rather in such incidents as peasant riots demanding a reduction of the tax rate at times of calamity or poor harvest and protesting the imposition of surtaxes or incidental taxation. These riots again did not aim at replacing the Tokugawa regime with, say, a "Peasant Republic" but were protests directed against notoriously corrupt clan bureaucrats and privileged merchants.

The crucial impact came from outside Japan through the arrival of the *kurofune* ("black ships") in 1853. The commander-in-chief of the East Indian Fleet of the United States, Matthew C. Perry, came to Japan with a message from the president of the United States asking for the opening of a port for trade. Faced with the military power symbolized by the *kurofune,* the Tokugawa Shogunate had to change its seclusionist policy.

A Treaty of Amity and Commerce was concluded between Japan and the United States, and similar treaties were concluded also with England, France, Holland, and Russia. Since the regime knew the strength of European military power as evidenced by China's defeat in the Opium War (1840–42), the arrival of the *kurofune* caused the Tokugawa Shogunate great consternation. Moreover, the shipbuilding technology needed in Japan to form the new navy was by that time almost nonexistent because of the prohibition against the construction of big ships.

The Tokugawa Shogunate had to lift its isolation policy because there was a great possibility, according to the then American consul in Japan, Townsend Harris, of Japan's suffering a similar fate to that of China if the country remained closed. Harris advocated the conclusion of the Treaty of Amity and Commerce as the only way to save Japan from the threat of England and France, since it would become the duty of the United States to regulate any actions taken by England and France if the treaty was concluded.

There had been occasions even before Perry's arrival when foreign ships had come to visit requesting the commencement of trade relations with Japan. There

were a few intellectuals who felt the crisis of foreign pressure. Their apprehension was largely based upon scattered information obtained from Dutch books available at Nagasaki, a port restricted to Dutch vessels. The majority of these intellectuals belonged to the medical profession, and it was they who introduced not only Western science but also military science and technology.

Their call for the strengthening of the nation's coastal defenses, however, was not respected partly because they were a medical minority, the majority at that time being herb doctors. It was also because the intellectual core consisted of warriors-cum-administrators (bureaucrats) who specialized in the political philosophy of Confucianism. Thus these scholars of Western science, such as those in the medical profession, were regarded merely as humble technicians.

B. *Advocacy of Imperial Rule and Exclusionism*

The warrior class was furious with the submission of the Tokugawa regime to the military superiority of the foreign powers. This gave momentum to the actions taken against the regime by discontented social elements in the population. Criticism of the Shogunate, in the form of objecting to the opening of ports, sprang up from the economically powerful feudal clans located in the western parts of Japan which had been ill-treated by the Tokugawa family. However, this exclusionism had a weak point in that the discontented warriors did not intend in principle and theory to overthrow the feudal system with which they identified. As a result, even though they were not intent on crushing the feudal system, crucial was the fact that they were successful in mobilizing village officials, big merchants, and wealthy farmers into various movements by setting as a target the overthrow of the Tokugawa family.

In the course of the protest movement, the discontented warriors who were critical of the conclusion of the treaties with the foreign powers by the Tokugawa regime gradually turned their eyes to the existence of the emperor, who was the only person who could legitimize the action taken by the Shogunate. Here they found their way out, preserving their own class interests by overthrowing the Tokugawa family and at the same time extricating the country from political turmoil.

The emperor did not have any practical political or administrative power. His was but a symbolic authorization of all decisions made. The anti-Tokugawa group took advantage of this mechanism and accused the regime of not going through the proper formalities. Thus, the anti-Tokugawa groups, justifying their movement by politicizing the emperor, gradually developed an ideology advocating the emperor's rule on the one hand and exclusionism on the other.

The state of confusion created by the confrontation between the pro- and anti-Tokugawa camps was reflected in the attitude of the foreign powers. For instance, France gave support to the pro-Tokugawa camp, while England basically maintained neutrality in this matter and did not openly rule out the anti-Tokugawa camp. Yet these foreign powers did not fail to penalize the forces advocating exclusionism.

The powerful Satsuma and Chōshū clans, the most radical advocates of the

exclusion of foreign powers, were attacked twice (in 1863 and 1864) by the British fleet and the combined fleets of four other European countries. Defeated by these attacks, both clans gave up the exclusionist idea and devoted themselves to opposing the Tokugawa family and advocating imperial rule.

In October 1867, having foreseen the gloomy future of the regime and recognizing the deterioration of military power, Yoshinobu Tokugawa, the fifteenth shogun, decided to resign and give up his authority as the highest executive of the nation to the emperor. This is what is known as the Meiji Restoration.

The new government took jurisdiction over all the territories that had been under the direct control of the Tokugawa regime. With this measure, the Tokugawa family became the head of only a small local clan. A military confrontation occurred between the new regime and the sympathizers of the ex-regime over this treatment but the defeat of the latter was the final blow that terminated the political life of the Tokugawa family. It is interesting to note that those who manipulated behind the scene to prevent a military confrontation between the two were the consuls of the foreign powers. They were very much afraid of the silk-producing areas in the eastern parts of Japan from being drawn into warfare.

C. *The Liabilities of the New Government*

The Meiji government, upon its succession to political power, inherited enormous liabilities to foreign countries. In February 1868, just eight months prior to the birth of the new government, the Tokugawa regime had borrowed 500,000 dollars from the Société Générale bank of France for the purchase of weapons when the confrontation with the anti-Tokugawa groups became inevitable. The repayment period was seven months; the rate of interest was 10 per cent per annum; and the Yokosuka Iron Mill, which had been constructed in 1865, with a loan of 2.4 million dollars from the French government was offered as mortgage. The new government had to repay this debt when it could not raise funds for postwar management. The government asked Sir Harry Parkes, the British consul in Japan, to arrange a loan to cover the payment. The repayment period of this new loan was one year, and the rate of interest was 15 per cent. Moreover, the creditor, the Oriental Bank of England, asked for the facilities of the Yokohama Custom House and its income as mortgage. Indeed, it was a crisis for Japan to be virtually colonized.

Facing this crisis, the government prohibited the local governments (formerly clans) from borrowing money from foreign agents and countries on mortgage. In fact, according to a survey conducted in 1870, the debt amount to foreign countries that the Tokugawa regime left unpaid was 6 million dollars, and another 4 million dollars were borrowed by thirty-seven feudal clans from foreign agents for the purpose of purchasing warships, weapons, etc. Silk, rice, and mineral products were the common items offered as mortgage. The Tokugawa Shogunate on the eve of the Meiji Restoration did not have the capacity to control and to settle these foreign debts.

D. *Unequal Treaties*

Around 1863, when the zeal for exclusionism was at its peak, nearly twenty foreign warships were always stationed in Yokohama port. After penalizing the isolationism of the Satsuma and Chōshū clans, the foreign powers demanded the right to construct a military station in Yokohama. The Japanese government had to provide 66,000 square meters of land and bore all expenses required for the construction and maintenance of the governor-general's residence, barracks, hospital, powder magazine, etc. In 1869, there were three thousand British soldiers stationed there and a somewhat smaller number of French.

In addition to the military station claiming extraterritoriality, the foreign powers did not allow Japan to have customs autonomy. According to the treaty concluded in 1854, import duties ranged from 5 to 10 per cent of the imported value; this became a flat rate of 5 per cent in the Edo Treaty concluded in 1866. As a result of this unequal treaty, Japan suffered from excessive imports, a drain of specie, damage to local textile industries, and distortion of the industrial structure. The new government continually asked the foreign powers to modify this unequal treaty. However, they refused to do so, demanding, instead, the opening up of additional ports and criticizing the ban on Christian missionary activities in Japan.

The unequal treaty had another side effect. After the opening of the ports, diseases so far unknown to Japan began to appear. The spread of cholera in 1878 was a good example. Upon receiving news of the spread of cholera from the Japanese consulate at Amoy, the Ministry of the Interior tried to conduct maritime inspection and to segregate ships that had come through Amoy. Parkes, the British consul in Japan, however, refused to allow either the inspection or the segregation of ships. Fourteen thousand people suffered from cholera, and eight thousand died. In the following year, preventive measures proposed by the government were opposed by the consuls of England, France, and Holland, and one hundred thousand people died of the disease. Similarly, over a hundred thousand people died of cholera originating in the foreigners' settlement of Nagasaki in 1885 [3, p. 196 ff.].

The spread of cholera had an impact in two ways. First, Oriental medicine gave way to Western medicine because the former failed to check the spread of cholera. Consequently, only Western medicine was officially legalized thereafter. Second, since the government mobilized the police to implement preventive measures for cholera, rather than the welfare office, it was the police force which began to take the initiative in the field of the nation's public health.

Given the above circumstances, Meiji leaders such as Hirobumi Itō and Toshimichi Ōkubo gradually became convinced that a strong military power was essential for Japan to survive as an independent sovereign state. A prerequisite for this was a powerful economy. This was the lesson that the Meiji elite learned from the aggressive policies of the Western powers. And this realization led to a national development target which advocated strengthening military power and increasing the wealth of the nation by industrial development.

The national development target, or basic strategy, for nation-building took

the form of developing export-oriented industries and import-substituting industries, in particular the ones related to military affairs being given top priority. In this we can see the initial symptom of Japanese militarism.

E. *Currency Problems*

The victims of internal disturbance are always the common populace and Japan was no exception. In 1866, when the first civil war broke out, Japanese agriculture experienced an extremely poor harvest. The increasing demand for food grains particularly for military purposes and the disruption of the transportation network boosted the price of rice to an extremely high level. In order to prepare for the civil war, every clan accumulated goods by issuing inconvertible local notes. Farmers who received these notes realized that they did not have much purchasing power. As the farmers had already suffered from heavy pressure under the feudal regime, they rose in rebellion on a massive scale, demanding the reissue of the convertible notes. In urban areas, merchants, moneylenders, rice shops, pawnshops, wine shops, etc. were attacked by the poverty-stricken populace.

There was a problem of specie behind the anarchic situation created by the civil war. By a treaty concluded in 1858 with five foreign countries, free entry of foreign currencies had been agreed upon. The prevalent international currency in Asian trade in those days was the Mexican silver coin. The standard currency in Japan was gold, and silver currency was subsidiary, with the conversion rate at 1 to 5. The official exchange rate was set at three Japanese silver coins (1 per cent silver content) for one Mexican silver dollar. The international exchange rate between gold and silver was 1 to 15. Therefore, it was profitable for foreign traders first to convert Mexican silver dollars into Japanese silver coins and then exchange them for gold currency; they could obtain three times the value of the official exchange rate through this simple handling [2, p. 16]. For this reason, a tremendous amount of Japanese gold was drained abroad immediately after the opening of the port of Yokohama in 1859.

To cope with this hardship, recoinage was inevitable to reduce the content of gold to a level comparable to the international conversion rate between gold and silver. This implied devaluation of the standard currency and caused inflation. Yet the Tokugawa regime had to increase the supply of currency to meet the demands of administration and defense. Since the Meiji government basically followed the same policy, consequently peasant riots and social unrest continued under the new regime. It was not until the 1890s that the authority of the new government was fully established throughout the country [6, p. 8].

F. *Institutional Reforms*

The new government launched a series of reforms in various areas. Some of these were the abolition of the status-hierarchy system; establishing prefectures as new administrative units in place of the clans; and securing freedom of occupation, free choice of crop cultivation, and enterprising activities of all kinds. With these reforms, the Japanese economy evolved into a free market economy on a nationwide scale. In addition, the government introduced a constitutional parlia-

mentary system which acted as a facade to curb democratic movements. It came as no surprise, therefore, that its final form should suffer substantial retrogression compared to the initially proposed plan. Similarly, freedom of speech was recognized, but with great limitations. These reforms played an important role in giving people a feeling of emancipation and hope. At least, people began to feel confident that the world was changing for the better.

There is no consensus among Japanese scholars with respect to the revolutionary character of the Meiji Restoration. Yet nobody would deny the fact that modern Japan underwent a revolutionary change. There are some who point out that the uniqueness of the modernizing process in Japan compared to that which took place in Korea and China lies in the fact that integration and compromise between exclusionists and those who advocated the opening of the country were made relatively smoothly [5, p. 25].

II. THE MOVEMENT OF CIVILIZATION AND ENLIGHTENMENT

A. *Westernization*

The damaging effects of forced "free trade" mentioned above had reached every corner of the country ten years after the opening of the ports. The principle of free trade, which brought undue benefits to foreign countries, was accomplished through the unequal treaties aided by military power. In 1871, Premier Sanjō expounded the view that Japan's legal system and customary laws which were incompatible with those of the Western countries might have to be modernized as the only way for Japan to alter the situation controlled by the unequal treaties. Westernization as a target of modernization was thus set forth. In this connection, a survey mission consisting of political leaders was sent to Europe and the United States.

The deputy leader of the mission, Hirobumi Itō, acknowledged the superiority of Western society in every aspect and strongly advocated the necessity of transplanting Western civilization in order to upgrade Japanese society to the level of Western society. The official report of the mission stated that the wealth of England was originally based upon her mineral resources. She was then successful in increasing her business capacity by the invention of ships, railways, and steam power generated from fire, heat, etc. She monopolized the textile industry and navigation and came to dominate the world.

The importance of the textile industry and of heavy industries—especially iron and steel, shipbuilding, and mining—pointed out by the mission report was channeled into the industrial policy of Japan thereafter.

To reiterate the problem of the unequal treaties, it should be noted that it was in 1899, when Japan had gone through her industrial revolution, that extraterritoriality was abolished and autonomy in tariffs was restored.

B. *Three Major Reforms*

Many reforms were introduced by the new government, as we have already

mentioned. However, the reforms of the education system, the draft system, and the revenue system are the most important ones to consider when we examine the modernization of Japan.

1. *The education system*

The proposed reform of the education system was to give compulsory education to children above the age of six by founding 53,760 primary schools, 256 middle schools, and 8 universities. Administrative reforms, however, such as the replacement of the clans by the prefectural system and the creation of the Ministry of Education (1871) were necessary before this plan could be implemented.[2]

The new education system of 1872 was too ambitious to function under the existing financial constraints. It might have been hard to recruit enough qualified teachers to run this system, at least above the middle school level. Nevertheless, this was the reality of the situation at the beginning of modern education in Japan.

A statement of the premier made it explicit that the purpose of education was for individual pupils to explore their potentiality, and so it should be regarded as a productive asset for all. The textbook used at this initial stage in the primary schools was a translation of the Wilson Reader [1, p. 8] from the United States. Inevitably, it would need to be revised sooner or later so as to meet the actual needs of the nation and this, in fact, took place in 1879 and 1886. However, it should be noted here that the basic idea behind the revision, as indicated in a statement by Arinori Mori, minister of education, was to shift the emphasis from education as a way of exploring the potentiality of individuals to education as a means of achieving the national development target already mentioned.

This shift of emphasis was perhaps an expression of the reaction of the Meiji elite to the difficulties in and out of Japan; the civil war (anti-new regime) of 1878, the rise of the democratic movements demanding mass participation in politics, the proclamation of the Constitution, and the opening of the Diet system. In other words, it was imperative for the new regime to establish itself firmly and to bring about stability in order to develop the country in the shortest possible time span. Education was conceived as one of the means to achieve this objective.

In spite of this change in principle, primary school education was diffused all over the country, and teachers' colleges to supply primary school teachers were run in each prefecture under the new education system. However, a heavy financial burden for the construction of primary school buildings in rural areas was borne by the local people in the form of local taxes and donations. Moreover, tuition and fees were so high that the majority of farmers could not afford them. The rate of enrollment was as low as 30 per cent in 1877. In addition to the financial burden, farmers could not afford to spare important working hands. In some places, farmers revolted against the enforcement of this compulsory education. Generally speaking, however, within a short period of time, the illiteracy rate

[2] See R. P. Dore, *City Life in Japan: A Study of Tokyo Ward* (London: Routledge & Kegan Paul, 1978).

decreased rapidly with the spread of education, and this was accelerated following the development of industries after the 1890s.

2. *The conscription law*

The Ministry of the Army proclaimed the conscription law in 1872. This was a corollary of the abolition of the status-hierarchy system, in which only the warrior class had been responsible for defense and warfare. With the abolition of old system, the role that had been played by the warrior class became every man's duty regardless of his former status and occupation. It was reasoned that the defense of a country was analogous to protecting oneself from trouble.

The abolition of the status-hierarchy system triggered the modernization and democratization of military service. Yet the reorganized military system was based on compulsory conscription, not on voluntary enlistment. Of course, even under compulsory conscription there were clauses providing for exemptions and postponements. Among those who were eligible for these clauses were the physically disabled, criminals, bureaucrats, students in national colleges, students studying abroad, professionals such as medical doctors, heads of families (or their proxies), and those who paid 270 yen as a substitute. Consequently, the healthy male population from farm households except for the head or heir became the main source of the new national army. It is clearly suggested that the government's intention behind this policy was to fill the conscription quotas on the one hand and to secure qualified manpower and maintain the family system on the other.[3]

The modern army, besides its regular duties, provided opportunities for young men drafted from all over the country to learn discipline and collective life. These young men who met in this way formed a new type of social group even after they left the army. This group functioned as an auxiliary agent of the authorities and acted as the most powerful pressure group at the grass-roots level.

As previously mentioned, those who paid 270 yen were exempted from the draft. This was one way of raising funds to maintain the army. Here evidence of plutocratic influence in the Japanese army formation can be seen. The upshot of these exemption clauses was that the conscription system could not achieve its initial objective. In fact, the figures in 1876 reveal that 80,000 out of 0.3 million potential candidates were eligible for these exemptions and the government could barely draft 14–15 thousand men every year.

One reason for the unpopularity of the Japanese army among the masses was the fact that most of the commissioned officers and noncommissioned officers were recruited from the former warrior class and, therefore, the class structure of feudal society actually survived in the army. This reflection of feudal class consciousness in the rank-oriented structure of the army created an inhumane structure and psychology in which the lower ranking soldiers from non-warrior classes were always victimized. The unpopularity of the army at the grass-roots

[3] For English reader, see E. H. Norman, *Soldier and Peasant in Japan* (New York: Institute of Pacific Relations, 1943), and also S. Fukushima, "Building of a National Army," *Developing Economies,* Vol. 3, No. 4 (December 1965).

level continued despite the government's endeavor to build a strong army except for the period after the victory of the Sino-Japanese and Russo-Japanese wars. The Japanese army, however, was able to attract promising young men from middle and lower middle-class families because they were exempt from tuition and fees at military schools, as at normal schools. And these young men became leaders of the modernized army.

The corruption and breakdown of party politics after the 1910s radicalized these young military officers toward the right. The ultranationalism of these officers had a very different ideology from that of the leftist radical groups formed in the years before the 1920s since the former represented nationalism and the latter internationalism. Nevertheless, as far as their basic policy on domestic affairs was concerned, they shared many things in common. This is attributable to the fact that most of the rank and file under the officers' command were from poor families in rural areas and the drain of these young men caused a deterioration of the household economy of their native homes. The young officers, under these conditions, could not be indifferent to arguments advocating social reforms following their own reasoning and their sense of national obligation.

3. *Revenue reform*

The revenue reform introduced by the Meiji government was the most important and crucial aspect of the modernization process. The major source of revenue under the new regime, as in feudal times, was land revenue. In feudal times, however, this had not been a stable source of révenue; it was to be paid in kind, and the amount collected each year and in each locality fluctuated substantially, depending on the harvest.

The new government introduced a revenue settlement over a period of six years (1873–79) in which the land revenue was to be paid in cash. The revenue rate was fixed at 3 per cent of the land value specified in a title deed. The actual revenue burden at this rate, together with the local village tax, amounted to as much as 34 per cent of the gross produce, which was almost equal to the burden under the previous feudal regime. Although farmers' discontent was immense, the government could raise a stable fund for government run industries and for the plan of the rapid building of military power free from annual market fluctuations and crop conditions. Here again, we can see the decisive role played by the agricultural sector in the process of the modernization of Japan.

The effect within the agricultural sector of the revenue settlement was the progress of class differentiation among the peasantry, which was in practice accelerated by the change of revenue payment from kind to cash and also the prolonged low price of rice. In this process, on one hand, wealthy farmers and landlords emerged, who accumulated land and then started investing their surplus in the nonagricultural sector; and, on the other, potential migrants to the urban industrial centers such as tenants and petty part-owners were created.

Another measure that the new government took in connection with the development fund was to terminate grants to the former warrior class. There were 400,000 households that had belonged to the warrior class, and their population

(2 million) was roughly 6 per cent of the total population. Payments to these ex-warriors in grants amounted to 30 per cent of the government's total revenue. Therefore, the government decided to terminate the payment of grants and instead a lump-sum allowance in the form of bonds was paid. With this measure, except for a few who were of the ruling class in feudal times, most of the lower ranking ex-warriors suffered a great deal and sold out their bonds. Those bonds were purchased in the main by urban merchants and moneylenders who channeled them into the development fund.

Some of these lower ranking ex-warriors became government officers, teachers, etc., but the majority of them were ruined and joined the urban poor. The government spent a vast amount of money to rescue the impoverished population, partly with an eye to maintaining public peace, but good results were not obtainable.

There was another group within the populace who shared a similar fate to that of the lower ranking ex-warriors. They were ex-privileged craftsmen[4] who had exclusively supplied their products to the warrior class. Some of their industrial arts have been protected in a number of areas (e.g., Kanazawa City), but most of them disappeared in the process of industrial development. In addition to these people, urban areas had to accommodate migrants from rural areas who failed to adjust to the rapid changes and who were hit by disasters or incidents particularly after the revenue reform. Thus, urban problems were already being generated even before industrialization. For several decades, these urban poor had to painfully wait before they could be absorbed into the various industrial sectors.

A continuous population influx[5] in excess of employment opportunities that urban areas could offer caused not only serious unemployment problems but also a deterioration of housing, the spread of epidemics, the formation of slums, etc. Under these conditions, the jobs open to the unskilled urban poor[6] were largely as day laborers in construction and public works. Some healthy men found jobs in the conventional local transportation sector (e.g., rickshaw pullers).[7] However, the income of the unskilled workmen was so low that, being unable to feed their families, their wives and children had to do work of various kinds such as labelling matchboxes so as to keep their households at home.

The unskilled laborers worked also as stall keepers and peddlers. They could

[4] See Shōgo Koyano, "Technology of Traditional Industry and the Role of Craftsmen," mimeographed, HSDRJE–1/UNUP–84 (Tokyo: United Nations University, 1979).

[5] Vivid descriptions on their life can be accessed by the two classic documents by W. Hosoi, *Jokō aishi* [Pathetic life of mill girls] (Tokyo: Iwanami-shoten, 1929), and G. Yokoyama, *Nippon no kasō shakai* [Lower classes in Japan] (Tokyo: Iwanami-shoten, 1898).

[6] Hiromichi Ishizuka, "Tokyo-shi kenkyū no hōhōron teki josetsu" [An introduction to methodology of historical study of Tokyo], mimeographed, HSDRJE–2J/UNUP–22 (Tokyo: United Nations University, 1979).

[7] T. Saitō, *Jinrikisha* [Rickshaw] (Tokyo: Sangyō Gijutsu Sentā, 1979), and also E. M. Satow, *A Diplomat in Japan* (London: Seely, Service, 1921).

work more than 250 days[8] a year by selling all sorts of daily necessaries at festivals held in various places. Their transactions were extremely small in scale, but the commodities they sold were of all varieties, ranging from flowers, garden plants, curios, and knives to medicine, take-out and ready cooked foods, and wine. They were a component of urban life at least up to the beginning of World War II.

C. *Characteristics of Employment and Management Systems in Japan*

In the course of the "civilization and enlightenment" process, new types of urban industry emerged manufacturing goods such as shoes, bags, matches, soap, hats, Japanese sandals, carts, bricks, glasses, Western furniture, etc. These industries offered full-time employment opportunities for craftsmen. Since workers were abundant and the wage rate was low in these sectors, the labor market was in the hands of employers. These employers preferred recruiting workers through personal connections which they had in their native localities. In search of a sure guarantee as well as loyalty they also favored the employment of members of their kinship groups.

The wages received by these craftsmen were very low; but their wives and children were given subsidiary jobs within the factories or companies (e.g., maid-of-all-work, apprentice) or at home, and a household could thereby obtain a subsistance income. Some scholars refer to it not as full employment but as a "total employment" system or "whole family employment" system [4, p. 229]. When the head of a family had an accident or was retired from a company, his son was employed in place of his father. This unique relationship between employers and employees can be observed even in large-scale modern Japanese heavy industries. There are not a few scholars who see this as the unique nature of the management system in Japan—quasi-family-type and/or affectionate relationship.[9]

Attention should be given to the unique training methods and to the attitude which these craftsmen as skilled hands had towards their work. For instance, their turnover rate was unexpectedly high. This was because they believed that they could improve their skills by furthering their experience in different places and under different masters, thereby earning a qualified certificate as skilled hands. Their sphere was surprisingly wide regardless of their actual occupation and their skills were also spread widely under this system. Employers needed to be able to assess the skills of these wandering craftsmen properly and promptly, and good craftsmen came to assemble around the employers who had this capacity. These craftsmen sometimes worked as apprentices for a fixed period of time without pay and even after they became independent, their wages remained quite low. For them, it was their skills that they were proud of, not the level of their income. However, such aristocratic aestheticism of the craftsman was harmed

[8] K. Hiraide, *Tokyo fūzokushi* [A history of manners and customs in Tokyo], 3 Vols. (Tokyo: Fusambō, 1899–1902), see especially Vol. 1, Part 2.

[9] See detailed studies of Hiroshi Hazama's *Nihon rōmu kanrishi kenkyū: keiei kazokushugi no keisei to tenkai* [A historical study on Japanese labor management: formation and development of paternalistic management] (Tokyo: Ochanomizu-shobō, 1978).

through the enforcement of the conscription law, since their training period could not go beyond the age of twenty. Consequently, the level of their skill began to stagnate.

Marriage was an opportunity for these wandering craftsmen to settle down. This was justified for two reasons: they were enabled to take apprentices and to earn a subsistence income if their wives could obtain subsidiary employment.

The case of unskilled migrants from rural areas was quite similar to that of the craftsmen. However, the character of the relationship between employer (who in many cases was a subcontractor) and employee in this case was rather one of patron-client; employers provided not only food, clothes, and shelter but also the necessary expenditure in connection with social functions, in addition to the bonus payment twice a year.

The employment system described above was quite popular in public works and in the metal mining industries. Although this system was inherently one of exploitation, it did provide social security in a private fashion to these proletarians who were freed of unemployment.

These two cases show an interesting contrast. Craftsmen tried to brush up their skills under uncertain conditions, while unskilled laborers consciously tried to seek security. This difference can be attributed to the fact that the former had an invisible asset to be proud of and the latter did not have anything to rely on. In any case, it is appropriate to point out here that the efficient organization and leadership that the employers of the latter had and the important role played by personal relationships common to both cases are not observable in the advanced modern industrial sector.

The life-time-employment system in Japan was formulated by the 1930s when the country entered the second phase of "civilization and enlightenment" with its policy of enriching the nation by industrial development. It was motivated by the necessity of retaining capable technicians and craftsmen and of coping with the rise of the labor movements led by leftists. Some may find here a reversion to the quasi-family-type relationship pertaining to the management system in Japan. The life-time-employment system has functioned in two ways to date. One has been to create a competitive situation within an enterprise in terms of loyalty and promotion by introducing the job-ranking system. The other has been to direct trade unions' efforts toward pressing managerial staff hard with respect to their ability to run the business on a sound basis, rather than to promote horizontal linkages with other unions of similar occupational category at the regional and national level.

The seniority system in wage payment popular in Japanese enterprises is one in which loyalty and contribution to the enterprise are basically measured by length of career. This has the advantage of securing a livelihood for all employees, but an individual's skill or talent tends to be evaluated relatively low under this system. It is important to note that this system was supported by the trade unions during the period of inflation immediately after World War II and at the time of high economic growth in the mid-1950s.

III. ENHANCEMENT OF PRODUCTIVE CAPACITY AND INDUSTRIAL DEVELOPMENT

A. *The Introduction of Foreign Technology*

It is misleading to state that modern Western science and technology began to be introduced in Japan immediately after the Meiji Restoration for they were known already in feudal times. The main emphasis, however, in those days was placed on the introduction of military science and technology in order to strengthen the position of the Tokugawa. Although the Meiji government continued to import Western military science and technology, one notable difference was that the introduction of science and technology for nonmilitary purposes increased substantially. Another difference is that the introduction of science and technology during the feudal period was in the form of the import of finished goods, while after the Meiji Restoration efforts to reproduce imported technology began to be made. This copying and imitating process started with learning the operation, as well as the repair and maintenance of imported machines, and then it gradually went on to the manufacture of similar machines appropriate for the country through the use of locally available materials.

One of the characteristics of technology transfer during the Meiji period was the introduction of technology in diversified fields on a large scale, and the vigorous efforts made toward home production. There were good reasons for the encouragement of home production. First, imported machines and plants were extremely expensive. Second, it often happened that obsolete machines and plants were imported at exorbitant prices set by shrewd foreign merchants who made full use of the absence of proper knowledge on the Japanese side both in market information and in technology.

It was a long process of trial and error before imported finished goods and machinery could be reproduced. For example, an attempt to manufacture textile machines was made in a government-run factory, but after several trials the end result was complete failure. On the other hand, efforts to manufacture locomotives were successful. The first railway service was opened between Tokyo and Yokohama via Shinagawa in 1872. Upon the arrival of locomotives designed by Japanese engineers and manufactured in the United States, one of them was disassembled immediately and a similar one was manufactured in 1893.[10] Since the private sector could not afford to take the risk of such ventures, government factories had to take the initiative.

There were some factories often called "shipyard" or "iron and steel mill"; however, in practice, they manufactured motors for use in ships and textile industries, and machines for use in mining. The first full-scale shipyard was built in 1855 with the technical collaboration of Holland, costing a vast amount

[10] Katsumasa Harada, "Tetsudō no dōnyū to gijutsu e no tembō" [Introduction of railway and prospect of technological independence], mimeographed HSDRJE–12/UNUP–32 (Tokyo: United Nations University, 1979).

of money and taking three and a half years to complete. It was originally attached to the Shogunate's navy school but was turned over to the Mitsubishi Company in 1878. Construction of a full-scale iron and steel mill started in 1865 at Yokohama, aiming at manufacturing weapons. These industries formed the basis and led the way in Japan's industrial development during the early Meiji period.

Industrialization in Japan developed primarily as a reaction to the military intimidation of the foreign powers, which was directly linked to the economic threat. Unlike in Europe, therefore, where the reverse order was typical, the process of industrialization initially began with shipbuilding followed by a concentration in iron and steel manufacturing and mining. The Meiji elite had to face all sorts of difficulties arising from this reverse process of industrial development. It was around the 1890s that Japan reached the industrial revolution stage, and it was completed with the indemnity from the Sino-Japanese War (1894–95). Water power used for industries began to be replaced by steam power in the late 1880s.

The second stage of industrialization, starting in the 1910s, was characterized by the establishment and operation of full-scale integrated iron and steel mills; self-sufficiency in the production of iron, cement, and glass; independence of both heavy industries and the chemical industry; and electricity as the major source of energy.

The Meiji government established the Ministry of Industry in 1885. This ministry allocated 3 million yen as a fund for development. Of 54 per cent of this amount spent during 1873–76, 80 per cent was allocated to the construction of railways and the development of government-run mines. The remainder went to heavy industries such as shipyards, telecommunications, etc. The pattern of the government's fund allocation would provide useful material for examining the problems of technology transfer in the process of economic development.

The initial policy of the government toward railway construction and management was that the government would be responsible for the main lines and the private sector for local lines. However, this plan did not materialize because of financial constraints and this resulted in the construction of some parts of the trunk lines which were later bought up by the government.

In contrast to the railways, the private sector was encouraged from the beginning to develop marine transportation. In this connection, the Mitsubishi Company took advantage of the Taiwan (Formosa) Expedition by enhancing its relationship with the government. It drew out subsidies and obtained ships disposed of by the government free of charge. The government's intention in this decision was to eradicate the American Pacific Mail Steamship Company from the coastal routes. Although the Mitsubishi Company thereafter grew to be the largest company in marine transportation in Japan, it also served the purpose of protecting national interests. A characteristic of the Meiji business elite, such as Eiichi Shibusawa, was that they were always conscious of national interests. In fact, most of the companies founded by ex-warriors using as capital the bonds received from the government, put in the opening sentence of the articles of

association the following clause—"in the service of the nation." Their loyalty to the country, in practice to the government, was often disguised as loyalty to the people, and in the name of national development they tended to ignore cooperation with the local communities and gave scant consideration to environmental problems.

As far as the development of road transportation is concerned, the central government designed the overall plan and the expense of actual construction was borne by the local governments. This was basically akin to the policy which had been adopted by the feudal clans. This was in contrast to the concession for railway construction between Edo (Tokyo) and Yokohama which had been given to Portman, a member of the American consulate, just before the end of the Tokugawa regime.

The location of the main railway lines was a controversial issue. Powerful army leaders preferred the central part of Japan for political and defense reasons. However, the final decision was in favor of the coastal area along the Pacific Ocean. Transportation problems which the government faced during the civil war of 1878 had an effect on this decision.

Although the construction of the main railway lines was aimed at meeting the demands arising from industrial development, it was primarily motivated by the political and military requirements of the time. Therefore, the army participated in designing the timetable for railway transportation, and considerations of profit and loss had no bearing.

B. *Technology Transfer in Three Major Fields*

According to a historian of scientific technology [2], there are three areas in which foreign technology was effectively introduced in the Meiji period: the Mint in Osaka (1871), the Tomioka Silk Mill in Gumma Prefecture (1872), and railway construction between Tokyo and Yokohama.

1. *The Mint*

The problems pertaining to the recoinage of the gold currency and the resultant inflation that Japan faced immediately after the opening of ports have been discussed above. The Meiji government inherited this state of affairs, and, therefore, it was an important task for the government to settle the matter relating to specie domestically as well as internationally. After a close examination of foreign currencies, it became clear that each coin was strictly standardized in terms of size and quality. From this fact, the government came to realize that the introduction of foreign technology was inevitable.

The process of coinage was divided into two parts: a chemical process and a machine process. The technology for the latter process was relatively easy to acquire, but the former process required a basic knowledge of chemistry and metallurgy. However, the technology applied in manufacturing cannon during the late Tokugawa period was of great help in this respect. At the same time, the traditional technology of chasing traditional Japanese swords and helmets played an important role in designing and chasing the new currency. In this

way, the new currency, standardized in quality and difficult to copy, began to be produced at home.

2. *The metal and mining industries*

The government's efforts to produce specie at home activated the metal-mining industry.[11] Production of gold, silver, and copper increased with the import of new technology, particularly the process which made it possible to collect metal out of refuse. Labor productivity increased drastically with the mechanization of drainage and transport. Imported technology in these areas was far superior to the endogenous technology.

In spite of the technological innovations, the organization and skill of the laborers remained unchanged. The implements they used were simple, and production efficiency, therefore, was heavily reliant upon their skills. The job of the mine workers was risky. There was good reason for them to form small work units called *tomoko*, which is peculiar among the miners,[12] consisting of a head who was respected and rich in experience (with knowledge of safety skills) and members who were also ranked according to their skills and experience. Since the leaders of these *tomoko* groups were conscious of and responsible for the safety of their members as well as for good operations, any technology had to be introduced with their consent.

With regard to the development of mineral resources, the Meiji government inherited from the feudal regime the direct control system. In 1873, the government passed the Mining Act, which prevented foreigners from owning mines and from becoming mine workers. C. Netto, who was invited by the government to run the government-operated Kosaka Mine and later contributed greatly to the spread of mining science and metallurgy in Japan while he taught at the University of Tokyo, also reluctantly admitted the reasons behind the Mining Act of 1873. He was of the opinion that the quickest and simplest way to develop mines was to employ foreign experts and capital. He was also aware, however, of the fact that Japan might become involved in difficult diplomatic and employment problems arising from the influx of less expensive and skilled Chinese laborers if the development of mines were commissioned to foreign hands.

In connection with the subject of specie, it is worth pointing out that the metric and decimal systems were adopted by the government in 1871 when the Mint was established in Osaka. It goes without saying that the impact of the metric and decimal systems went beyond the problems of specie, weights, and measures.

Before entering into a discussion of the textile industries, reference should be made to the means by which new technology was introduced. In the 1850s and

[11] A full description on the pre-modern level mining engineering and the absorption of modern technology by Junnosuke Sasaka is expected to come out soon in the form of a UNU paper.

[12] Studies on *tomoko* are not numerous. See S. Matsushita, *Tomoko no shakai-gakuteki kōsatsu: kōzan rōdōsha no itonamu kyōdōseikatsutai bunseki* [Sociological observations on *tomoko:* an analysis of miners social life] (Tokyo: Ochanomizu-shobō, 1978).

1860s, the level of modern industry and the quality of labor in China were higher than in Japan. A considerable number of books on science and technology written in Chinese were published and widely read. This is attributable to the efforts made by Christian missionaries. Books on Western science and technology translated into Chinese had a profound impact when few could understand European languages. In Japan, the introduction of science and technology was attempted most enthusiastically by the newly formed navy. The navy was modeled after the British navy, and English technical terms, therefore, began to replace the Dutch which had been used in former feudal times. In this respect, books on science and technology in Chinese played an intermediate role in disseminating new knowledge which was accessible to any intellectual of traditional culture.

3. *Silk and cotton mills*

Silk and cotton mills were the leading sectors in the first half of the history of Japan's industrialization. Silk production was recognized as an export-oriented industry and cotton production as an import-substitution industry. Cotton cloth had become popular among the common people in place of flax, but the consumption of silk was confined to limited aristocratic circles. The major producing areas of cotton were the western parts of Japan, while silk was produced mainly in the eastern parts.

Silk was the most important earner of foreign currencies. Silk-reeling technology in Japan lagged behind that of China, but it could capture the international market for the following reasons: first, the stagnation of silk production in China because of the Taiping Rebellion (1851–64); second, the spread of a corpuscle disease in France, the major producing area in Europe; and, third, the cheap price of Japanese silk, which was almost half that of the international price.

The silk exported from Japan, however, was used only for warp in Europe, mainly because the denier was irregular for technical reasons. The government tried to disseminate new technology in the Tomioka Silk Mill, the government-operated pilot mill founded in 1872. All machines and equipment were imported from France, and French experts were also invited. An unexpected problem, however, occurred: female workers could not be recruited. Information on Western societies was extremely limited in those days and wild rumors of all kinds were spread in rural areas and nearby towns. The wine that Europeans drank was rumored to be human blood, and so people feared that those who went to the silk mill might not be able to return home alive. The government, therefore, passed an order that every village and town should supply fifteen female workers of thirteen to twenty-five years of age. However, people refused to send their daughters on the grounds that the daughters of the headmen in those villages and towns were not sent to the mill.

The author of *Tomioka Diary*,[13] Ei Wada (1857–1929), was the daughter of

[13] Edited and published in 1965, 1971, and 1976 based on her personal memories partly written in 1907, 1908, and in 1913.

a village headman in Matsushiro town, Nagano Prefecture in central north Japan, who was sent to Tomioka together with sixteen other girls. She was then fifteen years old. After working a little more than a year at Tomioka Silk Mill, she came back to her native town and became a technical leader of the newly established silk mill there. According to her observation, the equipment and buildings of the new mill at Matsushiro were quite inferior to those of the mill at Tomioka: wood was used in place of copper, iron, and brass; wire was substituted for glass; and brick floors became earth floors. Though these capital-saving modifications were made to take into account the capital-bearing capacity of the local people, silk was produced fairly well and was sold to foreign buyers at a handsome price. Shortly afterward, the Tomioka Silk Mill went bankrupt as a result of an increased number of these new capital-saving mills in various parts of Japan, but its historical role should be highly evaluated.

In connection with Tomioka Silk Mill, one factor should be noted. The initial success of Tomioka was attributable to the fact that the managers of this mill learned a lesson as a result of the failure of a mill located at Maebashi, forty kilometers north of Tomioka. The main cause of failure was that people resisted learning from foreign experts and hated a new mode of production because there was no division of labor between sericulture and silk reeling in this town, and the control of production by wholesale dealers was strong enough to block the introduction of any new system.

These two cases suggest the importance of both channels and agents of technology transfer: the wrong combination of these two invites cultural as well as socioeconomic tension. Generally speaking, how to disaggregate the whole production process (sericulture, silk reeling, weaving, and dyeing) economically and where to mechanize ultimately determine the direction and the extent of technology transfer. Cotton spinning was no exception.

As far as the cotton textile industry is concerned, the disaggregation of the production process (cotton growing, spinning, weaving) was made before the Meiji period. Since this disaggregation took the form of a regional division of labor (i.e., one region specializes in one part of the process) helped by a conventional network of commerce, the introduction of foreign technology did not bring any particular cultural conflict. The only problem here was competition with less expensive imported cotton products, mainly from India.

Cotton was one of the important cash crops in Japan. Therefore, the development of the cotton textile industry and its competitiveness were of grave concern to the cotton growers. The government planned to establish small-scale cotton mills (2,000 spindles) in various places after a successful trial in a government-operated mill. For this purpose, the government decided to dispose of ten plants imported from England to the private sector, the cost of which was payable on a ten-year installment basis at no interest.

However, the result was far from satisfactory, since two-thirds of these mills went bankrupt within ten years. The reasons for this poor performance can be listed as follows: First, 2,000 spindles were too few to run the mills economically. Second, the water wheels used as a source of power were unable to operate

efficiently when rice transplanting started and when water became scarce during the summer. Third, there was a shortage of skilled workers and technical staff, and a lack of capital to employ foreign experts. Furthermore, the supply of raw material was not sufficient in quantity and quality to run the mills at full capacity.

C. *Industries and Rural Changes*

Cotton mills became viable only with the importation of modern plants designed to achieve economy of scale. Electric lighting, though quite expensive in those days, began to be used, greatly reducing the risk of fire and also making possible the introduction of the two-shift system learned from India. In these large-scale cotton mills, Indian cotton began to be used in place of Japanese cotton, which resulted in a disastrous effect on the cotton-growing areas in the western parts of Japan. These areas, however, turned out to be the places where small-scale rural-based industries developed producing such items as brushes, shell buttons,[14] lenses, etc.

The first modern factory to produce shell buttons was founded by a foreign merchant at Kobe City. Those who learned the techniques at this factory were successful in disaggregating the production process into more than ten parts. The production process based on these disaggregated parts was further simplified to the extent that it could be transplanted to the rural areas. Rural industries were thus developed employing capital-saving and labor-intensive methods, and these industries provided part-time employment opportunities for the rural populace. The modern Kobe factory went into bankruptcy with the development of these rural-based industries which had close ties with wholesale dealers in the urban areas.

As has been discussed, silk reeling and cotton spinning were the leading industries in the initial stage of industrialization in Japan. However, the former developed as an export industry, after absorbing modern techniques, based on small-scale, capital-saving, and labor-intensive methods. In contrast, the latter developed initially as an import-substitution industry and later into an export industry based on large-scale, capital-intensive, and labor-saving methods.

In both industries, the overwhelming majority of the workers were daughters of poor rural households. In those days, Japanese agriculture was characterized by a deteriorating land/man ratio, exposure to the impact of the international economy, monoculture of rice, and destitution of the rural economy.[15] Many of these female workers suffered from various diseases, particularly tuberculosis, due to the hard and long hours of labor under inferior working conditions. Besides, bound by advance payment handed over to their parents in the name of

[14] See an excellent case study by Johzen Takeuchi compiled in this study.

[15] The destitution of farmers was reflected in the frequent occurrence of violent tenant disputes. The agricultural policy of the government had been to foster own farmers, but the tenant violence forced the government to pass the Tenancy Adjustment Law in 1924. This law was practically enforced by the officers of Peasant Affairs stationed in each prefecture. Successful implementation of the postwar land reform was partly attributable to the detailed records kept by these officers.

a contract, the only way they could protest was by flight. However, the subsequent jobs available to these runaways were worse.

The initial twenty years of Japan's industrial history beginning from the end of the nineteenth century were full of tragic stories about these young female laborers. The textile industries, both silk reeling and cotton spinning, began to suffer from a shortage of labor, particularly skilled labor, which enhanced the competition of recruitment among factories. The shortage of engineers was serious. An example is had of an engineer trained abroad who had to rotate among three different factories—two days a week in each factory. The increase in the cost of recruitment and advance payment and the shortage of skilled workers intensified the degree of watch and restraint over the female workers. Dormitories and compulsory savings systems were instituted and popularized as preventive measures against desertion. The savings of those who left a job before the end of the contracted term were confiscated. Efforts for the retention and recruitment of workers took different forms in large-scale and small-scale mills: improvement of welfare facilities in the former case, and intrigue and violence in the latter.

D. *Iron and Steel Mills and Foreign Experts*

The Meiji government wanted to build warships at home. This was analogous to the target set by the previous Tokugawa regime of manufacturing cannon at home. It may not be too much to say that this was the major objective of industrialization in the Meiji period. Warship construction required modern science and technology and for this purpose the production of iron and steel was a prerequisite.

In 1880, the government established an iron and steel mill at Kamaishi, in the eastern part of Japan, at a time when small-scale textile industries equipped with 2,000 spindles were being set up in various places. Opinion was divided between an English engineer and Takatō Ōshima, who was responsible on the Japanese side, on such issues as the location of the plant, routes of transporting iron ore, the method of water and fuel procurement, and above all the working conditions of the laborers. The government adopted the plan proposed by the German engineer. However, the mill had to be closed six months after the initial kindling of a furnace due to accidents such as fire and coagulation.[16]

Twenty years later (1901) the Yawata Steel Works set up by the government went into operation with the technical collaboration of Germany. Again, it ran into trouble one year after its inaugural kindling, mainly because of a design error; the plant, modeled after those in Germany, was not suited to the iron ore and fuel available in Japan. The problem was solved by the import of suitable raw materials from China. A lesson to be learned from this example is that mere transfer of advanced technology and its replication, or overestimation of conventional foreign experts leads nowhere.

[16] Detailed and full explanations are given in papers by Ken'ichi Iida, one of them is available in this issue.

In any case, the Yawata Steel Works finally paved a way and developed to the extent that iron and steel were produced in an integrated production system. Like other heavy industries in Japan, however, the raw materials were imported from abroad and the only asset this industry had was skilled manpower and technical know-how. Thus the Yawata Steel Works was successful from a technical point of view, but, economically speaking, it took more than ten years before it could produce a profit. The increase in demand known as "iron hunger" caused by World War I made this possible. The slogan "iron is the base for nation-building" supported and encouraged engineers to bear with the long process of trial and error in this industry. Yet it should be noted that the Yawata Steel Works was able to survive for a long time without making a profit and at the same time it could ignore the people's protest against pollution because it was a government-operated enterprise.

It is often the case that success and risk are two sides of the same coin. Kageyoshi Noro, a metallurgist who opposed the commissioning of foreigners to design the plant at Yawata, had to resign from his office at the initial stage of its operation. However, the first failure of this mill brought him back. He found that the problem lay in the coke. In fact, Japan did not produce good coke. Noro finally solved this problem. His reappointment suggests to us that politics and nepotism prevalent in the public sector caused great loss to the nation.

CONCLUSION

Noro said, "People say that technology has no boundary. However, in its actual application, each country must make an appropriate modification to fit the local conditions. Success can be expected if each recipient country of foreign technology is ready to undertake this creative work." The notion of appropriate technology was already made explicit at the beginning of this country.

Even in the successful case of silk reeling in Japan, it took almost twenty years before the Italian direct reeling method was replaced by the indirect reeling method, and the "Kennel" system in raw-silk reeling began to be used instead of the French method known as the Chambon system. A variety of improvements were made in sericulture and mulberry growing which reached a peak on the eve of World War II. The war destroyed the stable international market for silk products, and this ended the industrial life of these appropriate export goods produced by appropriate technology.

It is important for human and social development not to apply foreign technology naively, but to scrutinize it carefully. Technology can be made appropriate if it is used to produce appropriate commodities and can find appropriate markets. The following example illustrates this point.

One of our collaborators, Akira Tamaki,[17] has pointed out that land was excessively developed compared to the availability of irrigation water in the late

[17] See a chain of his works, for instance, *Mizu no shisō* [On water] (Tokyo: Ronsō-sha, 1979), and also "Development of Local Culture and the Irrigation System of the Azusa Basin," mimeographed, HSDRJE–4/UNUP–50 (Tokyo: United Nations University, 1979).

seventeenth and early eighteenth centuries. The only frontier left for Japan in the Meiji period was Hokkaidō. The development officers of the Meiji government relied on the advice of foreign experts. They recommended the introduction of North American-type agriculture, with the development of dairy farming and the cultivation of potatoes. It appeared to be a reasonable proposal, suited to the ecological and climatic conditions of Hokkaidō, and in fact it proved to be a minor success in some places. Ironically, however, such success did not come from the application of North American but of Danish-type farming.

It is interesting to note that, in parallel with the long and desperate efforts to adopt the Danish-type agriculture, the settled farmers in Hokkaidō also persistently tried to grow rice in this semi-arctic region. Efforts to improve seed were continuously made by the farmers, universities, and the government experiment stations. Hokkaidō today is the largest rice-growing area in Japan.

As the farmers were aware by experience, the length of daylight required during the rice-growing season was longer than in the rest of Japan. A more important reason for the farmers to grow rice was the psychological satisfaction obtained from rice growing which was much greater than that obtained from wheat. It is a recent finding by nutritionists that the calories obtained from rice produced per unit of land is twice that of wheat. The adherence of the farmers to rice cultivation was thus proved to be rational. It is to be wondered how the development officers and foreign experts of those days would react to present-day rice cultivation in Hokkaidō. However, what should be stressed here is the fact that the farmers in Hokkaidō have kept on growing rice despite the fact that the labor input required for rice cultivation is three times that of wheat.

A similar example can be found in the World Bank project to reclaim waste virgin lands in Kushiro-Nemuro in Hokkaidō after World War II. Many of those who settled there with the hope of developing mechanized farming had to leave, since the Jersey cattle that the World Bank experts recommended could not find an appropriate market. Only those who switched to keeping Holstein cattle and who also could leave their farms temporarily for part-time jobs found ways to settle there. This example raises a question with regard to the effectiveness and limitation of foreign experts. It also calls to mind the metallurgist K. Noro, mentioned above. It is this writer's hope that a person like Noro is somewhere making efforts jointly with the local inhabitants for human and social development through appropriate technology transfer and appropriate technology transformation thus bringing about a self-reliant development of technology.

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