

HOW HOKKAIDO BECAME THE LARGEST RICE PRODUCER IN JAPAN: IMPLICATIONS FOR AGRO-BASED DEVELOPMENT STRATEGIES IN AFRICA

Susumu WATANABE¹

1 INTRODUCTION

The organizer has invited me to discuss Japanese experience relevant to African nations in their industrialisation efforts. When we talk about the “industrialization of Japan”, we usually refer to the development of imported modern manufacturing industries, such as mechanized cotton spinning and weaving, shipbuilding and iron and steel industries. However, the relevance of Japanese experience to African countries is extremely limited in this domain, because initial conditions are too different. I have therefore opted for discussing how the Japanese managed to turn its northern provinces, the northern island of Hokkaido in particular, into main rice supplying areas by overcoming the cold climate. The strategy adopted was much the same as those for the promotion and modernization of small consumer goods industries, including traditional rural industries.

My choice of this alternative subject has been motivated partly by the current debate on development strategies among Ethiopian policy-makers and researchers. The desirability of a rapid development of the urban sector is obvious, as surplus rural population is bound to flow out of villages to expand the urban informal sector. Given the extremely limited industrial base and the severe policy-constraints imposed by the Washington-based international financial institutions and the WTO, however, the prospect of such a strategy is far from promising: how could one sensibly expect a rapid expansion of industrial exports, while domestic markets for the simplest industrial products are flooded by imports, let alone those for more sophisticated products? On the other hand, given the extremely primitive conditions of Ethiopian agriculture and rural industries and services, there seems to be an ample room for their improvement and expansion, provided that unyielding efforts could be made for that purpose. As the situation is similar in many other African countries, much the same can be said about other Sub-Saharan countries as well.

¹ Tokyo International University

Before proceeding to the main subject, however, let me explain briefly how the initial conditions of Japanese industrialization were different from those of present-day Africa.

2. THE JAPANESE ECONOMY AT THE END OF THE FEUDAL PERIOD

The difference pertains partly to the external political climate and partly to the Rostowian stage of development².

As to the first, when Japan's modernization started in the mid-19th century, the advanced Western nations were at the zenith of their imperialist regimes, and the international rules of game they were trying to impose on the rest of the world were not very different from the traditional Japanese. The Japanese and the Western strategies were basically the same: industrialization for and through armament, under a regime much more authoritarian than today's. In order to survive as a sovereign state, one had to keep up with advanced nations, depending on its own resources. So long as one could do this, however, one could adopt whatever approach one wanted and implement it as one liked. In contrast, today's African countries heavily rely on external aids not only for their material needs but also for human resources, and they are inevitably subjugated to rules of game tailored to the socio-political conditions of the donor countries.

As regards the stage of development, Japan's starting point was incomparably higher than present-day African countries'. If one accepts Maddison's estimates³, its per capita income was lower than those of most Latin American countries and some Asian countries (notably the Philippines under the US colonial rule) until the early 20th century. It was also technologically behind those Western countries which had already completed their Industrial Revolution, based on mechanical mass-production technology. However, the level of its institutional and social development was in many ways equal to, and sometimes higher than, theirs. Under the rule of Samurai (warrior class) regimes after the late 12th century, a sufficiently solid structure of nation state had been built by the 1580s to expel foreign missionaries and conduct a nation-wide land survey and a once-for-all disarmament of the non-Samurai classes. By the early 17th century the Tokugawa Shogun's feudal regime (1603-1867) was tightly controlling the entire country, completing and refining a series of major socio-economic reforms initiated by Toyotomi Hideyoshi at the end of the previous century.

² Cf. W.W. Rostow: *The Stages of Economic Growth*, 3rd Edition (Cambridge, Cambridge University Press, 1990), especially chs. 2 and 3.

³ Maddison, *The World of the 20th Century* (Paris, OECD).

When the Samurai regime was toppled in 1867, under the pressures from the impoverished lower-class Samurai and peasantry as well as from Western powers demanding the opening of the country, Meiji Japan -- i.e. the first period of modern Japan under Emperor Meiji (1868-1912) -- inherited a thoroughly developed national administration and taxation system linking the central government to individual households in the remotest villages, as well as a nation-wide marketing network facilitating the flow of commodities between villages and national markets of Tokyo, Osaka and Kyoto and international markets, through a few intermediaries. Financial and shipping services were there to support such flows.

As regards agriculture, the application of animal and human manure as well as plant ash spread in the 12th and 13th century. So did animal-drawn ploughs. Together with the arrival of a new rice variety from Southeast Asia, paddy productivity rose significantly during this period. The use of water wheel for irrigation and crop processing spread in the following centuries. Paddy production almost doubled between the early 17th and the mid-18th century, partly due to the expansion of farmland and partly due to technological innovations such as improved varieties and dried-fish fertilizers. Living conditions of the peasantry were harsh. Yet, until the 1890s, when the public revenues from the modern sector began to increase as the Industrial Revolution advanced, they managed to bear the bulk of the financial burden of the ambitious modernization programme, either directly in the form of land tax or indirectly in the form of tenancy fees, which amounted to 40 to 60% of their annual crop values. During the same period, they were also the main earners of foreign exchange as Japanese exports consisted mainly of tea and raw silk.

A significant stock of human capital was not lacking, either. The Tokugawa Shogunate Government had a number of schools specialized in different areas of study: Chinese and Japanese classics, history, medical science, Western technical books (Dutch translations), etc. Virtually all the provincial Samurai governments, about 260 in number, had their own schools for the Samurai class, and many had also schools for commoners. Samurai and non-Samurai scholars ran private schools specialized in different areas of study. Consequently, the ruling Samurai class (about 5% of the total population) as well as better-off merchants and farmers were highly educated. In addition, there were roughly 15,000 informal private schools all over the country. Run by monks and Samurai, those schools taught 20-30 boys and girls reading, writing and arithmetic. Ron Dore estimates the literacy rate of the Japanese male population in the mid-19th century at about 40%, which was higher than the contemporary European standard⁴.

⁴ R. P. Dore: *Education in Tokugawa Japan* (London, Routledge and Kegan Paul, 1965).

In fact, literature was an important means of nation-wide diffusion of medical and agricultural knowhow already in the 16th and 17th centuries, when compendia of best farming practices in various parts of the country were prepared by farmers and scholars. For example, after the publication of a monograph on the sweet potato in 1735, the cultivation of this crop spread all over the country and helped reduce victims of famines caused by abnormal weather. A Portuguese-Japanese dictionary was completed in 1603. Although the importation of Western books was banned in 1630, the ban was lifted in 1720 except for those related to Christianity. Thus, Western science and technology, especially in the fields of medical science and metallurgy, were absorbed through Dutch textbooks and later their Japanese translations. A Dutch-Japanese dictionary was completed in 1783.

Finally, with the reopening⁵ of the country to the world in the mid-19th century, the aspiration for the revision of the 'unequal treaties' imposed by Western nations⁶ --- France, the Netherlands, Russia, the UK, and the USA --- and the threat of colonization helped overcome inter-provincial frictions and united the whole nation under the slogan of "Enrich the Nation and Strengthen the Army".

In brief, by the time Meiji Japan started its modernization effort, most of the Rostowian pre-conditions of take-off had been prepared, so much so that the first British consul-general to Japan, R. Alcock, rightly foretold, in the 1860s, that Japan would become a threat to Sheffield's metal workers⁷. The main missing factors were modern industrial technology and industrial capital.

3. THE DEVELOPMENT OF THE PADDY PRODUCTION IN HOKKAIDO

Japan consists of four major islands plus much smaller Okinawa. Hokkaido is in the north of the mainland with an area of 78,500 square kilometers, or 21% of the country's total territory. Until the end of the feudal period, the island remained more or less a virgin territory, its population being no more than 80,000. The main explanation for this situation was that its cold climate prohibited the cultivation of

⁵ For about a century starting in 1543 Japan had contact with the Portuguese and the Spanish, and later also with the British and the Dutch, before closing the door in 1639 for fear of Christianity.

⁶ Forced to open the country to the world under the threat of Western gunboats, Japan was also obliged to accept treaties which denied its tariff autonomy and granted Western Powers extraterritoriality.

⁷ R. Alcock: *The Capital of the Tycoon: A Narrative of a Three Years Residence in Japan* (London, Longman, 1863), 2 vols, see vol. I, chs. 15 & 20, and Vol. 2, ch.13.

paddy, the Japanese staple food⁸. Since the frontier of new farmland development in the rest of the country had more or less exhausted in the 18th century, however, the Meiji Government started encouraging migration to Hokkaido, partly for providing farming and other jobs for ex-Samurai who had lost their traditional status and income, and partly for preventing the penetration of Russians. Subsequently, the pressure of growing population in the rest of the country⁹ accelerated the rate of immigration to the island, raising its population to 2.4 million by 1920 and 3.3 million by 1940 (now 5.7 million). With the relatively abundant supply of land¹⁰, Hokkaido has developed a strong base of livestock and dairy farming. As manufacturing industries expanded rapidly in southern and central Japan, moreover, the centre of paddy production shifted continuously to the northern part of the country: the aggregate rice production in the seven north-eastern prefectures and Hokkaido rose from 2.6 million tons in 1930 to 5.0 million tons in 1970. Due to the shift in the government policy from the encouragement of production increase to production control in 1970, the total output declined thereafter to just below 4 million tons by 1999. In the meantime, the share of the Northern provinces in the national total continued to rise from 25.8% in 1930 to 39.5% in 1970 and 43.3% in 1999. Hokkaido alone produced 0.9 million tons in 1970, when it was the largest producer accounting for 7.2% of the national total. Its share rose to 8.1% in 1999.

As Japanese agriculturists say, the history of Japanese agriculture is a history of continuous northward movement of paddy farming, since its arrival in the southern island of Kyushu in the 3rd century B.C. It was, however, the technological progress since the Meiji Period that has turned the northern part of Japan into the country's main supplier of rice. No dramatic technological breakthrough such as biotechnology has been involved. Just as in the Japanese car industry, where the cumulative effect of small but continuous improvements is considered to be larger, in the longer terms, than the impact of an occasional major innovation such as robotisation¹¹, the transformation of barren Hokkaido has been a fruit of incessant efforts for the improvement of all aspects of conventional farming practices.

⁸ Cf. Susumu Watanabe, "The Lewisian turning point and international migration: The case of Japan", *Asian and Pacific Migration Journal*, Vol. 3, No. 1, 1994.

⁹ With the advancement of modernization and improvement of living conditions, the rate of population growth doubled from about 0.5% in the early 1970s to over 1.0% by the mid 1890s, making the average for the period 1870 - 1920 to 1.0%. 1920-1935 is a period of exceptionally high growth rate of 1.4%, reflecting the expansionary national policy.

¹⁰ In 2000, the number of inhabitants per square kilometre was 73, as compared with the national average of 340.

¹¹ See Watanabe's chapter on Japan in Susumu Watanabe (ed.): *Microelectronics, Automation and Employment in the Automobile Industry* (Chichester, John Wiley, 1987), and idem, "Work organization, technical progress and culture with special reference to small group activities in Japanese industries", in D. Foray & C. Freeman (eds.): *Technology and the Wealth of Nations; The Dynamics of Constructed Advantage* (London, Pinter, 1993).

Cold-resistant and fast-growing rice varieties were developed through selective cross-breeding, culminating in the currently popular Kirara. The seedbed was improved to maintain a sufficiently high temperature. Better use of fertilizers, herbicides and insecticides was sought, and a variety of improved agricultural machinery was introduced to finish all the necessary farming work within a limited period of reasonably high temperatures. Another important area of efforts was related to the improvement of land through better water control and irrigation. It is only in this last domain that the government played a major role, especially after World War II. In other domains, progress was brought about primarily through private initiatives.

At the centre of the agricultural progress in Japan has always been the “Ro-no”, or those farmers who have ample experience and who are devoted to the improvement of farming practices. They sometimes travel a long distance to exchange information with other interested people, study literature on old and new innovations in different parts of the country, and incorporate relevant elements into their own experiments. Since the early 20th century, they have been assisted by agricultural and industrial research institutes and experiment stations, which the government established at the national, prefectural and lower provincial levels. Advice and suggestions come also from researchers at agricultural colleges and universities. Other important supporters include agricultural-chemicals producers and equipment manufacturers.

Those efforts were not confined to the northern Japan, of course. With the end of World War II, Japan lost Korea and Taiwan¹² which had been supplying over 10% of its total rice consumption, while about 6 million people returned from abroad, either from former colonies or from battle fields. Thus, food shortage became the nation's most urgent problem, and concerted national efforts started. While farmers in the north were eager to develop cold-resistant varieties, those in warmer areas were anxious to shorten the cultivation period in order to harvest before the typhoon season. In Chiba Prefecture, for example, the cultivation period has been shortened by almost one month since the 1950s. Farmers' problems in overcoming the low temperatures in northern Japan must have been considerably reduced by the fact that virtually every work item involved in paddy production was mechanized by the late 1970s, as small-scale agricultural machinery adapted to the fragmented paddy fields became available, such as tillers, planters, harvesters and threshers. Here, the knowhow of metal engineering technology accumulated during World War II

¹² Taiwan and Korea (both South and North) became Japan's colonies in 1895 and 1910, respectively.

played an important role, just as prewar research contributed to the development of a variety of low-cost chemical fertilizers after the 1950s¹³.

Table 1: Development of paddy production in Japan, 1885-2000

Year	Total paddy field (‘000 hectares)	Total production (‘000 tons)	Output per hectare (tons)
1885	2,552	5,063	1.98
1890	2,694	6,422	2.38
1895	2,708	5,933	2.19
1900	2,731	6,122	2.24
<u>1905*</u>	2,783	5,637*	2.03*
1910	2,834	6,855	2.42
1915	2,907	8,189	2.82
1920	2,960	9,205	3.11
1925	2,992	8,717	2.91
1930	3,079	9,790	3.18
<u>1935</u>	3,044	8,414	2.76
1940	3,004	8,955	2.98
<u>1945*</u>	2,798	5,823*	2.08*
1950**	2,877	9,412	3.27
1955	3,045	12,073	3.96
1960	3,124	12,539	4.01
1965	3,123	12,181	3.90
1967	3,149	14,257	4.53
(1969	3,173	14,223	4.35)
1970***	2,836	12,528	4.42
1975	2,719	13,085	4.81
<u>(1980****</u>	2,350****	9,692****	4.12****
1985	2,318	11,613	5.01
1990	2,055	10,463	5.09
<u>(1993*</u>	2,127	7,811*	3.67*)
<u>(1994</u>	2,200	11,961	5.44)
1995	2,106	10,724	5.09
2000	1,763	9,472	5.37

Notes: Underlined are years heavily affected by the cold weather. Bold letters indicate historical records.

*Year of exceptionally bad cold weather. **The post-war land reform had completed.

The government policy shifted from the encouragement of production increase to the reduction of the acreage of paddy field. *Hokkaido is not included.

Source: Yano Kota Kinen-kai (ed.); Suji de miru Nihon no 100-nen (Summary of 100 Years' statistics on Japan), 4th edition (Tokyo, Kokusei-sha, 2000), pp.203-204. The figures for 2000 are from *Zusetsu Shokuryo, Nokyo, Noson Hakusho: Sanko Tokei-hyo (Statistical Supplement, Illustrated White Paper on Food, Agriculture and Village Life)*, Norin Tokei Kyokai (Tokyo), 2001, p. 65.

¹³ Cf. Showa Nogyo-Gijutu Hattatsu-shi Hensan linkai (Commission for the compilation of a history of the development of agricultural technology in the Showa period) (ed.): *Showa Nogyo Gijutsu Hattatsu-shi Vol. II. Suidem-hen (A History of Agricultural Technology during the Showa Period, Vol II. Paddy)* (Tokyo, No-rin Suisan Gijutsu Joho Kyokai).

As in manufacturing industries, the “cooperative rivalry” has been one of the key features of the progress in Japanese agriculture. Exhibitions, fairs and contests are organized by official or private organizations, in order to stimulate competitive efforts as well as to promote exchange of experience and ideas. The Asahi Newspaper Company began, in the midst of the serious post-war food crisis, to award a prize to the country’s No.1 paddy producer every year. Aimed at supporting the national effort at overcoming the food shortage, the company awarded the prize to the farmer who produced the largest amount of rice per hectare. Not infrequently, farmers recorded more than 9 tons per hectare, and sometimes over 10 tons. This annual contest is believed to have been one of the most important factors contributing to the growth of the annual paddy production to 14 million tons by 1967-68 (Table 1).

Before closing this section, a few words are in order regarding the post-1970 trends in Table 1. The 10% per annum economic growth between the late 1950s and the first oil crisis of 1973-4 dramatically raised the Japanese standard of living and changed their life style. One of the areas that were affected the most was the pattern of food consumption. While consumption of meat and dairy products more than doubled during the 1960s, the average amount of rice purchased per household declined from 427.5 kg in 1960 to 250.6kg in 1970 (and to just about 100 kg by the late 1990s). Consequently, by the time the annual paddy production reached 14 million tons, the stock of old rice and related fiscal burden became too large. In 1970, therefore, the government changed its policy from the encouragement of rice production to the reduction of the total paddy area and the diversification of Japanese agriculture. Paddy producers changed their target from a larger output per hectare to the development of higher-value added (i.e. higher-quality) varieties. The increase in the paddy output per hectare in more recent years is a combined result of two factors: the pursuit of higher-quality cum higher-productivity, and the withdrawal of less productive paddy fields.

4. GOVERNMENT POLICY

For agricultural development, the Japanese government adopted basically the same tactics as in accelerating the economic development process itself: (a) stimulation of people’s initiative, (b) elimination of obstacles to their spontaneous development efforts, and (c) provision of supporting services. Except where risk was too large for the private sector (introduction of large-scale heavy industries, acquisition and development of totally new large-scale technologies, construction of major infrastructure such as long-distance railways, large-scale dams, etc.), the government tried to create an appropriate climate for people’s initiative rather than do it itself. Its policy instruments were also much the same as for the promotion of small-scale

industries or light consumer goods industries. Apart from price, fiscal and trade policies, the following three may be taken up here as the main areas of government intervention: (i) education and vocational training, (ii) R&D institutes and experiment stations, and (iii) fairs and exhibitions.

Before deciding upon their development strategy and policy instruments, Meiji Japanese spent their meagre resources rather generously for learning about the conditions in advanced countries. Between October 1871 and September 1873, for example, a group of leading political figures toured in the United States and Europe, exchanging views with Western leaders and studying socio-industrial conditions. Their itinerary included the 1873 Vienna International Exhibition. The 1867 and 1878 Expositions in Paris are also believed to have had an important impact on the modernization of the country, partly because Japanese visitors made most of their trip to learn about modern technologies and systems. Thus gained knowledge was essential for their selection of sources of technologies and experts imported.

(i) Education and vocational training

“The central role of education is perhaps the most prominent characteristic of Japan’s transformation”¹⁴. The Meiji and subsequent governments placed top priority on education. The education programme before World War II was characterized by (a) a great emphasis on elementary education, (b) a very limited scale of higher education and its focus on national needs, and (c) an extensive programme of elementary vocational education (Table 2).

Elementary school

Elementary education is the key to the economic development, as spontaneous development efforts by the mass presupposes their “thinking ability”. The modern school system was initiated and primary schools were set up throughout the country in 1872. Given the solid state-administration structure, the scheme was implemented quickly, mobilizing as teachers those educated Samurai who had lost their jobs and incomes. Three years later, nearly 2 million children were studying at more than 24,000 schools (Table 2). In the same year a male teachers’ training school was established in Tokyo and a school for female teachers two years later. Because of poverty and mismatch between local conditions and the content of education, however, progress was slow. It was after the reform of 1886 that the modern

¹⁴ Shigeru Yoshida, “Japan’s decisive century”, *Britanica Book of the Year 1967*. As prime minister, the author played the key role in re-constructing the Japanese economy after World War II.

education system started developing systematically. Primary school education was made compulsory, while the schooling period was reduced 4 years to be extended to 6 years in 1907. A primary-school teachers' training school was set up in each of about 45 prefectural provinces¹⁵, and a higher-level school in Tokyo for the supply of teachers for these schools.

Table 2: The expansion of school education in the pre-WWII Japan*

	Primary school	Middle school	Girls' high school	Teachers' training school	College**	High school	University
(A) Numbers of schools							
1875	24,303	116	--	82	110	--	--
1880	28,410	187	--	74	74	--	1
1890***	26,017	55	31	47	36	7	1
1900	26,857	218	52	52	52	7	2
1910	25,910	311	193	80	79	8	3
1920	25,639	368	514	94	101	15	16
1930	25,673	557	975	105	162	32	46
1940	25,860	600	1,066	103	193	32	47
(B) Number of students (in thousands)							
1875	1,926	5.6	--	6.8	7.7	--	--
1880	2,349	12.3	--	5.2	5.1	--	2.0
1890***	3,096	11.6	3.1	5.3	10.3	4.4	1.3
1900	4,684	78.3	12.0	15.6	14.9	5.7	3.2
1910	6,862	122.3	56.2	25.4	33.0	6.3	7.2
1920	8,633	177.2	151.3	26.6	49.0	8.8	21.9
1930	10,112	345.7	369.0	43.9	90.0	20.6	69.6
1940	12,335	432.3	555.6	41.4	141.5	20.3	82.0
(C) Number of teachers							
1875	44,501	265	--	588	489	--	--
1880	72,562	924	--	675	327	--	117
1890***	67,730	680	311	654	564	300	169
1900	92,899	3,748	658	1,068	1,112	345	291
1910	152,011	5,902	2,913	1,679	2,536	351	625
1920	185,349	7,665	6,566	2,062	3,758	561	1,882
1930	234,799	13,843	15,223	2,971	7,087	1,418	5,941
1940	287,368	15,798	19,066	2,904	10,102	1,438	7,021

Notes: *The length of period of schooling at each category of school changed from time to time. According to the legislation around 1919: University = 3-4 years after 13 years' schooling; college = 3-4 years after 11 years' schooling. **Includes business colleges. ***The reform in 1886 introduced systematic norms for different categories of schools for the first time.

Source: The same as in Table 1, pp. 529-531.

¹⁵ The number of provincial administrative units was reduced from 260-270 feudal territories to 40 odd prefectural units by the 1880s. Currently there are 47.

The primary school enrolment rate of the boys surpassed 50% by 1875, 90% by 1900, and 99% by 1920. The basic motto of the education was “Japanese soul, Western technology.” Primary and secondary education contained an important element of “ethnic training”, which was meant to cultivate a sense of obligation to the nation and commitment to the national mottos, such as “Enrich the Country, and Strengthen the Army”.

University education

In 1873, an Imperial College of Engineering (Kobu Daigaku) was established, “with a view to the education of engineers for service in the Department of Public Works”¹⁶. Before it was absorbed by the Imperial University of Tokyo (today’s Tokyo University) in 1886, 211 students graduated from the College: 48 in mining, 45 in civil engineering, 39 in mechanical engineering, 25 in applied chemistry, 20 in agriculture, 8 in shipbuilding and 5 in metallurgy. The subject distribution roughly corresponded to the structure of the Department’s expenditure during the period of its existence (1870-85).

At Tokyo University, set up in 1877, the students of natural sciences including medical accounted for 90% of the total in 1880 and for over 80% in 1886. Article I of the Imperial University Ordinance of 1886 clearly defined the objective of the Imperial Universities as being “to teach and study sciences and practical arts in response to the national needs”. As the supplier of bureaucrats and high-level teachers, Tokyo University had faculties of social sciences and humanities, as well. Subsequently established imperial (state) universities --- Kyoto (1897), Kyushu (1907) and Tohoku (1911) ---, however, invariably started with faculties of natural sciences (science, technology, medical science, agriculture), and faculties of social sciences and humanities were added later.

During the summer vacations, students were sent to actual work places for on-the-job training. Upon graduation, they secured a high post in a government office or in the private sector, and they were often sent abroad for several years to improve their expertise and familiarize themselves with conditions in Western countries. What is remarkable about this official overseas study programme is that no case of “brain drain” was recorded, although a significant number of students died of tuberculosis.

¹⁶ This is a direct citation from the English calendar prepared by Henry Dyer, principal of the College. Considering the work done by the Department, I believe “Ministry of Engineering” is more appropriate than “Department of Public Works”.

There was a practical reason why the Meiji Government was so enthusiastic about the practical education and training at the university level. When its programme of modernization started, it had to hire thousands of foreigners to run imported production facilities and to train Japanese. Invited from countries of high reputation in individual fields of work or study, their salaries were high. Some received more than the top minister's salary, as was the case with Henry Dyer, principal of Kobu Daigaku. During the 1870s, when the Department of Public Works and the Department of Education hired hundreds of foreigners every year, two-thirds of these Departments' annual budgets was spent on the pay bills for their "hired foreigners". In the next decade, however, the newly created local manpower started to replace those foreigners, quickly reducing their number to an insignificant level by the end of the 19th century.

The number of colleges and universities began to expand after 1918, when the government changed its policy to permit local governments and the private sector to establish such schools.

Vocational education and training

Soon after the Meiji Restoration (of the imperial rule), the new government established a number of business colleges. One of the earliest was Sapporo Agricultural School, which was opened in 1876, obviously as the vanguard of agricultural development of Hokkaido. Komaba Agricultural School was set up in Tokyo two years later. Subsequently, they became the Faculty of Agriculture of Hokkaido University and of Tokyo University, respectively.

Around the turn of the century, with the advancement of the Industrial Revolution, the demand for technical personnel began to grow rapidly. Accordingly, the number of business colleges run by the central government rose from 4 in 1900 to 20 by 1920 and 51 by 1940, extending the areas of study from industry, commerce and agriculture to many other fields and specializing in increasingly narrow areas as the Japanese industries became more sophisticated. Contributions of local governments and the private sector were limited at this level: 3 and 18, respectively, by 1940.

Local governments were far more enthusiastic about somewhat lower-level business high schools. The number of such schools grew from 15 in 1880 to 116 by 1900 and to 279 by 1920 and 1,207 by 1940. Local governments accounted for over 80% of those schools in 1900 and 73% in 1940, the rest being in the private sector. Starting in the 1890s, two- to four-year industrial, commercial and agricultural "supplementary schools" were superposed on the elementary schools. Their number exceeded 14,000 by 1920 and reached 20,500 in 1940. Private-sector initiatives were

encouraged, but this programme was overwhelmingly dependent on local governments, which accounted for 98% of the total supplementary schools in 1920 and 89% in 1940. Usually established upon petition from local communities, the content of training at those schools was tailored to the needs of the locality¹⁷.

It is notable that graduates from these lower-level vocational schools became the central figures in the “new village” movement aimed at the improvement of farming practices and rural living conditions. Their innovative efforts were assisted by more highly trained university and college graduates working at agricultural experiment stations or colleges and universities.

(ii) R&D institutes and experiment stations

In 1893 an agricultural ‘experiment station’ was set up in Tokyo, followed by those in other parts of the countries (eventually at least one in each prefecture). Their aim was to assist farmers in their technological problem-solving and innovating effort, carrying out various experiments and analyses on their behalf and providing advisory, consultancy and information services.

The official R&D programme started with the Tokyo Industrial Laboratory which was set up in 1900 as the country’s ‘central laboratory’. Choosing technologies of nationwide relevance, it undertook research for local production of imported materials (e.g. chemicals), and scientifically analysed traditional materials and processes (e.g. dyes and ceramics) to find means of their improvement. A similar national laboratory of a general nature was subsequently opened in Osaka, while other national laboratories were specialized in particular areas such as electrical engineering and railways. By 1931 fifty-six national R&D institutes had been established, supplemented by the prefectural and other local laboratories. Their research often resulted in patents, but the major area of their contribution is believed to have been in their services assisting companies’ and individual people’s efforts for technological progress, e.g. by opening their experimenting facilities for public use and providing advisory or consultancy services.

¹⁷ Cf. Susumu Watanabe, “The patent system and indigenous technology development in the Third World”, in Jeffrey James and Susumu Watanabe (eds.): *Technology, Institutions and Government Policies* (London, Macmillan, 1985), based on the Japanese Ministry of Education: *Gakusei 90-nen-shi (90 years of Japan’s official education system)* (Tokyo, 1954).

(iii) Fairs and competitive exhibitions

Probably because of the enormous impact they received from the International Exhibitions of Paris and Vienna, the Meiji Japanese organized many exhibitions, fairs and contests, at various administrative levels (and this tradition has survived until today). Distinguished exhibits were awarded prizes and publicized through media for their diffusion. Expert referees analysed them to make concrete advice for further improvement, or suggested alternative approaches and indicated directions in which future efforts should be made. How serious the Meiji government was about these events may be surmised from the fact that the Emperor personally attended national industrial fairs and spoke at the opening or commendation ceremony.

The national fairs took place five times between 1877 and 1903. Their impact on industrial progress is well known, especially in relation to the development and diffusion of “intermediate technologies”, such as the Gara spinning machine which applied the water wheel to traditional manual spinning equipment, the Battan weaving loom which added John Kay’s flying shuttle to the traditional hand loom, and Minorikawa’s multi-reeled silk-reeling machine which led to the mechanization and automation of silk industry.

In terms of the practical impact, however, by far the most important was a somewhat smaller-scale exhibition of textile industry held in the 1880s. Here, an expert commentator pointed out the superiority of the ring spinning frame over the then popular “mule”. Invented half a century after the latter, around 1830, the former was not yet widely used even in the UK. Comparing precise operational data related to the two machines, the expert argued that the ring frame was more suitable for the mass production of coarser yarns used in Asia and incomparably economical because drawing, twisting and winding of the thread was done in one rapid continuous operation. The Japanese spinning industry rapidly switched to the ring and, by the turn of the century, regained the domestic market once completely dominated by imports from the UK and expanded exports.

Because agricultural products and technologies are mostly locality-bound, no such dramatic examples are known as regards the impact of agricultural fairs and exhibitions. But numerous small-scale local fairs and exhibitions were organized by local authorities and farmers’ associations, to stimulate improvement of varieties and farming methods, in ways similar to industrial fairs and exhibitions. The already mentioned annual contest organized by the Asahi Newspaper Company is the most conspicuous example of such events.

5. IMPLICATIONS FOR AFRICAN COUNTRIES

Africans are spoilt by the generous nature. While the population pressure remained low, they could survive on the gifts of the good earth without much effort, except during a drought.

The situation has been changing rapidly now. Borrowed medical science has been reducing the death rate dramatically, but the decline in the birth rate has been lagging behind due to the slow pace of transformation of their life style. What is worse, so far they have failed to make good use of accessible science and technology for the purpose of feeding the ever growing population. The greatest explanation for this failure rests, in my view, in their attitude that broadly remains unchanged since the good old days.

From Section I above, it should be clear how remote African societies are from the starting point of Rostowian take-off. If they really want to reduce the gap between industrialized countries, they need to be really serious and make desperate efforts unyieldingly. Japanese leaders in the Meiji Period used to talk about the "100 Years' Grand Programme of National Development." As we have seen, they started this programme with considerable preparation. And yet, it took Japan exactly 100 years before it began to overtake Western nations in terms of per capital income, starting with Finland and Italy in 1967. African leaders need to take this historical fact seriously.

Having said this, I must concede that in two respects African nations are potentially in a much more favourable situation than the pre-WWII Japan. One is the availability of high technology, such as microelectronics and biotechnology. The other is the cooperative international environment. Potentially, these factors can help reduce the time and effort required for African catch-up. So far, this expectation appears to have been frustrated. It is not difficult to explain why. As regards the high technology, I have argued elsewhere, on the basis of empirical country case studies that it can sometimes facilitate "leap-frogging", but only where adequate preparation has been made in many ways, such as in the Republic of Korea¹⁸. The experience of the Green Revolution in Asia points to the same lesson. How many African countries are ready for the "Age of Hi-Tech"?

The cooperative international environment is an opium. It may work as a medicine or as a poison, depending on the user's attitude. In this connection, it is relevant to

¹⁸ Cf. my concluding chapter in Susumu Watanabe (ed.), *Microelectronics and Third-World Industries* (London, Macmillan, 1993).

quote the following passage from Deng Xiaopin: “To win time and speed, we must necessarily import advanced technology and equipment from foreign countries. To import them is for the purpose of learning from them and promoting our own creations instead of using them to replace our own”¹⁹. As the episode of “hired foreigners” indicates, the Japanese approach is consistent with this view. The same argument holds good with respect to foreign aids in general, of course. Without hard commitment to self-reliance, easy access to foreign aids will kill African nations’ vigour in development efforts. Would it have been possible for the Japanese to do away with “hired foreigners” so quickly, if their services had been freely available?

Probably the most practical lesson from the Japanese experience is that small but continuous improvements can result in a major change in the long run, as Hokkaido has become the top paddy producer in Japan despite its cold climate. Given the extremely low level of development of African agriculture, it has a great potential. In order to realize it, African leaders have to mobilize the general public.

To encourage people’s spontaneous efforts for improvements, it is necessary to boost their “wants to improve” and “capacity to improve”.

The “capacity to improve” is fostered basically through education and vocational training. Effectively universal elementary education merits first priority, as this will create people’s thinking ability. Higher education is obviously essential for high-level R&D. However, a large majority of improvements needed in Africa do not require formal R&D. What is needed is a thorough knowledge of products and production processes, capacity to absorb new ideas from reading and observations, and capacity to think. This is particularly true in agriculture and in light industries which dominate African economies. To encourage this kind of improvements, basic vocational education and training may be incorporated into the elementary and secondary education. Or, it can be supplemented upon the latter, as was the case in pre-WWII Japan. The Japanese experience also points to the great merits of local agricultural and industrial experiment stations in assisting efforts made by graduates of these schools and courses. It is crucial that that they are operated by people of not only high level of scientific knowledge but also of abundant practical experience, so that they can offer services matched with local needs.

The “wants to improve” depends on the awareness of the need for specific types of improvement, such as the tax pressure, and on the return expected from the intended improvements, such as after-tax surplus. The experience of Japan, as well as China

¹⁹ Deng Xiaopin, quoted in *China Business Review* (Washington, D.C.), Sept.- Oct. 1977, p. 11.

and the Republic of Korea, suggests that “wants to improve” can also be boosted through moral suasion which urges individual citizens to contribute to the nation’s development. In this connection, it is interesting to note the following remarks of Gerschenkron (in a context of French and English industrialization!): “in an advanced country rational arguments in favour of industrialization policies need not be supplemented by a quasi-religious fervour.... In a backward country the great and sudden industrialization effort calls for a New Deal in emotions”²⁰. In fact, many distinguished economists have made similar remarks, including Alfred Marshall on Japan²¹.

²⁰ Alexander Gerschenkron: *Economic Backwardness in Historical Perspective; A Book of Essays* (Cambridge, Mass., Harvard University Press, 1962), pp. 24-5.

²¹ Alfred Marshall: *Industry and Trade* (London, Macmillan).

