The Role of Agricultural Extension in the Modernization of Agricultural Technologies: A Lesson from the Japanese Experience

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Abstract
The modernization of agricultural technology and the modern version of an extension service in Japan began in the Meiji era (1868-1912) with the adoption of widespread modernization policies. In this process, Japan strongly emphasized the importance of the farmers’ participation both in the processing of new technologies in the experiment centers and in extension activities. They implemented this by employing rules and regulations that varied from forceful to peaceful or the so-called rural cooperative spirit based on mutual understanding between the farming community and the extension officials. This helped to establish close relationships between farmers and government officials. Japan realized that without strengthening these relationships and getting farmers’ active participation it would be practically impossible to encourage adoption of technology developed in government laboratories. The other remarkable strategy was the attempt to localize imported technologies, combining them with indigenous knowhow, while making solid connections between formal education and practical experience. In other words, the modernization of agricultural technologies through the unification of formal education, research, experiment and extension has been a success for Japan. At the same time, Japan was very careful to appoint suitable and capable people to the extension services, who were committed to the work and to gaining a greater understanding of the agricultural community. These strategies have contributed to Japan’s rapid modernization through land-saving technologies to achieve one of the world’s highest levels of agricultural productivity though retaining its dwarf-sized farm management. They have also enabled it to establish the agricultural sector as a base for the industrial sector development.

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I. Introduction

The distribution of population and land resources throughout the world is decidedly uneven. Its effect is more severe in the Asia Pacific region because it supports more than half of the world population on less than 20 percent of the land. However on closer inspection, the situation is even more serious because the region has only about 14 percent of the world’s cultivable land. Japan faced the same imbalance when it began its modern development process from the Meiji Restoration\(^1\) in 1868. However, Japan’s situation was even more serious than other countries in Asia due to its population size and the availability of arable land.

The state of Japanese agriculture and its dwarf-sized farm management inherited from the Tokugawa period (1603-1867) is clearly outlined in the Russian book Memories of my Captivity in Japan written by Mikhaelovich Gorovnin, a prisoner for two years (1811-1813) at Matsumae in Hokkaido. He observed that Japanese farms were very small and farmers grew crops between the rows of other crops. Thus, land use was complicated and highly intensified. As a result, all field work had to be done by hand because the main crop and the catch crop were grown in

\(^1\) The formation of the modern Japanese state is began with the Meiji Restoration, bringing far-reaching changes in the country’s political and economic structure. In 1867, Yoshinobu Tokugawa, the 15\(^{th}\) shogun of the Tokugawa shogunate government, which, for 260 years had maintained a feudal structure, whose strength was without parallel in the world, surrendered all the powers of state to the Emperor. In December of that year, an Imperial decree was issued declaring the restoration of the Emperor as the supreme ruler of the country. A new Government was formed and in the following year the new era was named Meiji (Ogura, 1967: 3).
a rotation system. It was also difficult to use any animal drawn machinery or equipment due to the small size of the farms. On the other hand, when farmers were ordered to increase the use of horses on their farms, it had severe consequences from the need to sacrifice land for growing food in order to feed the horse, because small farms did not produce enough to support both man and animals (Ogura, 1967: 299–300). These descriptions of the state of agriculture in Japan clearly demonstrate how it was struggling to produce sufficient food on these small traditional farms. This was what drove people to adopt ‘land-saving technologies’ and which contributed to increased productivity. As a result of this, Japan was able to meet all its staple food requirements after a relatively short period thanks to the rapid modernization of her agricultural technologies. In this sense, the role of agricultural extension remains as one of the most important factors to improve land-saving technologies in the agricultural sector. At present, although agriculture in Japan does not play a major part in the economic structure (either in production or employment\(^2\)), it has had a major influence on its social, political and cultural activities and patterns of consumption.

The main thrust of the present study is to examine how Japan modernized its agricultural technologies to achieve one of the world’s highest levels of land and labor productivity and meet its growing food demand, while establishing the agricultural sector as a base for the development of the industrial sector. In particular, the study expects to explore how Japan used ‘extension’ as the major strategy to transfer its modern technologies from the laboratories to the farming sector. In this context, the analysis is limited mainly to the experience of agricultural extension in the Meiji era because this was considered the beginning of

\(^2\) At present, Japan’s agricultural labor force accounts for about 4 percent of the total labor force and their contribution to GDP constitutes approximately 2 percent (ADB, 2008).
modern development in Japan. The experience of agricultural extension in this period is more relevant to developing countries today than the post-WWII experience. However, the study overcomes this shortfall to some extent with an attempt to discuss some of contemporary Japan's experience of agricultural extension service.

II. Agricultural Extension and the Modernization of Agricultural Technologies: An Overview of the Concept and its Historical Roots

The term ‘agricultural extension’ has several meanings. As Leeuwis (2004: 22) noted, the meaning of the term extension has evolved over time, and has different connotations in different countries. Thus, research in various countries has defined agricultural extension as the promotion of new technologies, the transfer of new technologies, innovation of technologies, improving skills, improving the efficiency of agriculture, disseminating new knowledge, assisting farmers to understand new farming practices and so on. Although it is difficult to provide a widely accepted definition of agricultural extension, its expectation or final goal is quite similar in almost all definitions. As Brunner and Yang (1949) emphasized (extracted from Wikipedia), ‘the central task of extension is to help rural families help themselves by applying science, whether physical or social, to the daily routines of farming, homemaking, and family and community living’. According to Bradfield (1966) (ibid), a person who is responsible for extension activities has the task of bringing scientific knowledge to rural families in farms and homes; the object

3 Dutch: Voorlichting (lighting the path); German: Beratung (advisory work); French: Vulgarisation (simplification); Spanish: Capacitacion (improving skills); Thai & Lao: Song-Suem (to promote); Persian: Tarvij & Gostaresh (to promote and extend) (extracted from Wikipedia); Sinhala: Viyapthiya (diffusion); Japanese: Fukyu (diffusion).
being to improve the efficiency of agriculture. Therefore the purpose of
this concept is to improve land-saving technologies and raise productivity
to meet the country’s growing food demands.

In this study, agricultural extension has been defined as a system or
service, which acts as a relay communicator between laboratories and
farmers to transfer modern technological knowledge to farm families. In
this respect, the present study hypothesizes that if we expect to successfully
modernize agriculture, the person who operates as a relay communicator
must have a very strong relationship with farming families based on
mutual trust and become a dedicated and enthusiastic member of the
agrarian community. This means, the extension official needs to live
among the farming families as a friend or as a member of the farming
community rather than an outside official. The extension officer must
also realize that he is not the farmers’ only source of information, because
in many cases farmers learn from other skilled farmers (Allo, 2009). At
the same time, the extension officers also can learn from farmers how to
adapt their knowledge to the requirements of the region’s geographical
environment. In this case, it is not necessary to state that the person who
engages in transferring technologies from the laboratories or educational
institutions must have a thorough knowledge of both the theory and
practice of modern farming.

The historical roots of the practical application of this concept are
not known, but the available information on agricultural extension
services reveals that it was conducted under two major institutions: first,
the extension services sponsored by government officials; and second, the
extension services under university teaching and research activities or so
-called ‘university extension’. According to Jones and Garforth (extracted
from Leeuwis, 2004: 22), forms of official agricultural extension existed
in ancient Mesopotamia, Egypt, Greece and Phoenicia. However, Leeuwis
(2004: 22) indicated that the term ‘extension’ itself is a more recent
phenomenon. According to his findings, it originated from academia, and was first recorded in common use in Britain in the 1840s, in the context of university extension. Similarly, information has been found in ancient Egypt, Mesopotamia and China relating to the practice of agricultural extension under the first category going back more than 3000 years (Wikipedia, 04. 09. 2009). The same source indicated that Chinese officials were employing agricultural policies, documenting practical knowledge, and disseminating advice to farmers at least 2,000 years ago. For example, in approximately 800 BC, the government minister responsible for agriculture under one of the Zhou dynasty emperors organized the teaching of crop rotation and drainage to farmers. The minister also leased equipment to farmers, built grain stores and supplied free food during times of famine.

However, people believe that the modern extension service originated in Ireland in the mid 19th century (Jones and Garforth, 1997: 5). The ‘potato famine’ in Ireland^4^, which occurred as a result of the destruction of Irish potato farming by fungal diseases from 1845 to 1851, is seen as the starting point of extension services in the modern world. In this instance the British Government dispatched practical instructors to farming areas to teach small farmers how to cultivate alternative crops to overcome problems in potato cultivation. By the end of the 19th century, this system had spread to other European countries, particularly Germany, Denmark, the Netherlands, Italy and France.

Although the pattern and development of extension service in modern Asia varies from one country to another, it is possible to identify a common sequence of four periods according to their specific nature and approach: first, colonial agriculture; second, diverse top-down extension;

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4 In Ireland, the decline of potato products were particularly severe because the predominantly peasant population relied on potatoes in their diet, and because ‘the potato famine’ persisted until 1851 (Jones and Garforth, 1997: 15).
third, unified top-down extension; and fourth, diverse bottom-up extension. It is commonly known that Western powers started extension services in plantation agriculture in Asia during their hundred year’s colonial administration. However, these services were limited to plantation agriculture which was an enclave investment in Asia and had no substantial impact on domestic agriculture, especially paddy and other subsistence agricultural crops. Extension services in the following three periods took place after WWII when Asian countries achieved independence from Western control. Several types of extension services emerged in many of these countries after independence under direct government control, but mostly using the remnants of the colonial system. These services were mainly designed to help small-scale farmers who were still poor and were still cultivating using traditional technologies at little above subsistence level. The unified top-down extension service commenced by the World Bank under the name of the Training and Visit (T&V) system in the 1970s and 1980s was established by merging various existing extension services into one. Under this system, the relevant government authority attempted to disseminate ‘Green Revolution Technologies’ among the farming communities through a top-down approach. After the end of the World Bank Fund, the T&V system collapsed in many countries, which led to the emergence of diverse bottom-up extension or the emergence of the so-called participatory method replacing the top-down approach.

At present, although the participatory approach is effective in many countries in modernizing agricultural technologies and moving farmers from subsistence farming to commercial farming, unfortunately agricultural extension receives little support from governments or researchers. According to academic opinion, (Wikipedia, 2009/04/09),

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5 See http://en.wikipedia.org/wiki/Agricultural_extension (2009/04/09) for detailed information on these four periods.
‘agricultural extension needs to be reinvented as a professional practice. Other researchers have abandoned the idea of extension as a distinct concept, and prefer to think in terms of a knowledge system in which farmers are seen as experts rather than adopters’. This is true in most developed countries because many farmers are experts in modern farming practices through having a close link with regional agricultural experiment centers. However, in most Asian countries this service is still largely seen as a government intervention top-down approach to the modernization of farming technologies.

‘University extension’ is the other major form of agricultural extension employed in many developed countries. It is believed to have originated at Cambridge and Oxford Universities in 1867 to provide for the educational needs of the rapidly growing population in the industrial, urban areas, close to their homes. Although many of their research and education activities were not directly related to the region’s agriculture, by the 1890s agricultural subjects were being covered by visiting lecturers in rural areas (Jones, 1994, quoted from Jones and Garforth, 1997: 1). However, ‘It was not until the beginning of the 20th century, when colleges in the United States started conducting demonstrations at agricultural shows and giving lectures to farmers’ clubs, that the term “extension service” was applied to the type of work that we now recognize by that name’ (ibid). Today, the term of university extension has been identified as one of the most important responsibilities of universities in developed countries in addition to their research and education activities. In Japan for example, the Ministry of Higher Education has asked all universities to submit evidence that they contributed to their regional economy and community in the annual progress report to the external evaluation committee. This has indirectly forced the universities to describe the teaching and research activities that extended the work of the institution beyond the campus. To some extent, it can be argued that
such incentives and regulations have contributed directly to the transfer of technologies from laboratories to practical application of the agricultural sector.

III. Agricultural Extension and the Modernization of Agriculture: The Japanese Experience

It is believed that the modernization of agricultural technology and the modern version of an extension service in Japan began in the Meiji era with the adoption of widespread modernization policies. The Meiji government attempted to modernize agricultural technology through the combined effort of college education or so-called ‘University Extension’ and a ‘Top-down Extension Service’. This changed after WWII along with the change in economic climate and in particular the emergence of information technologies and equipment. Today, Japan disseminates its new technologies through the unification of ‘Education, Experiment and Extension’ and through close links with the farming community. It is significant that all initiatives were implemented under strong government intervention. These efforts to provide agricultural extension and their contribution to the transfer of technologies from the laboratory to the farming sector can be grouped under four major categories: 1. Farmers’ Participation and Agricultural Administration; 2. Adaptation of Imported Technology to Local Needs and Practice Localization/Japanization/indigenization of Imported Technologies and Farmers Participation; 3. Localized Technologies, Farmers’ Participation and Agricultural Extension; 4. Unification of Education, Research, Experiment and Extension.

6 The basic agricultural policy of the new Meiji government was, as were other policies for establishing a modern state, developed around the ideas of Lord Iwakura, who visited America and Europe from 1871 to 1873, and around the ideas of other high officials of the Meiji Government who followed Iwakura on his inspection tour of the West (Ogura, 1967: 300).
1. Farmers’ Participation and Agricultural Administration

The dissemination of agricultural technologies in Japan was characterized by an attempt to form close relationships based on mutual understanding between farmers and government officials. Japan realized that without strengthening these relationships it would be practically impossible to encourage adoption of any technology developed in government laboratories. The agricultural administration’s top-down approach that attempted to form these close relationships based on mutual trust is demonstrated in Figure 1. Although it is common to see this kind of structure relating to agricultural administration in any country, each section was specifically designed to secure farmers’ participation in agricultural administration. At the same time, agricultural education in agricultural schools and universities was also linked to rural agricultural associations.

The other important aspect depicted in this Figure is that the national administration, which was linked with regional administration, concentrated on forming strong relationships with the farming community. It was very important to do this, as a large part of the population was involved in agriculture and it generated a large percentage of the national income. For example, in 1868, 80 percent of the people were remained in the rural sector and they contributed about 45 percent of the national income. Moreover, 84 percent of the country’s export earnings were also produced by agricultural products in the period 1868–1872. The Meiji government had realized the importance of modernizing its agricultural sector to provide a strong base for industrialization, and to address the acute economic problems.

The most decisive approach shown in Figure 1 was linking education from elementary to university level with the rural farmers’ associations. The government realized the importance of improving vocational and agricultural education to drive industrial development. In 1894, the
Figure 1: The Top-down Relationship among Government, Education and Farming Organisations in Meiji Era
government established two types of agricultural schools, day classes for
general students and night classes for farmers. From 1894 to 1912 there
were about 5,530 such schools teaching agriculture as a major subject.
These schools were linked with agricultural societies or related
organizations in the same region. This definitely helped to form strong
relationships between agricultural education and farming activities.
Furthermore, it also contributed to the development of basic agricultural
science and its practical application by farmers and school children.
These improvements for the farming community helped form strong
relationship between farmers and officials as well as greater participation
by farmers in agricultural extension work and village activities relating
to agriculture.

2. Localization of Imported Technologies and Farmers Participation

Imitating western technologies was much more popular in Japan than
in other countries. Japan attempted to develop its own or indigenous
technologies through imitating or borrowing these technologies rather
than simply copying them. For example, Saxonhouse (1974: 149) noted
that “it was not uncommon to think of the Japanese as slavish imitators
of foreign technology. Initially, Japan’s worldwide search led it to adopt
a French-style army, an America-style banking system, and a British
-style cotton textile industry. In time, each of these models was either
discarded in favor of other national models or, otherwise modified to
meet the imperative of assimilation”. This approach to the modernization
of technologies was not an exceptional to the agricultural sector. The
Meiji government’s first step was to employ Western scientists in
Japanese agricultural colleges while dispatching its own students to
Western colleges to learn their advanced agricultural technologies. The
data in Table 1 shows the number of foreigners employed in the
government and private sector in various fields from 1870 to 1900.
Table 1: Trend of Foreign Employees Employed in Government and Private Sector

<table>
<thead>
<tr>
<th>Decades</th>
<th>Teachers</th>
<th>Engineer</th>
<th>Clerks</th>
<th>Artisan</th>
<th>Unclassified</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1870s</td>
<td>947</td>
<td>353</td>
<td>1294</td>
<td>916</td>
<td>453</td>
<td>140</td>
</tr>
<tr>
<td>1880s</td>
<td>692</td>
<td>1006</td>
<td>513</td>
<td>2100</td>
<td>481</td>
<td>416</td>
</tr>
<tr>
<td>1890s</td>
<td>626</td>
<td>2940</td>
<td>140</td>
<td>1930</td>
<td>253</td>
<td>313</td>
</tr>
</tbody>
</table>


The Meiji government employed 18,665 western scholars (including both the government and private sector), of which teachers and engineers comprised about 72 percent. The teachers alone comprised 6,564 or about 35 percent. Most of these employees originated from Germany, UK, USA and France. According to Umetani (1971: 93), on the whole, these foreign employees cooperated wholeheartedly with the Japanese in constructing Meiji Japan. The most outstanding aspect of borrowings and imitating of foreign technologies is that they combined them with their own cultural practice and technological knowhow producing a better result than the original countries had.

Ogura (1967: 300) noted that at the very beginning of the Meiji government, efforts were made to introduce and absorb Western agricultural theories and techniques by inviting Western scholars mainly from USA, UK, France and Germany. The government’s first step was

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7 See Umetani (1971: 71–90) for a detailed analysis of foreign employees by nationality and field of specialization during the Meiji era.

8 Japan employed people from the following European and Asian countries during this period: USA, UK, France, Germany, Holland, Italy, Switzerland, Belgium, Russia, Sweden, Austria, China, Korea and Canada.
to establish agricultural colleges in Tokyo and Sapporo in the mid-1870s, staffed mostly by Western scholars (at first from America and England and later from Germany) who were offered very high wages, sometimes even higher than the prime minister’s salary. At these two colleges, the theoretical aspects of agricultural science and their practical application were taught through class-room education and experimental work. At the same time, agricultural fairs and exhibitions were conducted, where progressive farmers gave talks and demonstrations. This led to the development of many agricultural societies from 1881 onwards, a ‘movement’ formalized by legislation in 1899 (Jones and Garforth, 1997: 8).

The Meiji government, while pursuing a policy of digesting and propagating Western knowledge, recognized the importance of appointing experienced farmers as itinerant agricultural lecturers at national and prefectural levels (ibid, 1967: 301). The following statement reveals how the Meiji government expected farmers’ assistance not only in developing suitable technologies but also in identifying the real problems confronting the farmers in each region.

In the year 1875, the government requested every prefectural government to recommend one or two leading veteran farmers. In 1878 the government began the Agricultural Correspondence System and asked veteran farmers of each prefecture to perform the duties of a local correspondent. The idea was for the Government to gather detailed reports about the conditions of crops, diseases, insects and other general agricultural news from these correspondents and then after drawing instructive material from these news sources, to send out agricultural instructions to the correspondents who, being veteran farmers, would then become instructors to propagate the instruction (Ogura, 1967: 301)
At the same time, the government instructed all its experiment officials who had graduated from agricultural colleges and were then working at the regional experiment stations to conduct their experimental works and extension works with experienced or veteran farmers in the region. Figure 2 shows this process of localization of imported technologies from the early years of the Meiji regime.

This integrated effort helped to find the best technologies for each region’s geographical environment through combining imported technologies with domestic knowledge. In 1871, the Hokkaido Development Commission established the country’s first agricultural experiment station in Sapporo. The first national agricultural experiment stations were founded in 1893 in Tokyo, Sendai, Kanazawa, Osaka, Hiroshima, Tokushima, and Kumamoto. In 1899, the act for prefectural agricultural experiment stations allowed for the establishment of agricultural

Figure 2: Localization and Diffusion of Imported Agricultural Technologies in Meiji Era
experiment stations all over Japan (Jones and Garforth, 1997: 8). At present, all prefectures have their own agricultural experiment stations which have strong relationships with national experiment centers, regional academic institutions and farming communities. In addition to this, farmers not only have close relationships with government officials and regional experiment centers and related educational institutions, but also work as indirect advisers to officials as well as learning new technologies from them.

Tajima (1991) and the Ministry of Agriculture (1993) noted that farmers in each region were able to form the basis of agricultural extension work with the support of the government experiment stations. This work, including the establishment of demonstration farms, was allocated in 1903 to numerous agricultural societies which, with the support of state funds, appointed agricultural technicians. In 1910, the 1899 law was strengthened; thereafter, farmers were required to belong to a village agricultural society which was linked to a national network and a hierarchy of societies, and they were compelled to adopt the societies’ extension workers’ technical guidance and recommendations—what became known as forced extension (extracted from Jones and Garforth, 1997: 8).

The government’s most distinctive approach in localizing and disseminating technologies was that it introduced two strategies to overcome deficiencies in the knowledge acquired by the officials at universities: first, the legal obligation for officials to take advice from farmers when localizing imported technologies; second, the farmers had to follow officials’ requests concerning utilization of farming technologies. Officials and farmers both faced legal action if they did not comply with this law. Thus, the government pushed both parties to develop new technologies suited to the local environment and disseminate them in cooperation with the farming community.
Not all officials who received theoretical and practical knowledge at the colleges were suited to the region where they were attached. However, the farmers, had extensive knowledge of the soil, varieties suited to the environment, climate, water level, rainfall, pest damage etc. and combined this with theoretical knowledge to find the most effective technologies for their region. Thus, the combination of theoretical and practical knowledge led to the rapid dissemination of new technologies among the farmers because they were able to adapt them. This led to greater success in applying extension works.

The other important approach to the extension of new technologies was that experiment centers organized “short–term training programs” in their regions, which aimed to provide farmers with theoretical as well as practical knowledge of new technologies. In 1920 all prefectures offered such programs. This was supported by translating various agricultural science and technology books into Japanese⁹. The government’s effort to transfer the paddy farming sector from traditional cultivation practice to modern practices was highly successful thanks to these training programs and the provision of Japanese literature that served to encourage the farming community through providing knowledge of new technologies.

At the same time, the agricultural experiment centers attempted to form ‘Research Groups’ comprised of farmers and officials of the region undertaking surveys of the major constraints farmers were facing. It is interesting to note that some veteran farmers were already conducting their own surveys and experiments regarding cultivation practices and agricultural problems. Most of their surveys were focused on finding new methods to increase productivity using the resources available. The most important aspect of these personal surveys was that the farmers intended to disseminate their findings among fellow farmers and tenant farmers.

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⁹ See Kawada (1976: 14–16) for a list of the foreign books on agricultural science translated into Japanese in the Meiji era.
The experiment officials appointed by the central government to prefectural experiment centers received invaluable support from the veteran farmers’ findings in adapting the technologies to the local conditions.

These technologies were available at a very reasonable cost to the farming community because veteran farmers were able to develop them very cheaply. Of the new technologies available, high yielding varieties, new fertilizers, pest control methods and water management were the most popular among farmers. According to Hayami and Ruttan (1971: 160–161), ‘although scientific research gradually evolved into a major source of new biological technologies, Japanese agriculture continued to rely heavily on rono (veteran farmers) technologies during the Taisho (1912–1926) era and even into the early period of the Showa era (1926–1989). Major rice varieties were still predominantly of rono selection. The Asahi variety, which was substituted for Shinriki because of its high responsiveness to ammonium sulphate, was selected (1911) by Shinjiro Yamamoto, a farmer in Kyoto’.

There are many such findings\textsuperscript{10} by individual farmers originating in the Meiji era and still in use with some modern scientific changes. Hayami and Ruttan (1971: 160) summarized this unique way of indigenization of agricultural technologies as follows:

through the dialectic interaction among farmers, scientists, and agricultural supply farms in response to relative factor prices which reflected Japan’s resource endowments, Japan was able to evolve a unique and highly productive system of agricultural technology called Meiji Noho (Meiji Agricultural Technology). These unique outcomes were the result of the influence of rono knowledge on officials and the officials’ respect for the rono’s practical experience and their commitment to combine their practical knowhow with theory.

At the same time, a large number of “voluntary local meetings” or

\textsuperscript{10} See Kawada (1976: 15) for a detailed analysis of an individual farmer’s findings in the Meiji era.
agricultural discussion societies (Nodankai in Japanese) were emerging in the regions under the leadership of veteran farmers. The main purpose of these newly emerged nodankai was to improve the farming methods introduced under the initiative of prefectural experiment centers. In 1881, the second Industrial Exposition took place in Tokyo at which a National Conference of nodankai was held. Veteran farmers throughout the country were invited to discuss important problems relating to agricultural development. The conference decided to establish a national organization for veteran farmers named Dai Nippon Nokai (the Agricultural Society of Japan)\(^\text{11}\). This undoubtedly helped achieve a greater participation of farmers in the agricultural development programs introduced by the government’s top-down administration.

3. **Localized Technologies, Farmers Participation and Agricultural Extension**

The Meiji government employed a number of distinctive methods to disseminate indigenized or localized agricultural technologies in each prefecture. The most important in the process of agricultural extension were short-term training programs, exhibitions of new technologies, competitions among farmers, inspection of the practices, veteran farmers’ visiting lectures, working with farmers and the itinerant instructor system. Although all these strategies contributed to the transference of technologies from the laboratory to the farming sector or the distribution of new technologies among the farming community, the present study will discuss only the last two strategies as these are recognized as being the most instrumental in the rapid modernization of Japanese agriculture (See Figures 2 and 3).

**The Itinerant Instructor System and the Role of Veteran Farmers:**

The available literature shows that until 1877 agricultural extension work

\(^{11}\) Ogura (1967: 302) noted that the national agricultural society was modeled after the Royal Agricultural Society of England.
in Japan was carried out by arranging meetings with farmers’ organizations on the advice of veteran farmers. However, the Meiji government realized this would not achieve the modernization of agriculture because the veteran farmers’ knowledge was limited to practical experience and they had no scientific knowledge. To overcome this shortfall, in 1885 the government attempted to establish an ‘Itinerant Instructor System’, forming groups comprising veteran farmers and government officials in each prefecture. The officials who had graduated from agricultural colleges, and were working as experiment officials as well as extension officials attached to the prefectural experiment centers were asked to form extension groups that had a mixture of officials and veteran farmers. This system operated under two major groups: the first, the “A” Group
which was composed mainly officials of the Ministry of Agriculture and Commerce who were all graduates of the Komaba Agricultural College (presently Faculty of Agriculture at the University of Tokyo) and whose range was nation-wide: and second, the “B” Group composed of local veteran farmers who were responsible for each prefecture (Ogura, 1967: 302). However, veteran farmers were also requested to work in the “A” group because of the shortage of college graduates as well as their low level of practical experience. In 1889 the “B” group was abolished, and in 1893, the “A” group was also abolished with the establishment of Agricultural Experiment Stations (AES) in all prefectures. The same instruction service was now carried on by the officials of the AES.

The instructors of these groups travelled throughout the prefecture as well as the country holding agricultural extension meetings. As Yamada and Hayami (1969: 51), and Hayami and Ruttan (1971: 155) noted, the government appointed instructors were officials who were agricultural college graduates, and veteran farmers, so that the best practical farming experience was combined with the scientific knowledge of the new college graduates. Thus, the itinerant instruction system was designed to publicize the best seed varieties already used by Japanese farmers and the most productive cultural practices used in staple crops, paddy and barley. This system was not just limited to lectures and teaching farmers working in the paddy fields about new technologies but in 1886 also set up experiment farms for staple crops and vegetables. This gave the farmers real evidence of the practical results of new technologies introduced by veteran farmers and officials.

In addition, the prefectural government realized that farmers’ active participation in agricultural administration was important if they were to successfully modernize the agricultural sector. The prefectural government employed two strategies to encourage farmers to participate in agricultural administration in addition to practicing the rules and regulations relating
to agricultural activities: The first was the provision of subsidies and the opportunity to learn and practice new technologies free of charge and the second was to impose legal action, using the village police to monitor violations of preventive methods in pest control etc. The first one was used as an incentive to encourage farmers to practice the new farming technologies while discouraging traditional farming practices. The second strategy was employed specifically to prevent the spread of disease in the farming sector. According to Ogura (1967: 423-424), ‘if insect pests occurred they had to be controlled by the cultivating farmers, and when there were signs of spreading, steps had to be taken to let all the community engage in insect pest control; if anyone violated the preventive regulations, he had to be charged with a breach of police regulations and punished. For example, in 1896, the Insect Pest Control Law was promulgated. Under this law, rice stem borer control operations were to be carried out under the direction of policemen’. Although this approach helped to achieve rapid dissemination of new technologies and the farmers’ active participation in the new practices, it was later abolished because of the serious conflicts that arose between farmers, extension officials and policemen. Using policemen to implement agricultural practices also damaged the peaceful relationships between farmers and extension officials. This changed the extension service’s approach from forceful to peaceful or the so-called rural cooperative spirit based on mutual understanding between the farming community and the extension officials.

The establishment of the official instruction or extension system under the guidance of prefectural experiment centers in 1893 signaled a new democratic approach to the dissemination of new technologies. In the same year the transfer of agricultural guidance from the hands of veteran farmers to experiment stations took place. In 1899, the government acted to provide all agricultural guidance and other services through the
agricultural associations under the direction of the regional experiment station. Although the government’s extension program was originally introduced in 1881 when the Agricultural Society of Japan was established to facilitate the activities of the veteran farmers, the main emphasis here was on the exchange of technical knowledge among the farmers (ibid, 1967: 303). However, this new system was not successful because of its gradual politicization. In particular, landowners were not satisfied with mere technical improvements and in the late 1880s they opposed the system. This resulted in the creation of a new system as described by Ogura (1967: 303–304);

The new association, according to the Agricultural Association Law, stipulated that the governor of each prefecture was to be the president of the prefectoral association and the head of counties or villages would be the president of their respective county or village associations; the landowners were offered the position of the vice–presidency at all stages of the organization. The association on one hand became an official organization to carry out the government’s agricultural extension program while on the other hand it became an organization through which landowners were able to voice their interests.

Thus, Japan was able to disseminate its new technologies successfully through farmers’ organizations because they combined the democratic values of the farming community with the government’s robust rules and regulations. These characteristics not only created powerful organizations but also achieved the farmers’ aspirations as well as the government’s. This system allowed the government to use forced extension if it needed, while limiting farmers’ democratic rights. For example, ‘some of the prefectures went as far as issuing their own ordinances, making it punishable by law when farmers did not practice checkrow planting, the
use of oblong seed beds, or didn’t apply lime to their fields. In some places the police accompanied the instructors in their enforcement activities’ (ibid, 1967: 304). Such extreme use of force in agricultural extension may not be reconcilable with the democratic rights of the farming community, but farmers in Japan realized that such practices benefited the people as well as the country. In this case democratic rights were not an important factor in the transfer of technology as it had been for any development activity in western countries.

4. Unification of Education, Experiment and Extension

In Japanese modern history, developing human capital has been seen as the most effective strategy in modernizing the agricultural and industrial sectors. In this respect, as discussed in the foregoing analysis, Japan attempted to localize imported technologies, combining them with indigenous knowhow while making solid connections between formal education and practical experience. In other words, the modernization of agricultural technologies through the unification of formal education, research, experiment and extension has been the best approach for Japan. It is still a powerful strategy with further modification in its modern agricultural extension service. Figure 4 demonstrates how Japan intended to develop its extension services through the unification of education, experiment and extension.

Figure 4 shows the main objective of Japan’s agricultural development and extension association, which is the creation of a practice-oriented knowledgeable people responsive to the changing needs of the country. The other important aspect is that Japan was not only very careful to appoint suitable and capable people to the extension services, but also people who were committed to the work and to gaining a greater understanding of the agricultural community. All extension officials had at least a college or university degree in agriculture with adequate
The Role of Agricultural Extension in the Modernization of Agricultural Technologies: A Lesson from the Japanese Experience

**Figure 4:** Unification of Education, Experiment and Extension

Source: Based on the following source; 査東日本の食料・農業・農村編集委員会, 「査東日本の食料・農業・農村第10巻, 農業・農業教育・農村普及」農林統計協会, 2003年

Theoretical and practical knowledge. At the same time, these officials were required to have knowledge of agricultural economics, management, rural sociology etc and to understand the farmers’ approach to farming activities. The unification of the scientific and practical knowledge of agriculture, and the social behavior of the farming community helped to create an effective path for the extension process in Japan. It should be also noted that this approach has enabled the extension officials to blend in with the farming community as members rather than strangers.

The surveys and researchs conducted by the extension officials, who believed they should carry out this work themselves to help farmers adapt to market demands, are a distinctive part of contemporary Japanese agricultural extension. Extension officials conducted six types of surveys

12 See the homepage of the Japan Agricultural Development and Extension Association for detailed information on the promotion of surveys and research. https://www.ek-system.ne.jp/www/contents/1150281220326/files/Promotion.jpg (2009/06/15)
under the Japan Agricultural Development and Extension Association and the most important surveys helped find an efficient method for the extension service. The types of surveys and their major objectives have been summarized as follows:

Survey and research of the extension services and its methods for strengthening the advisory services: (a) support for surveys and research of how to efficiently develop farmers who can use innovative techniques; (b) support for surveys and research of how to comprehensively develop community-based agriculture; and (c) surveys and research of how to perform extension activities according to the new agricultural policies (Homepage of Japan Agricultural Development and Extension Association: June 15, 2009).

They also engaged in other surveys such as a survey of rural life and the promotion of agricultural improvement lending services etc. At present there are about 7,790 extension advisers (Fukyu Shidoin in Japanese) working as agricultural extension officials who are attached to 387 agricultural extension centers throughout the country.

In addition, the Ministry of Agriculture, Forestry and Fisheries in Japan has employed strategies to improve agricultural education for both farmers as well as the younger generation. For example, in 1934 Japan established Prefectural Agricultural colleges and in 1968 the National Farmers Academy, in addition to agricultural schools which were introduced early in the Meiji era. These aimed to improve agricultural education and land saving technologies to meet changing food demands. Moreover, as the foregoing analysis noted, the university extension system was a major factor in combining theoretical knowledge with practical knowhow and in disseminating those technologies at most of the government run and private universities in Japan. Today, this is not
limited to natural science such as engineering and agriculture, but is available for all social sciences such as economics, education, management etc. This was augmented when the Ministry of Higher Education instigated an internal and external evaluation policy that required all universities to give an annual account of their regional contribution and this indirectly stimulated the university extension programs. This evaluation also led to an increase in the government subsidy to the institutions and salary increments for teaching staff. Thus, the Japanese government is still using laws, regulations and incentives to develop the best technologies and to disseminate them, through its policy of unifying education, research, experimentation, practical experience and extension.

IV. Concluding Remarks: Lessons from the Japanese Experience

The Japanization of imported agricultural technologies adapted to local conditions was expected to increase productivity of agricultural crops, particularly in the paddy farming sector as traditional small–scale fragmented paddy farms\(^\text{13}\) did not provide sufficient yield to meet domestic food demands. Japanese scholars (Ogura, 1967; Hayami and Ruttan 1971; Hayami 1975) noted that the productivity of Japanese agriculture prior to the Meiji Restoration was low, probably not very different from, or at best only slightly higher than, the productivity levels found in many parts of the Asian region today, although in Korea and Taiwan where Japanese techniques have been transplanted yields are relatively high. It was the rapid dissemination of Japanized technologies among the farming sector which resulted in a dramatic increase in productivity levels, specifically of rice, making Japan one of the highest rice growing countries in the world not only for productivity but also for quality. According to Ogura (1967: \(\text{--- } 27 \text{ ---}\))

\(^{13}\) The average size of Japanese farms was approximately 1.0 hectare in 1878 and 0.8 hectare in 1962 (Ogura, 1967: 618)
618), the average yield of rice per hectare rose from 1.8 metric tons in 1868–82 to 4.0 metric tons (husked rice) in 1956–60 and 6.4 metric tons in 2003–2007. In comparison, despite the rapid development of agricultural technologies and information science after WWII, the level of productivity in Japan remains at a highest level compared to other countries in Asia (See Table 2).

Today, Japan’s rice production exceeds domestic demand despite the reduction of cultivable land area and increased industrialization. It is interesting that Japanese authorities today discourage rice growing, and provide greater subsidies to encourage production of other crops such as fruit and vegetables. There is no question that achieving a rice surplus, the country’s staple food, is the outcome of the distinctive approach to processing modern technologies and their extension services. There are five important lessons that developing countries can take from the Japanese experience of extension activities: first, the government policy towards agricultural administration and education; second, the adaptation to local requirements of imported modern technologies; third, appointing of knowledgeable people as extension officials; fourth, the unification of education, research, experiments and extension; and fifth, the people’s contribution, social values and responsibility.

Table 2: Average Annual Yield of Selected Products for Selected Countries in Asia, kg/ha (2003–2007)

<table>
<thead>
<tr>
<th>Country</th>
<th>Paddy</th>
<th>Maize</th>
<th>Onion</th>
<th>Potatoes</th>
<th>Sweet potatoes</th>
<th>Tomatoes</th>
<th>Pumpkin &amp; Gourds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>6352 (1.8)</td>
<td>n.a</td>
<td>48517 (4.7)</td>
<td>31898 (2.3)</td>
<td>24517 (3.8)</td>
<td>57826 (6.5)</td>
<td>13630 (1.4)</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>3643</td>
<td>1441</td>
<td>10370</td>
<td>13933</td>
<td>6403</td>
<td>8937</td>
<td>9777</td>
</tr>
<tr>
<td>The Philippines</td>
<td>3591</td>
<td>2224</td>
<td>9286</td>
<td>13160</td>
<td>4628</td>
<td>9894</td>
<td>16901</td>
</tr>
<tr>
<td>Thailand</td>
<td>2879</td>
<td>3891</td>
<td>14302</td>
<td>14877</td>
<td>n.a</td>
<td>23537</td>
<td>12216</td>
</tr>
<tr>
<td>India</td>
<td>3149</td>
<td>2050</td>
<td>12034</td>
<td>17019</td>
<td>8935</td>
<td>16681</td>
<td>9722</td>
</tr>
<tr>
<td>Pakistan</td>
<td>3117</td>
<td>2860</td>
<td>13630</td>
<td>17093</td>
<td>11517</td>
<td>10254</td>
<td>9740</td>
</tr>
<tr>
<td>China</td>
<td>6264</td>
<td>5141</td>
<td>21083</td>
<td>14157</td>
<td>21980</td>
<td>24369</td>
<td>19068</td>
</tr>
</tbody>
</table>

Source: FAO Data Base; data in the parenthesis reveal times of productivity compared to Sri Lanka.
The Role of Agricultural Extension in the Modernization of Agricultural Technologies: A Lesson from the Japanese Experience

The Government Policy towards Agricultural Administration and Education: As demonstrated in Figure 1, one of the most distinctive approaches to modernization of agricultural technologies and their dissemination in Japan is the top-down agricultural administration and its close affiliation with agricultural education and farmers organizations. The provision of agricultural education to children in day schools as part of their regular education, and to farmers in night schools and vocational schools was also a major policy of agricultural development. This contributed not only to expedite dissemination of new technologies smoothly among the farming community, but also the advancement towards a market economy. At the same time, this enhanced the relationship between government officials and farming communities while getting farmers to participate actively in farm improvement projects implemented under government rules. Furthermore, extension officials were able to pass on their knowhow without any difficulty because most farmers had a basic knowledge of the concepts of agricultural science from the agricultural education they had received at school. The other important outcome was that farmers were active in sharing problems in their daily farming activities with extension officials or other agricultural officials in the experiment centre. Therefore agricultural officials had to be knowledgeable and to listen to farmers’ requests. Thus, the Japanese agricultural administrative system has been structured as both a top–down and bottom–up approach to ensure the commitment of officials as well as farmers in the modernization of agricultural technologies and their dissemination.

The Adaptation to Local Requirements of Imported Modern Technologies: When Japanese people imported foreign technologies to modernize domestic agriculture, they did not just copy them, but combined them with traditional techniques and practices in each prefecture. The most important strategy was that the government enacted legal rules and
regulations democratically as well as forcefully to achieve farmers’ active participation in processing technologies, and disseminating them in the relevant region. The same rules and regulation were also applied to the experiment and extension officials who had greater responsibilities for finding new technologies and disseminating them among the farming community. The combination of laboratory technologies with practical knowledge enhanced farmers’ active participation and officials’ commitment to experiment work as well as the dissemination of the outcomes of the experiments. This was undoubtedly the major factor in the augmentation of relationships based on mutual understanding and mutual benefits between extension officials and farmers. This strong relationship between farmers and officials helped in the free exchange information concerning farming activities among the farmers and officials. Thus, the agricultural extension service’s communicative intervention practice helped Japan not only in the dissemination of technologies but in communication for innovation of the village economy.

**Appointing of Knowledgeable Extension Officials:** The officials, including veteran farmers appointed by the government as extension officials had sufficient knowledge on both theory and practice of agriculture to meet any challenge arising from their respective work. In addition, it should be also noted that most of the officials had a good knowledge of rural society, especially the farming community’s traditional behavior, which helped them to understand the farmers before introducing any new practice that might disturb or offend their traditional practices and way of thinking. At the same time, the Meiji government enacted rules and regulations forcing the officials to work with the farming community on one hand, and on the other hand compelling farmers to follow officials’ specific instructions relating to new technologies. In some instances, the government even employed police to make sure that farmers followed the new cultivation practices.
This interactive approach induced people to work together to achieve a common target.

**Unification of Education, Research, Experiments and Extension:** Modern Japanese policy makers realized that if education, research, experiment and the extension service worked in isolation they would not achieve the expected outcomes for the modernization of agriculture. In other words, Japan understood that practical-oriented education was the most effective strategy to meet the objectives of any educational program relating to both agricultural modernization and the creation of a competitive industrial sector. This new approach provided an opportunity for all educational institutions including agricultural schools, universities, and agricultural experiment centers to work together and share their findings in collaboration with the farming sector and achieve their common aspirations. This approach helped the academic and farming communities to share their ideas and consult with each other on common problems faced by people in the field. The most remarkable outcome of this system has been the ease of disseminating new technologies as extension officials and farmers are in contact at all times. Thus, any new type of technology or practice will not stagnate or remain isolated at the institution or in academic writing, but will be rapidly put into practice.

**People’s Contribution, Social Values and Responsibility:** Although it is difficult to measure the contribution of these factors (people’s contribution, social values and responsibility) to the success of Japanization of agricultural technologies and their rapid dissemination among the farming community, there is no doubt that together these factors have provided the backbone for the modernization of agricultural technologies and country’s other economic success. This means, any country in the world can design far-reaching development policies, but achieving favorable outcomes of such policies depends completely on the commitment of the people. For example, the slogan ‘Yono tame hito no
tame’ (work for the country and for the people) in Japanese society is reflected in how the general public works hard in development activities. The Japanese people believe that everyone’s efforts will bring prosperity to all (minna de doryoku shite issoni yoku naru). This means that working together as a united group for a common goal, i.e. the betterment of the country, will help to improve everyone’s living standard.

The practice of reciprocity for mutual benefit is also a very important Japanese social value that also involves lending a hand to disadvantaged people to alleviate their poverty. At the same time, they ostracize, or drive out from society, people who have worked against the common prosperity/interests of the majority (murahachibu in Japanese). Undoubtedly these traditional Japanese social values have contributed enormously in enabling Japan to modernize its domestic agricultural sector faster than in any other country in the world. According to the older generation, these social norms were strictly adhered to in all economic activities throughout its modern history. In particular, yono tame hito no tame created a strong sense of unity among the people in the agricultural community, enabling them to work together to increase productivity. It is interesting that this advance did not enrich a specific group, but benefited all farmers as well as contributing to creating an affluent society.

Another very important social value that other countries could learn from Japan concerns the ‘responsibility of employees’ in both public and private sector institutions. Japanese employees have a clear perception of the result of their work as to ‘why they are getting a salary’. The employees believe that they get a salary to make other people affluent. In other words, they think it is their responsibility to help all people to become as rich as possible. Even today, this self-motivating social value is prevalent among employees in both government and private sectors, despite differences in educational levels or status. As a result, the
Japanese employees always think of their responsibility first, and would rarely fight for, or talk of, their rights or blame their employers. Moreover, ‘hard-work’ (kinben in Japanese), ‘strong loyalty to work and the work-place’ and ‘devotion to work’ are other social values upheld by Japanese employees in public sectors. These work ethics are common or natural values (atarimae no koto) in Japanese society. They understand clearly that they can survive and become affluent only if they work properly to achieve the final target, which will bring prosperity to all society.

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