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**ELECTRIC IRRIGATION AND  
LOCAL SOCIETY**

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**This paper is being circulated in a pre-publication form to elicit comments from readers and generate dialogue on the subject at this stage of the research.**

## I. THE SOCIAL BACKGROUND OF ELECTRIC IRRIGATION WORKS AND THEIR INSTALLATION

The Saga and Chikugo plains, watered by the Chikugo River, straddle Fukuoka and Saga prefectures, and their 3,000 to 4,000 hectares of paddy are irrigated by creek systems.<sup>1</sup> "Creek" (kuriiku) is an English word introduced to Japan after the Sino-Japanese war of 1894-95, and locally, these water systems are known as hori. The creeks run the length and breadth of the paddies in irregular patterns. Creeks occupy a total surface area of some 3,200 hectares and are said to store as much as 45 million tons of water.<sup>2</sup> Of this amount, the effective volume of water is said to be 24 million tons, which represents the main supply of irrigation water for this rice-growing region.

The water stored in the creeks is used repetitively for rice cultivation, and the rate of water utilization is therefore particularly high, but the use of creeks for irrigation purposes has an important drawback: Whereas river irrigation systems rely on the natural energy of the river to distribute water to the fields, water taken from creeks must be hauled or pumped up by artificial means.

In the Meiji period (1868-1912), farmers used a water wheel activated by foot to draw water from the creeks. During the Taisho era (1912-1926), they switched to mechanical pumps run by electric motors.<sup>3</sup> This was the beginning of electric irrigation works whose spread wrought major changes in the hydraulic system of the region.

The water systems of today represent a considerable technological advance over the electric irrigation works of the Taisho period. Nationally administered drainage and irrigation projects have resulted in a growing number of dams built to store water and major irrigation

canals, and prefectural land improvement projects in particular have consolidated creek systems and divided fields into 0.3 ha units. These systems have become quite elaborate. Irrigation water drawn up by pumps installed along the creek is now distributed evenly to each field via a network of underground pipes, and water intakes in each field allow farmers to control freely the amount of water taken in or drained off.

Three basic types of electric irrigation works have been installed in the farm region downstream of the Chikugo River and will be examined in detail in the next chapter. Two of these are mechanized water pump systems for creeks, one of which, using electric motors to operate the pumps, is primarily designed to drain water from newly developed paddyland.

One of the two mechanized water pump systems was installed in the central flatlands of the Saga Plain by the Oide Irrigation Association. The Oide Irrigation Association was an ordinary irrigation association set up to control the use of irrigation water from the Kase River which cuts through the Saga Plain; paddyland within its jurisdiction was irrigated with creek water. Between 1922 and 1923, this association was responsible for investing more than 700,000 yen in an electrified irrigation project extending to 4,225 hectares. Within a very short period of time, motorized pumps had completely replaced the traditional foot-operated water wheels. Another such project was the electrified irrigation system set up in Mizuma Country, Fukuoka Prefecture, on the opposite shore of the Chikugo River. Mizuma County was divided into two different irrigation zones, the north where towns and villages relied on river irrigation systems, and the south where creek irrigation prevailed. The electric irrigation works installed here were therefore also of two types: those designed primarily for newly developed paddyland in the towns and village of the north and those set up in the south consisting of mechanized pumps for creek irrigation. The Southern Mizuma District Land Improvement Association organized in the south provided electric irrigation facilities for 4,498 hectares.

The electrified irrigation projects of the Taisho era played a significant role in the development of Japanese agriculture in general. Not only did they result in the mechanization of water pumps, but they were also instrumental in promoting the mechanization of Japanese agriculture. These projects were linked with the reorganization of agriculture that occurred in response to the structural transformation of Japanese capitalism brought about by the first world war and in this sense, too, had an important impact on the evolution of agriculture in Japan.

The electrification of irrigation facilities meant that important savings could be made in the use of the human labour power required to pump water out of irrigation ditches. In the past, even the water required for shirokaki, an operation in which the paddy bottom is levelled out just before planting season, had to be pumped into the paddy by foot, but with the introduction of motorized pumps, the flick of a switch could send water gushing into a field. The economy of manpower thus realized was considerable. But this was not the only advantage of electrification. It also contributed to the reorganization of the agricultural infrastructure of this region, enabling local agriculture to adapt to the modern industrial society then emerging in Japan. This latter feature was of particular importance.

The task of integrating agriculture into modern industrial society was not part of the European experience of modernization. Fitting small-scale farms into a high-growth modern economy, and preserving them as such, is a unique pattern characteristic of the modernization process in Japan. An analysis of the relation between agriculture and the high-growth industrial society of the postwar period would be revealing in this respect.

The land tenure system in the Saga-Chikugo region was formerly dominated by landlords, although independent and semi-independent (part-tenant) farmers hiring two or three employees per year and working two to three hectares and, at the bottom of the scale, the mass of small-scale tenant farmers supplying the larger farmers with labour power

comprised the bulk of the farm population. However, the expansion of non-farm employment that accompanied the first world war attracted labour power out of the villages even in this area, resulting in the exodus of agricultural workers and smallholders and making those farms dependent upon their labour difficult to maintain. Electric irrigation projects were designed to alleviate the shortage of manpower caused by this development. However, these projects also effected a change in the composition of the farm labour supply, causing local farmers to rely almost exclusively on family labour, and this in turn served to strengthen the rivalry between family farms which now competed to raise productivity in order to offset the lack of hired help.<sup>4</sup> The shift to competitive family farming brought about by electrified irrigation may be thought of as one of the factors enabling the small-farm economy of this region to adapt to modern industrial society. The theory of the progress of owner cum tenants advanced by Tanaka Sadashi confirms this, clarifying the model of small-farm adaptation in a modern industrialized economy.

The concentration and centralization of industrial monopoly capital on a national scale brought about a reorganization of the labour market, which assumed a dual structure (a modern and traditional sector). It was during this period that, as parasitic landlordism spread, tenant disputes became common occurrences. These were the circumstances in which the adaptive model of small farm reproduction, i.e., the economic progress of owner cum tenants, was worked out. Here again, an examination of the structure of the national economy which, following the second world war, allowed small farms to coexist alongside a rapidly expanding modern industrial sector would be of genuine interest.

The industrial boom sparked by the first world war and the depression that settled in its wake forced major changes in the structure of Japanese industrial capitalism. In rural Saga, located in a remote corner of Kyushu, local agriculture was inevitably reorganized in response to these structural changes, evidence that by this time even outlying agricultural regions had by and large been incorporated into the capitalist economy.

After early Meiji, railroads rapidly replaced sea transport as the primary means of shipping goods, and by the late 1880s, a rail link had been extended from north Kyushu to the western part of the island. In 1891, a railroad was established between Fukuoka and Tosu, bringing trains into Saga for the first time. In 1895, a line was extended to Takeo, in 1897 to Kaiki, and in 1898 from Moji to Nagasaki and Sasebo. In 1898, branch lines were built to Imari and in 1903 to Karatsu. By then, the prototype of the rail network that today covers most of Saga Prefecture had already been completed.

The alluvial plain formed where the Chikugo River empties into the Ariake Sea is a major transportation centre linking the interior of Kyushu with the great sea lanes. Because of their favourable location, Saga, at the estuary of the Chikugo River, and the entire Chikugo region were developed intensively as industrial sites by the han [clan] government during the feudal period, and as a result, building on agricultural and local production, mercantile capital had flourished.

Local industry was for the most part oriented toward the production of consumer goods in response to local demand, but some capital goods were also being produced, although not in large quantities. Local endogenous products from the Saga area in late Meiji included sake, Japanese paper, textiles, flour, vermicelli, Japanese sweets, soy sauce, and patent medicines. Arita ceramic ware and coal were also important industries producing for the consumer market.

The capital goods sector produced cement, castings, metal machinery, and a few other items. Although limited in number, these products, too, were transformed by the industrial revolution that swept Japan toward the end of Meiji. Relying on industrial forms of organization adapted to the use of steam or oil-driven motors and especially electricity, a number of manufacturers based on the factory system of production appeared at this time. These included the Taniguchi Steel Mill (200 skilled workers, 120 manual labourers), the Saga Machinery Works (35 skilled workers), the Kosei-sha (43 skilled workers), the Saga Cement Company (321 skilled workers, 265 manual labourers), the Mazaki Iron

Works (45 skilled employees), the Karatsu Iron Works (397 employees), and the Kaheigomei Company (266 employees). To the list of industrial activities one should add the coal industry, an important concern in Saga.

The relationship between coal mining and local rural society is complex and raises a number of unresolved problems. Mines employed both the naya [bunkhouse] system of labour management, whereby workers were recruited from a particular village by a contractor-foreman, and, inside the mine, the factory system of production. The relationship of these practices to local rural communities is therefore a very special one compared to that of other industries.

However, the use of motorized machinery was introduced to mining at an early date, and even in Saga, machine parts and machine production had become part of the coal industry. Wealthy merchants and English engineers from Nagasaki introduced the steam engine to mining where it was reportedly used in place of traditional hand-operated bellows pumps to evacuate water from the pits as early as 1873 or 1874, but it was not until 1888 that this innovation came into wide use.

As a result, mechanization proceeded apace as steam-powered water pumps and power wenchers for hauling coal carts to the surface of the mine were introduced, laying the groundwork for the rapid development of the mining industry in general. For example, Saga's Haya mine introduced a generating station inside the mine in 1890 and in 1904 changed over to steam engines for drainage purposes. By 1906, the generator was producing 1,544 units of horsepower inside the mine, more than ten times the power produced by other mines, which had, on average, about 100 horsepower units. Another innovation was the use of compressed-air machines which greatly enhanced mining capacity at Haya. As a result, the number of miners grew to 1,963 and production capacity to 500,000 tons. Ownership of the mine was transferred to Mitsui in 1911.<sup>5</sup>

The wave of prosperity unleashed by the first world war saw the

transformation of joint-stock companies such as the Saga Spinning Mills (1,500 employees) and Katakura-Gumi's Tosu plant (1,500 employees), which had previously hired a limited number of workers, into large-scale concerns. Smaller regional industries were soon reorganized by these larger companies in the course of their expansion, but during the late Taisho period, most were either forced to close down or were absorbed and reintegrated by big capital. The mining industry in particular was brought under the general control of the leading Zaibatsu interests at this time.

As regional industries were restructured or destroyed by the advance of big capital, the number of agriculturists declined at a rapid rate, more quickly in fact than at any other period in modern Japanese history except during the postwar years of high economic growth. As of 1975, Saga Prefecture boasted a very high percentage of people engaging in agriculture, and its agricultural vocation remained one of the prefecture's salient features. Farm households accounted in 1975 for about one-third of all households in the prefecture, twice the number of farm households (15.4 per cent) in all of Japan. Sixty years ago during the Taisho period, the rural character of Saga, with its agriculture and rural household industries, was all the more pronounced. In 1912, 62.8 per cent of all households were farm families, and in 1921, this figure still stood at 53.5 per cent. According to the 1921 national census, a total of 174,000 people, or 55 per cent of the population, were farmers and 141,000 people were non-farmers. However, excluding a few coal mines organized along factory lines (there were only 171 such mines hiring more than 10 workers, and together they employed only 10,000 people), most non-farmers were engaged in domestic putting-out activities and were self-employed (see table 1).

However, it is important to note that the percentage of farmers declined at a rapid rate in the late Taisho period despite the appearance of rural stability. In the 15 years between 1910 and 1925, the number of farmers in Japan fell from 278,000 to 216,000, a decrease of 22.3 per cent. One begins to appreciate the extent of this decline when one compares it to the sharp drop in the farming population that

TABLE 1. Employers in 1920 by Occupational Category (Saga Prefecture)

Occupation	Total	Employers	Clerical staff	Workers	Percentage of employers	Number of employees per employer
Agriculture	174,344	61,047	42	113,255	55.2	1.85
Fisheries	6,278	3,369	36	2,873	1.9	0.86
Mining	29,632	224	2,031	27,377	9.4	131.28
Manufacturing	42,553	13,346	1,300	27,907	13.5	2.18
Commerce	32,170	18,309	2,656	11,205	10.2	0.75
Transportation	12,039	3,103	1,169	7,767	3.8	2.88
Government/liberal professions	15,428	4,338	6,659	4,431	4.9	2.55
Others	3,193	55	47	3,091	1.0	57.05
Domestic	207	-	-	207	0	-
Total	315,844	103,998	13,940	197,906	100	2.03 (average)

Source: National Census 1920 (Saga Prefecture)

occurred in the 15 years between 1950 and 1975 during the era of rapid economic growth. At this time, 29.3 per cent of all Japanese farmers disappeared. Moreover, during the Taisho period, more than 10 per cent of all farm families were eliminated. During the postwar economic boom, the number of farm households fell from 41.6 to 31.7 per cent, but even then the rate of decline did not exceed 10 per cent.

However, while the percentage of farm households declined relative to the number of total households in Japan, the absolute number of farm households remained constant during Taisho. This fact sets Taisho apart from the years of high economic growth following World War II during which the number of farmers and farm families declined in both relative and absolute terms. The reason for the relative decrease in farm households in Taisho was the large number of new, independent families which were able to establish themselves, resulting in a 20 per cent increase in the total number of Japanese families. The economic base supporting the appearance of new households was formed at this time.

With the changes in the structure of employment that occurred in Saga during Taisho came major changes in the distribution of incomes brought about by wage levels and the price of rice.<sup>6</sup> The sales price of the Hizen rice sold in Fukuoka and Nagasaki prefectures remained high before and during World War I but plummeted thereafter, stabilizing at a low level in the years that followed 1923. The low price of rice was due to the government's food policy worked out in the wake of the rice riots of 1919 and which imported cheap rice from the colonies of Korea and Taiwan in massive quantities in order to avoid further incidents of popular agitation. Hizen rice, too, was affected by this policy, and its price soon fell.

Wages paid to labour were traditionally based on the price of rice, but with the greater labour mobility that occurred between the late Meiji and early Taisho periods, wage rates came to be determined independently of rice prices, fluctuating differently from the latter, even in periods of economic slump.

Changes in the structure of Japanese capitalism announced a period of economic transition in Saga Prefecture. The form of industrial production itself changed as monopoly capital concentrated labour and resources and consolidated its hold on the regional economy; the occupational structure of the prefecture shifted, and income was also redistributed. Agriculture could not escape being affected, and like other industries, it underwent a rapid reorganization. The most striking feature of this change is not merely the wholesale exodus of rural wage labour from the countryside to the city but the changeover from landlord-managed farms to those run by absentee (parasitic) landlords that accompanied it.

In the Saga flatlands, however, this evolution took a different form. Instead of Taisho landlords withdrawing from the countryside as labour grew scarce, farming itself changed. Saga is perhaps the first instance where Japanese capitalism directly affected rural households and by bringing about a major change in the type of farm management practiced by family agriculturists, succeeded in reorganizing local agriculture.

itself. Underlying this transition was the gradual introduction of motorized machinery which the development of modern agriculture encouraged.

Gasoline and steam-powered machinery first came into wide use in farming between 1897 and 1907. Electricity was employed for farm purposes during the early Taisho period, but although landlords were quick to adopt it to help open new ricelands and construct irrigation facilities, it was not until middle Taisho that ordinary family farmers began to make use of electricity as a permanent means of production. Hydro-electricity was used to light electric lamps in Saga during the late Meiji period, and the coal industry as well as local factories are reported to have utilized electric power after 1897.

In late Meiji, the middle and lower reaches of the Chikugo River valley were outfitted with motorized irrigation pumps in a total of 19 locations servicing 1,094 ha. of paddyland. Mechanical pumps using large-scale electric motors were introduced in the lower Chikugo region in early Taisho. The pumps were installed as part of an irrigation project designed to transfer water from the river into canals by means of steam engines or large-scale motors. The mechanical water pumps set up in the creek region of Saga were somewhat different. It did not require large-scale power-driven machines to pump water from the creeks into fields, and small-scale motors were used instead, replacing foot-operated water wheels. In the place of heavy machinery, inclined turbine pumps harnessed to small one to two horsepower electric motors were used.

Worthy of special note is the fact that the development of improved small-scale electrically powered motors was pioneered by local companies in Saga engaged in the manufacture of machinery. One of the important background factors underlying the introduction of electric irrigation systems in Taisho was the existence of precisely this kind of intermediary industry linking agriculture and local industrial activities.

Electrified irrigation works were the first large-scale projects to be

systematically implemented in this area. They were not of course comparable in scope with the enormous bureaucratic reorganization of rural society that occurred after World War II, with the agricultural staffing provided at the local and prefectural levels through state subsidies, with the agricultural extension system, or with the organizations for the promotion of agriculture set up to improve the land base. However, it is important to examine in some detail the rural infrastructure laid down in Meiji and Taisho based on which many of the recent, modern agricultural projects involving small-scale independent farmers have been carried out. Here, special attention will be paid to the early acquisition of technical expertise and technology, the activities of local industries, and the establishment of regional agricultural associations.

## II. THREE TYPES OF ELECTRIC IRRIGATION PROJECT

In the years between 1912 and 1926, a major agricultural water and land improvement project, large even by national standards, was undertaken in the lower Chikugo Plain. Here during the Tokugawa period, three fiefs, Kurume, Yanagawa, and Nabeshima, had confronted each other from opposite sides of the river. After Meiji, the region was again divided between Fukuoka and Saga prefectures. However, while the agrarian structures of each area differed, the improvement of local irrigation systems was a common need.

In the Taisho period, three major agricultural projects were carried out on 11,000 ha. in the lower Chikugo Plain, spanning the two prefectures. Each project saw the installation of independent mechanized irrigation pump systems. The Mizuma Land Improvement Co-operative Association was responsible for one such project completed between 1913 and 1924. The project affected 12 towns and villages in north Mizuma (Fukuoka Prefecture) and covered a total of 3,545 ha. of farmland. Here autonomous generating stations were built capable of generating 1,500 kilowatts. These were the first power stations in Japan to be built specifically for purposes of agricultural development. Their appearance testifies to the zeal and determination with which local landlords invested in the construction of these stations, opposing corporate electric-power capital which was then gradually extending its monopoly over this region.

The second and third pump mechanization projects followed shortly after the completion of the first. The second effort was an electric irrigation system servicing 4,224 ha. in 12 villages around Saga City. Carried out between 1922 and 1923, the project was administered by the

Oide Irrigation Association of Saga Prefecture. The project spread to neighbouring farm villages where land-improvement associations were soon established on a sub-regional basis and similar work was performed. By 1925, a huge irrigation network had been put in place in this region, covering a total of 7,300 ha. The third project also involved the construction of electrically powered irrigation works, this time in the southern part of Mizuma adjacent to the northern district administered by the Mizuma Land Improvement Cooperative Association. Here, a total of 2,716 ha. of farmland irrigated by creeks and belonging to nine villages in the Ogawa-machi area were provided with irrigation facilities, a project identical to that implemented by the Oide Irrigation Association.

All of the projects were designed to mechanize irrigation pump systems, but there were slight differences between the first, carried out in the northern Mizuma District, and the second and third which were undertaken in the southern creek region. Not only were technical requirements different, but the economics involved varied considerably for the first project begun in early Taisho and the remaining two started late in this period. Below are listed some of the differences observed between the projects in north and south Mizuma.

- The northern district includes some areas where irrigation systems are fed by creeks and streams, but in contrast to the southern part of Mizuma, which is almost entirely irrigated by creek systems, this area relies mainly on natural water supplies such as those provided by river irrigation works.
- The northern section uses water from the Chikugo River which is pumped into fields by large electrically operated pumps with a force of more than 100 horsepower on average. Here 18 pumps with a combined force of 1,991 horsepower were installed. In the southern district, however, motorized pumps were used to draw water from creeks and streams and channel it into individual fields. Fixed pumping stations were therefore constructed alongside creeks, and water was distributed to each field via a system of brick-lined aqueducts. Thus, while the number of such pumps was large, 410 in all, their combined force did not exceed 558 horsepower.

- In the north, the irrigation project was responsible for opening up about 1,000 ha. of new paddyland, roughly one-third of the 3,400 ha. fitted with irrigation facilities. This area was zoned as agricultural land. In the south, however, the project aimed only at motorizing pumping systems, and no other agricultural improvements were made.
- Total expenditures in the north came to 3.07 million yen, in the south to 700,000 yen. This represents an average outlay per 0.1 ha. of 90 and 25 yen, respectively.<sup>7</sup>

Motorized pumps were first installed in the lower Chikugo Plain after the first world war, and thereafter, the region mechanized rapidly, becoming one of the most advanced farm areas in Japan. It should be noted that the mechanization of the more than 10,000 ha. comprising this region was carried out using electric power. The southern plain of Okayama Prefecture, another highly mechanized agricultural region, was modernized using gasoline engines instead of electric motors. These regions may be said to represent the two types of farm mechanization prevalent in Japan.<sup>8</sup>

The installation of electric irrigation works did not take place overnight but has a history. The earliest form of motorized irrigation relied on steam engines. Steam engines are reported to have first been used in Japanese agriculture in 1892 to drain the lower plain of the Shinano River in Nagano Prefecture. However, numerous attempts were also made in the Chikugo River region to install steam-driven pumps along the river banks for irrigation purposes. Table 2 outlines these efforts. It is significant that the majority of steam engines in use in Kyushu in the late Meiji period were found concentrated in the lower Chikugo Plain.

The lower Chikugo region is a vast flood plain. The severity of flooding in this area is notorious: In the 25 years between 1846 and 1871, there were a total of 190 floods, or an average of 7.6 floods per year. Yet despite the large size of the Chikugo, its lower reaches were not utilized for irrigation. Instead, water was taken from its

TABLE 2. Mechanized Irrigation Facilities on the Chikugo River (1897-1912)

Location	Date installed	Area (ha.)	Prime mover	Facility used	HP	Responsible agent
Mizuma, Torikai, Oishi	1905, 1906	141.0	Steam engine	Pump	70	Cultivators
Mizuma, Torikai, Chomonseki	1897, 1901	90.0	"	"	70	Subcontractor
Mizuma, Torikai, Chomonseki	1912	87.6	"	"	60	Subcontractor
Mizuma, Daizenji, Nakatsu	1909	85.2	"	"	70	Co-operative
Mitsui, Zendoji, Otsuka	1905, 1908	45.8	"	"	115	Cultivators
Mitsui, Zendoji, Iida	1905, 1908	42.5	"	"	115	Cultivators
Mitsui, Yamakawa, Tarohara	1904, 1907	61.3	"	"	58	Co-operative
Mitsui, Yamakawa, Yamakawa	1911	70.0	"	"	35	Cultivators
Mitsui, Seppara, Aikawa	1902, 1905	72.4	"	"	50	Co-operative
Asakura, Kukimiya, Kukimiya	1907	55.7	"	"	94	Cultivators
Ukiha, Yamaharu, Yamakita	1910	27.6	"	Other	70	Cultivators
Miyaki, Kitashigeyasu, Eguchi	1905	56.8	"	Pump	30	Subcontractor
Miyaki, Kitashigeyasu, Eguchi	1910	26.7	"	"	40	Cultivators
Tosu, Maki, Shinhama	1907	85.0	"	"	200	Cultivators
Tosu, Maki, Minami-tsuru	1911	65.3	"	"	45	Cultivators
Tosu, Kisato, Sakai	1905	30.0	"	"	12	Co-operative
Yamato, Nishimiyana, Yoshitomi	1912	41.7	"	"	20	Private
Yamato, Setaka, Oehide	1909	5.4	Gasoline	"	5	Cultivators
Yame, Uazuma, Baba	1910	4.0	"	Other	2	Co-operative

Source: Local History of Irrigation on the Chikugo River, p. 289.

small and medium-sized tributaries to irrigate the surrounding rice fields. The first river conservancy project was carried out on the

Chikugo in 1887. As a result, "after 16 long years and a major investment of 2.67 million yen, the river's currents were tamed, flood damage was reduced, and local inhabitants could live in peace."

With the introduction of steam engines, irrigation, experiments in rice farming, water-control projects on the Chikugo, and the stabilizing of the river all became possible. It is said that the rough bottom land along the river, which until then had been used as upland field, was subsequently transformed into paddyland. However, it is still not clear why steam was used as the power source for motorization. According to a survey of Chomonseki in Torikai Village (see Table 2), the Fujita Iron Works was the maker of local steam engines. Fujita installed and operated the machines. Those using them to irrigate paid Fujita 288 litres of rice per 0.1 ha. of land plus 90 litres per 0.1 ha. as salary for those who took charge of diverting water into fields.<sup>9</sup> Encouraged by the rising price of rice and deferred payments for land, landlords opened new ricelands to profit from the improvements in local irrigation systems brought about by the introduction of steam-powered pumps. It is clear that direct producers themselves were not able to fully utilize for their own benefit the new power sources.

The era of the steam engine lasted roughly from 1897 to 1907, and by early Taisho, steam was being replaced by electricity everywhere for irrigation pumps. The first electrically driven irrigation pump to be put into operation in the Saga region was installed by the Mizuma Land Improvement Cooperative Association. The idea behind the land improvement project dates back to 1900 and the Land Improvement Law promulgated that year. Basically, the project was intended to take irrigation water directly from the Chikugo River, creating one large water source for the region. The preliminary survey for the project was entrusted to Tsuruta Tamon, an engineer. The original objective was to provide water for the entire Mizuma region, but because water rights overlapped throughout the area, it was decided to provide a single large water source for four counties: Mizuma, Yame, Yamoto, and Miike. According to the plan, the Yabe River was to provide hydraulic power to three generating stations which would supply power to electric pumps along

the Chikugo. These would draw 200 cubic feet of water per second from the river.

It is interesting to note that the present day land improvement project being implemented in the lower Chikugo River region of Fukuoka Prefecture resembles the earlier plan in several respects. It is significant that the Yabe River had already been designated as the source of hydraulic energy from which electricity could be generated.

According to Ota Ryoichiro, Fukuoka Prefecture may be divided into the following agricultural areas:

1. The Kitakyushu economic region is subdivided into the Kitakyushu peri-urban agricultural zone (Chikuzen, Buzen); the Buzen littoral zone; and the Chikuzen-Buzen coal and rice zone.
2. The Fukuoka economic region is the Fukuoka peri-urban agricultural zone.
3. The Chikugo economic region includes the middle Chikugo River agricultural zone (part of Chikugo, Chikuzen); the Chikugo plain agricultural zone (Chikugo); and the Chikugo Yamato agricultural zone.

Mizuma County including Ogawa and Yanagawa cities, together with Yame, Yamamoto, and Miike counties, lies in the Chikugo Plain. During Taisho, Mizuma County was the central agricultural region in the plain. The county had one city and 20 villages; it included 7,800 ha. of paddyland and was home to 43,000 people and 8,800 farm families owning an average of 0.92 ha.<sup>10</sup>

As early as 1898, a major project had already been conceived for this region, but spanning four vast counties, it was too ambitious, and the consent of all local parties could not be obtained; the opportunity was not yet ripe. This did not mean that farmers gave up hope of readjusting and improving the land. Local pressure for such a project arose again with the amendment of the Land Improvement Act in 1909, and six villages in Mizuma County undertook preliminary surveys. In October, permission was given to go ahead with the project; state and prefectural

funds including 25,000 yen for planning costs were pledged; and a master plan was drawn up. However, a consensus concerning the project still could not be obtained inside the county. Although the Chikugo River ran through the entire region, its tributaries began in the mountains, and each was an important water source for various sub-regional collectivities. The general region, then, was divided into a number of smaller units each relying variously for irrigation on natural water sources, streams, or swamps. Local interests differed, and unanimity was therefore difficult to achieve.

After numerous setbacks, the plan was finally realized, but only after individual villages set up steam-powered irrigation pumps inside 200 ha. land improvement zones. This was done just as a severe drought hit the region, and the new irrigation pumps proved their worth in a way no one could ignore. This led to the immediate and thorough installation of motorized irrigation works throughout the district. By 1913, 11 villages in Mizuma joined together to request a third project survey. The survey was conducted immediately in Fukuoka, and five engineers and 16 labourers were hired and sent to see it through. By 1914, plans for conduits and a main canal line had been completed.

The original plan called for the construction of a canal system to channel water from the Chikugo River via large-scale pumps, but in the end the scope of the undertaking was reduced in scale and limited to 12 villages in the northern part of Mizuma County. This area was subdivided into five districts, and the sources of water supply and the location of installations were pinpointed. A project was carried out in each district. Most of the 18 motorized pumps put in were powered by large-scale motors between 100 and 400 horsepower. Their total capacity was 1,991 horsepower, and they could lift 15 to 35 cubic feet of water per second. Electricity was chosen as the power source and large-scale dynamos installed. The introduction of electric motors in this area strongly influenced the subsequent choice of fixed, small-scale electric motors for irrigation purposes in the zone irrigated by creeks.

The total force generated by these pumps, then, was nearly 2,000 horsepower, and to manage this much power, the land improvement and irrigation associations formed a co-operative and signed a ten-year contract with the Kyushu Electric Light and Railway Company to supply the co-operative with electricity. The average charge per unit of horsepower generated was less than 10 yen per year (during the irrigation season which lasted from May 15 to September 30, the pumps were in operation 18 hours a day). However, electricity rates gradually rose, and by 1918, one horsepower unit cost 15 yen. It was in this context that the co-operative drew up plans to supply its own electricity. In 1919, permission was granted to use the Yabe River for hydro-electric power generation. A new contract was to be signed between the co-operative and the power company in 1924 at which time the company planned to raise its rates to 43 yen per unit of horsepower produced. In anticipation of this move, the co-operative hired Toho Electric Power Company to build a generating unit, which was completed in May 1925 at a cost of 1.11 million yen.<sup>11</sup>

The land improvement co-operative included among its member organizations both associations established under the old legislation governing the formation of such groups and associations set up under the new laws; it did not, therefore, become a federation of land improvement associations.

A total of 3.10 million yen were invested in the motorization of the irrigation systems in most of Mizuma County, but landlords as a class played a central role in this development. Their objective was the opening up of about 1,000 ha. of new rice land in the region, as may be seen from Table 3. Mechanized pumping systems were also set up in the creek irrigation zone in late Taisho, but nothing was to be gained from creating new rice lands, whether in the Saga flatlands or the southern creek region of Mizuma. The sole advantage to mechanization here was the savings that could be realized in terms of manpower, but pump motorization in Mizuma County, in particular, was an important stimulus to farmers in the creek region and a good learning experience.

The Saga, Chikugo, and Kumamoto plains facing on Ariake Bay constitute

TABLE 3. Land Reclamation via Land Improvement in North Mizuma County

Land improvement association	Land prior to reclamation (ha.)										After reclamation		Number of electric motors and HP		Cost of construction (in yen)
	Total area	Rice land	Other cultivated field	Forest and field	Lakes and swamps	Others	State-owned land	Area (ha.)	Increase in rice (%)	No.		HP			
										No.	HP				
Yasutake	956.5	421.0	401.6	66.8	0.7	24.0	42.3	532.6	226.5	6	810	1,129,613			
Mizuma	918.0	577.8	143.8	68.7	0.2	5.5	121.9	231.0	139.9	4	470	588,826			
Egami	780.5	604.4	5.4	4.6	-	1.4	170.6	31.5	105.2	1	180	255,466			
Daizenji	195.9	97.6	70.9	16.2	0	4.0	7.1	111.2	213.9	1	150	185,351			
Nakazu	32.8	19.9	6.1	1.5	-	4.1	1.1	10.0	150.2	1	28	32,065			
Araki	186.2	32.1	69.0	75.3	0	0.4	9.2	141.5	540.8	2	275	761,472			
Aoki	310.7	281.1	0.1	0	29.2	0.1	-	-	0	1	60	121,588			
Fujiyoshi	10.7	5.0	3.8	0.3	0.6	0.3	0.5	4.8	196.0	1	8	22,977			
Yasutake District 5	18.9	-	14.9	3.4	0.3	-	0.3	20.2	202.2	1	30	92,798			
Total	3,416.0	2,039.2	715.8	236.8	31.1	40.1	353.1	1,082.8	152.6	18	2,029	3,160,156			

Source: Proceedings of the Mizuma Land Improvement Cooperative Association.

a vast rice-growing region but one that is plagued by the presence of pearl moths. Of the three areas, the Saga Plain had the largest farm sizes and suffered most from a shortage of irrigation water. Because the labour needed to man water pumps during the planting season was in short supply, it was necessary to shorten the transplanting season, formerly divided into early, middle, and late stages, such that rice seedlings were transferred from seed beds to fields once in the early middle season and once again in late season. Since most pearl moths reproduced three times per year, the damage to rice crops was heavy. According to surveys conducted between 1909 and 1917, the average annual crop loss due to moths was 4.7 per cent of the late rice harvest; this figure sometimes reached as high as 12 per cent in particularly bad years.

As competition in the rice and grain market grew more intense in late Meiji, private attempts to prevent and eradicate the pearl moth multiplied, but the wide variety of efforts designed to limit crop damage caused a drain on the manpower required to operate irrigation pumps, limiting their effectiveness. To complicate matters, as the economy grew rapidly during World War I, labour power flowed out of farm villages, and wages rose accordingly, making the introduction of labour-saving techniques and devices an absolute necessity in rural regions, particularly for irrigation activities.

Saga looked to the example of northern Mizuma where the installation of large-scale electric motors had resulted in important labour economies in irrigation work. But financial, technical, and a host of other problems had to be solved before this technology could be successfully applied in the Saga Creek zone, Hayata Tatsuji, the district governor, who was later responsible for the Saga irrigation electrification project and was made manager of the Oide Irrigation Association, summed up the situation as follows:

After receiving instructions from the main office, I became aware that the foot-operated water wheel requires a great physical effort and is expensive. I thought of utilizing machine power in order to offset the shortage of labor and increase yields. At the same time, I thought of promoting one

(rice) crop, thereby standardizing quality and improving it. By effectively using time thus saved, it would become possible to develop sideline activities, make farm villages prosper, and thus contribute to the well-being of the whole country.

I sometimes consulted the opinions of old farmers and knocked on the doors of experts, devoting all my energies to studying this problem until I was confident I had mastered it. Finally, at an irrigation association conference held in December 1920, I had the chief of general affairs under me announce my master plan. But the project was new, the plan ambitious, and no one had this kind of experience. It is therefore very difficult to secure the agreement of those concerned. I decided it was necessary to first get farmers to accept the notion of using machines for irrigation.

First of all, I dispatched irrigation association officials to Fukuoka Prefecture and to the Miyaki district of Saga Prefecture to study how such projects were implemented there, and in September of the following year, I invited technical personnel from the prefecture and organized an itinerant lecture series to explain the need of using machines for irrigation and promote their utilization. I occasionally sent people to invite farmers to undertake irrigation projects and distribute tracts advertising such projects. I tried very hard to convince people to accept the mechanization of irrigation.

In 1921, about 50 ha. were irrigated at Gongendo in Kyosei village by using induction gasoline-operated motors according to the provisions of the Land Improvement Law and under prefectural supervision. This project was quite successful, farmers were interested, and each village vied in sending representatives to take a look. Kita-kawaso and Nishi-kawaso villages actually decided to undertake similar projects themselves. Following the Land Improvement Law, they began planning the construction of mechanized irrigation facilities. Afterwards, Kyosei and Hyogo villages asked Nippon Electric Machine Works to supply the project with electric power. Even in the plains area, one village after the other decided to implement electrification projects.

I subsequently dispatched the head of the general affairs department to Osaka and Hyogo and Shiga prefectures to study related projects from an economic point of view. At the same time, we studied the pros and cons of electric versus gas-powered machinery. We decided that electric power is the most advantageous economically. However, at that time, it was difficult to get electricity from outside of our jurisdiction, and this caused difficulties. In Kyosei Village, which is under our authority, Nippon Electric Machine Works, Inc. volunteered to generate its own electricity and sign contracts with Hyosei and Hyogo villages. However, both places were within the reach of Kyushu Electric Light and Railway Company, Inc., and Nippon Electric Machine Works could not get permission to supply the villages, so it abandoned its plan to develop its own electric power capacity. Rather than each village

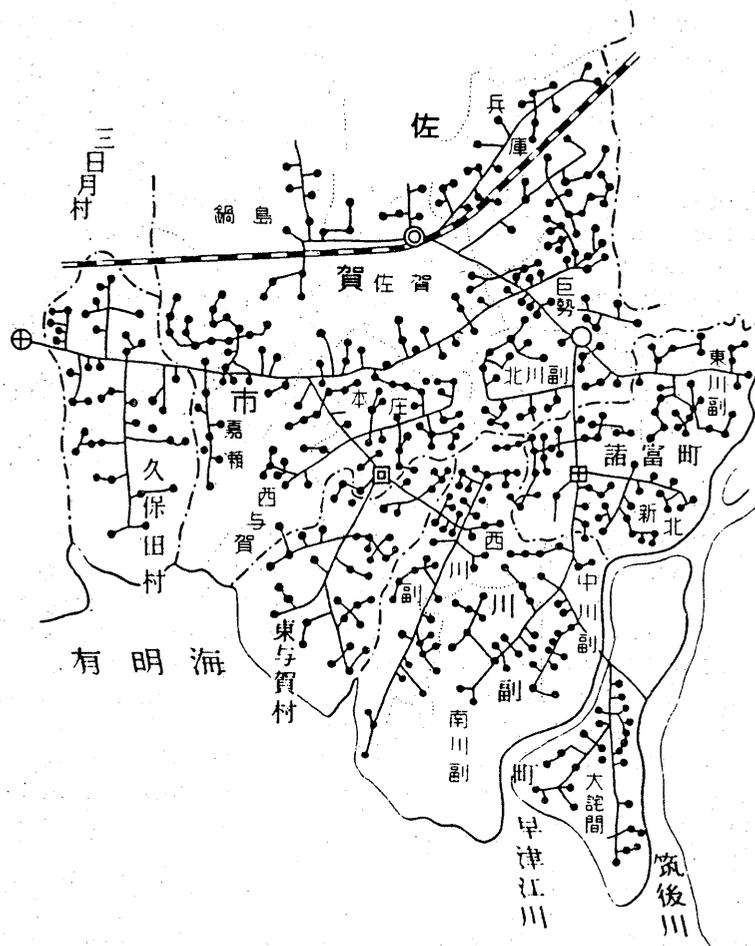
attempt to supply its own electricity, it was decided that both would ask the Oide Irrigation Association, which was in this area, to undertake the electrification of irrigation works wherever foot-operated water wheels were in use.

Moreover, despite the fact that irrigation is seasonal, Kyushu Electric Light and Railway Company, Inc. agreed to provide electric power to the Oide association. As a result, Kitakawaso and Nishikawaso villages also signed contracts for electricity with the company. In our own region, because there is not much possibility that Nippon Electric Machine Works, Inc., will be granted permission to generate electricity on its own, we explored the idea of consulting with Kyushu Electric Light and Railway to get electric power and finally signed a contract.

Because Nippon Electric Machine Works produces equipment of comparatively good quality, which is also easy to repair, we decided to place an order with this company for the construction of electric pumps and wiring systems as well as for other machinery. On May 2, 1922, we submitted an application for approval to build electric generating equipment for our own use and began construction of the project on June 12 after receiving permission. Because we have worked hard day and night to complete the project, we were given permission to generate electric power on June 30. The project, begun in 1922, lasted two years, all construction being completed by June 13, 1923.<sup>12</sup>

The figure below outlines the electric irrigation project undertaken by the Oide Irrigation Association. The project affected 12 towns and villages around Saga City and provided 4,224 ha. of farm land with electricity. Here 465 pump houses were built, each with one electric pump in the 1-2 horsepower range. From the pump houses, several dozen water conduits led into the fields. One horsepower unit was capable of irrigating 4.5 ha.; the total force generated by the pumps amounted to 946 horsepower units. Total construction costs came to 870,000 yen, or about 20.63 yen per 0.1 ha. No subsidies were granted for the project by either national or local governments. The work was financed entirely with low interest loans made available by the central government and the industrial promotion bank.

The project, carried out in the Saga Plain in 1923, was an event of epoch-making proportions for local farm villages: it made possible the unification of transplanting activities, a farmer demand of long standing. On February 16, 1923, a prefectural report was released



Key

- ◎ Saga transformer station
- ⊕ Ushizu switching station
- 100-horsepower pump
- ▣ Honjo switching station
- ▤ Mizumachi switching station
- Electric pumps
- Power lines

Schematic Diagram of the Oide Electric Irrigation Works (according to Kamagata) Showing the Power Lines and Electric Pump Stations in the Saga Plain

announcing that, with the co-operation of agricultural technical experts from the prefectural and county governments, agricultural chambers of commerce, and the agricultural experimental station, the planting season for rice, divided into early and late phases, would begin everywhere on June 20.

A unified planting season had been suggested by Masuda Sohei, a farm leader in the Chikugo region, as early as 1878 as a technique of controlling pearl moths. It required nearly 50 years for this idea to be fully accepted and implemented in the Saga plain.<sup>13</sup>

### III. RURAL SOCIETY AND LOCAL PRODUCTION

Looking at the structural changes that occurred in Japanese capitalism from late Meiji through Taisho from the perspective of rural society, three broad currents may be discerned. The first is the rapid concentration and centralization of enterprises that accompanied technological innovation and the progress of scale economies in the modern industrial sector. The same process was occurring in Saga Prefecture in the areas of banking, railroads, electricity, and coal production. The second major trend was the relocation of factories operated by big capital in the industrial centres to rural areas. In Saga, too, large-scale factories (primarily spinning mills) employing 1,500 workers and far surpassing local industries in size were established at this time. The factors making industrial relocation to the countryside attractive were cheap labour, cheap land, and the diligence of rural workers. Here, the money-making instincts of big capital, which was concerned only with the efficient utilization of labour power, were given full play.

The third current diverged sharply from big monopoly capital. This was composed of local endogenous industries such as machine manufacturing which were integrated into the regional economic circuit and relied on locally produced raw materials. These industries were quite dynamic. One such enterprise was the Kyushu Iron and Electric Company, which manufactured and installed the small-scale electric pumps developed for use in the creek irrigation districts. From mid Meiji, the company grew rapidly by designing and manufacturing the machines used to process vermicelli, a speciality of the Saga Plain region.

The activities comprising economic production in rural society, then,

were in no sense limited to agriculture. Local industry was also an important branch of production. In northern Kyushu, the farm villages of the lower Chikugo River region, particularly those of Mizuma in Fukuoka Prefecture, and a prime example of rural communities with a large number of local, endogenous industries using locally produced farm products and raw materials which have been in operation for a long time. This does not mean that regional agriculture was in open conflict with large urban capital. Local machine manufacturers used both regional agriculture and the local industries that depended on it as the basis of their production, and all three activities, agriculture, local industry, and machine manufacturing, were interwoven into, and formed the basis of, the local economy. This was the case in the lower Chikugo farm region.

Because the farm machines that were gradually introduced into use were closely related to soil and climatic conditions, machine makers were in direct and constant contact with farmers, improving machine models based on the farmers' experience and diffusing the refined final product throughout their region. For this reason, the progress of mechanization was linked to the presence of small and medium-sized farm-machine factories. The southern farm plain in Okayama Prefecture, where the first small-scale motorized cultivators were introduced after the second world war, and the Chikugo Plain were both areas in which large numbers of such factories were concentrated; machine makers here played a key role in improving and spreading farm machinery. In considering the mechanization of irrigation pumps during Taisho, it is important to look at the relationship between these makers and local rural society.

In Mizuma, Fukuoka Prefecture, local industries produced Kurume kasuri cloth, wood products, sake, tiles, figured rush mats, Japanese-style umbrellas, and soy sauce in addition to machinery. In each instance, locally produced farm products and raw materials were processed into finished goods. Most industries were concentrated in Mizuma district because of its location near the mouth of the Chikugo River which was used to transport these raw materials. But local industrial activities also exerted a strong influence on the rate of development of the

regional market economy, regulating labour supply and opening new outlets for goods. From late Meiji to Taisho, these outlets were established in areas outside the boundaries of rural society, spreading from Fukuoka Prefecture to Saga, Kumamoto, and Nagasaki in northern Kyushu. The figured rush mat industry even exported its products to India, Southeast Asia, and America.

The manufacture of Kurume kasuri cloth and wood products assumed an even greater importance. Kurume kasuri was made using both hand-operated treadles and automatic looms. The cloth was produced in the Chikugo River area but particularly in Kurume which lies in the heart of this region. In 1887, there were 900 household establishments making kasuri, and they employed fewer than 10,000 workers, but by late Meiji, only 154 establishments employed more than 47,000 workers. The wood manufacturing industry was concentrated around Ogawa-machi at the mouth of the Chikugo River and produced household utensils and building materials for neighbouring farm villages. There were 900 family enterprises engaged in this activity here but 2,000 if related activities are included, and together these employed more than 4,000 people.<sup>14</sup>

Mizuma district included several dozen machine factories supplying farmers with machinery and tools. They hastened the mechanization of farm activities. The relation between the mechanization of irrigation pumps in Taisho and the Mazaki Ironworks and, in particular, the Takeshita Ironworks, which introduced motorized hand plows after World War II, is a typical example.

The Nippon Iron and Electric Company, which owned a plant in the Saga Region, undertook the production of small-scale electric motors in the 1-2 horsepower range and the construction of power lines for the electrification of creek irrigation facilities. This company was formerly the Mazaki Ironworks. Its founder, Mazaki Shokyo, was born into a wealthy sake merchant's family in 1851. In 1875, at the age of 24, he thought of making a machine to process handmade vermicelli, a regional speciality, and opened a factory. It is clear that Mazaki Ironworks was started in order to supply machinery for the production

of vermicelli, a product specific to that region. Doubling his efforts after the Sino-Japanese war, he began a new project, opened up new outlets for vermicelli processing machines, set up a second factory in Tokyo, a branch factory in Shanghai, an agency in Taegu (Korea), and special sales outlets throughout Japan. Following the Russo-Japanese war, in 1909 Mazaki began manufacturing flour-milling machinery, and in 1911, he went into the making of electric dynamos, high-voltage turbine pumps, and electric motors. Until the company was designated part of the Sasebo and Kure arsenals in 1916, its technical expertise was recognized as highly reliable.

During the period of prosperity that followed the first world war, the company became a corporation in order to expand the manufacture of electrical machinery, Fujiyama Raita (president of Dai-Nippon Sugar Manufacturing Company and head of the Tokyo Chamber of Commerce) was appointed company president, and in 1918, the enterprise was reorganized as the Nippon Iron and Electric Company, Inc. In addition to the main factory which covered an area of 511 square metres and had five shop buildings (210 square metres), the company owned a second factory with a site spanning 316 square metres. The factories produced electric machinery with a horsepower range of up to 200 and turbine pumps with attached electric motors. They employed more than 250 workers at one time.<sup>15</sup>

The firm became involved in the installation of electric irrigation works under the direction of Mazaki's son, Goichi. Asked by prefectural authorities to make motorized irrigation pumps for flatland areas, Goichi imported small, three horsepower gas-operated dynamos, and together with pumps, transported them by ship into the network of creeks where he set up pumping stations on an experimental basis. This method was eventually abandoned. Both prime mover and pump were carefully selected in terms of technical and economic efficiency. After a long search, it was finally decided to use a Hueffer pump with dynamo attached, the most suitable for local requirements, and the company undertook both the manufacture and installation of this machine.

The electrified irrigation projects of the Taisho period, then, were considerably different from those of Meiji, which had relied on the importation of foreign machinery, in that the creativity and technical expertise of local companies played an important part in their realization. Even in a remote region like Saga, local machine manufacturers whose activities were closely linked to the regional economy were in evidence, although they were not numerous; the Mazaki Ironworks was not the only local maker. Space does not permit a detailed discussion of these companies, but the Taniguchi Ironworks, founded in 1883, the Karatsu Ironworks, and Kosei-sha each grew up and expanded within the framework of local industry. It was because of the capital resources and technology of local industries, quite different from those of big, centralized capital, that the electrification of irrigation works came to be linked to the mechanization of agriculture.

Most of the small and medium-sized enterprises which had overcome the crisis of late Meiji and actively expanded in early Taisho were forced to rationalize or go under during the long recession of late Taisho. The Mazaki Ironworks was no exception and in 1924 experienced a slow-down in business. The scope of rural industrial activities inevitably shrunk as large urban capital was concentrated and grew, and agriculture gradually came into open conflict with outside enterprises. Here a look at the relation between big capital and the electric power companies responsible for the construction of electric irrigation facilities is in order.

The Kyushu Electric Light and Railway Company was responsible for supplying electric power to the creek region at the lower reaches of the Chikugo River. Kyushu Electric had already absorbed a number of smaller companies set up in Fukuoka and Saga during Meiji and, expanding, became the major supplier of electric lighting and power for western Fukuoka, Saga, and Nagasaki. Co-operating with Kyushu Hydro-electric which, founded in 1911, supplied electricity to the mining belt stretching from Oita Prefecture to northern Kyushu, the company expanded its base of operations and in 1922 changed its name to the Toho Electric Company.

The transition from paper lanterns to electric lighting took place between 1887 and 1907, and it was during this period that electric power projects began in northern Kyushu. The first electric light company was founded in Kumamoto in 1888 and in 1891 began generating electricity and supplying electric power. Electrification got fully underway following the Sino-Japanese war (1894-95), but electric companies were already in operation in the cities of Nagasaki and Fukuoka by the beginning of the war. In 1897, the population of Fukuoka stood at 70,000. Although the age of electricity is said to have begun after the Sino-Japanese war with the founding of modern industry, in the Saga region, electrification did not commence until after 1908. The neighbouring prefectures were also about ten years late in developing electric power.

In Saga, the first electric generation project was conceived by an influential family entrepreneur who began to collect stocks in 1906. Receiving help from central financiers such as Matsunaga Yasuzaemon and Fukuzawa Tosuke when the business failed to expand locally, he established the Hirotaki Hydro-electric Power Company in November. The company immediately set about building a generator, and in 1908, the generator completed, it began producing electricity. The original goal was to supply electricity to Saga, Hakata, and Kurume, but by the time the company was in operation, the Hakata and Kurume electric light companies had already been set up, and to avoid overlapping, Hirotaki restricted its business to Saga Prefecture. An account of the construction of the Hirotaki power station (1,400 horsepower) in 1908 is contained in The History of Saga City; it relates that the machinery and installations used by the company were imported from Germany.

The power station included a water conduit 270 metres long and a 240-metre tunnel. The waterhead was 175 metres high. The installations were built by the Matsuo-gumi and two other local construction companies. The Matsuo-gumi was the main sub-contractor, hired by the Saga Civil Engineering Company. Most of the construction materials were of German make. These included an 800 horsepower water wheel and two 1,100-volt generators. The generators arrived at Kanzaki station in

March 1907, but the machines were too large and could not be transported to the power plant at one time. They had to be broken down into 25 pieces, transported, and reassembled. In August, two German engineers arrived in Japan to install the dynamos, and the first tests were carried out in September.

The materials required to build the power station included cement, coal, large induction pipes, and parallel water conduits. The large-scale induction pipes were built by the Taniguchi Ironworks, a local enterprise, and the water pipes were provided by the Fukawa Shipyards located in Ogawa City on the lower Chikugo River. A total of 42,000 barrels of cement, 7,000 bags of volcanic ash, 6,000 bags of coal, and 1.57 million English bricks went into the construction of the plant. The bricks were unloaded at Tobata harbour, transported to Kanzaki Station by train, and delivered to the site by more than 100 horse-drawn carts which formed a long line between the two points. After conducting trial runs, the main company headquarters were set up in Saga City, several transformer stations were built in Kurume and other locations, and in January 1, 1908, the power station began to generate electricity.<sup>16</sup>

Hirota merged the following year with the Takeo Electric Light Company and in 1910 with the Karatsu Electric Light Company, expanding until it provided all of Saga Prefecture with electricity. The growing demand for electric power resulted in the construction of additional generating plants. Hirota bought up the Furuyu power plant on the Kawakami River (the main river in the Saga Plain) which was used to supply electricity to its own mine. A new power station was also built along the Kawakami River at the suggestion of Matsunaga Yasuzaemon. Afterwards, the company merged with the Hakata Electric Light and Railway Company in Fukuoka, which until then had relied on thermal electricity alone, and in 1912 changed its name to the Kyushu Electric Light and Railway Company, becoming the main supplier of electric power to all of northwest Kyushu including Nagasaki. Electrical and chemical industries developed extremely rapidly after 1914 because of the war, and the demand for electricity skyrocketed. It was at this

precise moment that a large-scale electric irrigation project was undertaken in northern Mizuma.

As I mentioned earlier, in 1922, the Kyushu Light and Railway Company changed its name to the Toho Electric Company. The co-operative association of northern Mizuma was preoccupied with supplying electricity to private families. The Oide Irrigation Association of Saga and the Land Improvement Association of southern Mizuma, however, turned to the Toho Electric Company for their electric power. By this time, all of Kyushu's electric projects were in the hands of five companies: Kyushu Hydro-electric Power Company, Kumamoto Electric, Kyushu Electric Railway Company, Nippon Hydro-electric Power Company, and Toho. Of these, Toho and Kyushu Hydro-electric became the two dominant companies, each disputing first place. The five companies did not turn to the possibility of developing electric power using the rivers of Miyazaki Prefecture until after late Taisho.

The suppliers of electric power quickly grew into modern industrial monopolies. Another major economic current was constituted by the implantation of factories controlled by centralized monopoly capital in the countryside. Examples are the Katakura-gumi's Tosu City plant and the Saga Spinning Mill belonging to the Suzuki Shoten interests. Both employed 1,500 workers at their height and were several times larger than any of the factories that had previously been built in Saga Prefecture. During the wave of prosperity generated by the first world war, Japan's spinning industry occupied a special place in the economy because of its export potential, and, stimulated by the boom, spinning companies appeared in every section of the country. Construction of the Saga Spinning Mill began in 1917; it was opened the following year. By 1920, the company boasted 32,000 spinning machines, 6,400 twisting machines, and 400 looms; it hired 300 men and 1,200 women workers. The Saga Shimbun, the prefectural newspaper, summed up the benefits conferred by the transfer of these factories to the region as follows.<sup>17</sup>

Saga was highly regarded from the first by the spinning industry as the very best site for locating spinning mills in all of

Kyushu. The factors recommending Saga as an industrial site for the expansion of spinning mills are numerous: inexpensive land, abundant supply of manpower, low wages, ease of recruiting workers, and a favourable transportation network. No other area in Kyushu can compare with Saga in fulfilling the above conditions. Everyone knows that land in Saga is relatively cheap and good pieces of property may be had for the asking. Moreover, the population is large, and wages are quite cheap. Women leave Saga to work as spinners in every part of Japan. Because their fingers are highly skilled, and because they are faithful and diligent workers, they are welcomed everywhere. Furthermore, there is rail transportation, electricity, and manpower in the mines. These factors make Saga the preferred choice of spinning mill operators.

It is clear from this account that by Taisho, the advance of factories into the countryside had made the effective utilization of labour resources alone an important sales point for attracting outside investment. In this evaluation, no concern is shown for the local economy or for regional industry. Indeed, the advance of outside industries into the rural areas was part of the process of industrial concentration and capital accumulation controlled by the Zaibatsu and big monopoly capital. This process represented the first step toward the re-organization of the Japanese economy in function of these dominant interests.

#### IV. CREATING NEW ORGANIZATIONAL STRUCTURES IN FARM VILLAGES

Electrified irrigation projects were a technical innovation that accompanied the structural transformation of Japanese capitalism following the first world war. Such innovations entailed the re-organization of the smallholding farm system in Kyushu's rice belt. Here the dynamism of smallholders, due to the spread of part-tenant, part-owner farmers, together with the tenant struggles which raged in farm villages during this period played a supporting role in transforming the land-tenure system as independent, full-time farmers replaced landlords. For this reason alone, the social structure of those farm villages which accepted the technical innovation of electric irrigation has drawn considerable interest among scholars, and several research reports have dealt with the class character of such innovations. The class nature of technical change is indeed important, but another equally important problem, and one that has received less attention, is the formation and consolidation of the organizational network in each village required to introduce these changes locally. It is here that the endogenous techniques handed down from generation to generation within the framework of traditional village society come into play.

Electric irrigation projects were carried out systematically, involving several thousands of hectares of land and as many farm households, but unlike the land improvement projects of the Meiji period, they were not organized around the landlord system, with large landlords at the centre of each effort. These projects coincided not with the re-organization of the landlord system in rural society but with the re-organization of independent smallholders in response to the exigencies of modern industrial society. This restructuring of village society anticipated in its form and evolution the transformation of small-scale

agriculture in the present period of high economic growth. The projects were organized and carried out by newly created village associations controlled by independent farmers, not landlords. The question of how these associations were formed does, of course, have a bearing on the problem of the class character of technical innovation, both being interrelated. But here I shall focus my attention on the first point only: how the new structures came into being.

Three major irrigation-pump mechanization projects were undertaken in the lower Chikugo River region, each organized and implemented independently of the others. While all three projects were technically similar, each making use of electric power, the social composition of the groups carrying them out, the class character of these groups, was not necessarily identical. Here I will contrast two different types of group involved.

The first type is that exemplified by the Land Improvement Cooperative Association of northern Mizuma, the second the Oide Irrigation Association. The Mizuma co-operative was first conceived in late Meiji, and the project it was set up to carry out was begun in early Taisho. The real purpose of the project was to increase rice yields and raise the price of land by opening up new land, primarily upland fields, woodland, and meadowland. The project was run by the local landlord class.

In contrast, the electrification project carried out in the Saga Plain was not designed to turn a profit by creating new land. The possibilities of opening up new land to cultivation in Saga's creek region had already been exhausted by the end of the feudal period. Electric irrigation was designed to benefit individual farm families and make everyday farm work easier by mechanizing, and thereby economizing on, farm labour. The principal proponents of this project were not landlords but direct producers themselves, mainly independent farmers employing full-time farm labourers.<sup>18</sup> Concerning project costs, total expenses for the mechanization of Mizuma's irrigation system came to 3.07 million yen, or more than 70 yen per 0.1 ha. The electric irrigation facilities

installed on the Saga Plain, however, were far less costly, a total of 876,415 yen being spent, or 20.75 yen per 0.1 ha. (installation fees came to 666,511 yen, or 15.78 yen per 0.1 ha.; the construction of water conduits to 210,304 yen, or 4.97 yen per 0.1 ha.). But in this case, the cultivators themselves, including tenant farmers, had to bear the expense involved.

The projects were completed one after the other, but the social strata responsible for implementing them were different in each case. The Mizuma project was carried out by those who inherited the traditions of Meiji village society, the Saga project by those reared during Taisho.

Tenants' struggles during the Taisho period were waged to reduce the amount of rent paid to landlords, and the land improvement projects of this period were designed by the landlord class to appease tenants and soften their demands. As indicated earlier in the case of the southern Mizuma Land Improvement Association (section II, note 13), electric irrigation projects were related to the social unrest among tenant farmers that characterized rural society at this time. In Kita-Kawaso village, Saga Prefecture, a land readjustment association was created to implement an electric irrigation project, but here a tenants' association was also set up as an ancillary organization with the following objectives:

1. The tenants' association agrees with the project of the land improvement association and shall do its utmost to contribute to the successful completion of said project.
2. The tenants expect the project to improve relations among tenants themselves and improve the situation of tenants (in rural society). At the same time, the project shall serve to create closer relations between landlords and tenants.

The tenants' association organized almost all tenants and part-owner, part-tenant farmers in the village. In May, 1922, the president of the association became head of the land improvement association, and in September, he became village chief.<sup>19</sup> Thenceforth, owner cum tenant farmers took the lead in introducing technical innovations and in

directing village politics.

Another point worthy of note in this context is the difference between pump mechanization in the southern plain of Okayama Prefecture and similar mechanization projects in the lower Chikugo River region. The mechanization of irrigation-pump systems was carried out in both areas at approximately the same time, between 1919 and 1926. However, in Okayama, portable gasoline-powered motors were introduced by individual farm families who used them for their private needs. According to the statistics, by 1925, nearly 4,000 oil-driven pumps were being operated by farm families (61 per cent were owned privately).

In contrast, stationary pumps driven by electric motors were installed in the creek region of the Chikugo River around irrigation ditches and used collectively. The development of two different modes of utilization, the one individual, the other co-operative, is worthy of interest. This choice appears to have been determined by differences in the regional structure of agriculture, but this aspect has not been adequately researched as yet.

The system of local administrative finances had been reformed several times in the early half of Meiji, but a final reform was carried out at the town and village level in 1890 and at the country (sub-prefectural) level in 1897. This indicates the lack of systematic official support for local agriculture during this early period. In each local area, various associations had been created by individual farm leaders, primarily independent cultivators, on a private basis to improve regional agriculture. These included the Agricultural Promotion Society of Hayashi Enri and the farmers' meetings organized in many regions before 1890.

However, after 1897, state institutions and their various organizations came into being, and under government direction, a system of direct assistance to agriculture was created. Special bodies were set up inside the central Government, and a legal framework was provided by the Irrigation Association Law, the Land Improvement Law, and the

Agricultural Association Law. But state aid to agriculture did not stop here. Within a short period of time, regional organizations, tied into the system of centralized farm institutions, had been set up even in outlying regions such as Saga and the Chikugo area. The activities of the farm-support network in each village played a very large role in implementing the electric irrigation projects of the Taisho period.

The organizations which carried out these projects were, in Mizuma, Fukuoka Prefecture, the local land improvement association (created under the Land Improvement Association Law), and in Saga Prefecture, the local irrigation associations (set up under the Irrigation Association Law). These agricultural associations, composed of landowners, grew until they were able to undertake, in the Taisho period, truly large-scale projects involving several thousand farm households. This was important as government subsidies were not forthcoming and each association had to bear the full cost of the project itself. However, another factor was also operative here. From late Meiji to Taisho, the upward trend of the price of rice led to increased investment in land improvement and an economic climate favourable to the realization of large-scale irrigation projects.

Nonetheless, local farm associations were not able, by their own efforts alone, to plan large-scale regional projects of this nature or provide proper technical guidance. After Taisho, the local farm institutions and organizations created in late Meiji came into their own, and their activities played a key role in seeing these projects through to fruition. The most notable institutions in the rural network of farm organizations were (1) the agricultural promotion system set up by local government authorities; (2) the land surveys carried out by prefectural agricultural experimental stations and the rural extension activities designed to disseminate the results of this research; and (3) the agricultural associations created in each prefecture and their interrelated activities. Agricultural organizations had already been established at the prefectural and county level by late Meiji, but it was not until Taisho that they spread to the more fundamental units of production, towns, villages, and hamlets.

## The Agricultural Promotion System of Local Government

During the Meiji period, the Ministry of Agriculture and Commerce issued ordinances enabling prefectural authorities to carry out a number of activities designed to promote local agriculture and diffuse improved agricultural techniques outside the scope of existing agricultural legislation. This subject has already been dealt with by other studies, and there is no need to dwell further on it here. However, when these policies were implemented in the Saga, Chikugo, and Kumamoto plains along the Ariake Sea, certain special characteristics of this region had to be taken into account.

The most pressing local problem was the very serious crop damage caused by the pearl moth. Damage was particularly great in the Saga region where the average amount of land per farm household was large and the transplanting of rice was performed twice a year, once in early mid-season and once later. Farmers lost at least 10 per cent of their crop each year to this pest, and once every six or seven years, the damage was particularly extensive, entailing major losses. It had been determined through experimentation that the moths had difficulty attaching their eggs to thin, weak rice plants, and cultivators therefore planted from 100 to 200 different rice strains closely together in order to weaken the stalks. However, the mixture of different strains coupled with the actual damage caused by the insects meant that the development of uniform strains was impossible, yields remained low, and the price obtained for this rice on the market tended to fall. Without first eradicating the pearl moth, it was therefore impossible to improve the situation by selecting out improved rice strains, developing more resistant plants, and using better cultivation techniques. It was natural, then, that prefectural policies designed to promote agriculture should attempt first to break this vicious cycle.

As early as 1877, Masuda Sohei, head of Mita Village in Mizuma, Fukuoka Prefecture, had analysed the reproduction cycle of the pearl moth and discovered several methods for eradicating it. In his book, Experiments with Rice Insects, he indicates six ways of destroying it:

(1) gathering moth eggs; (2) killing the larvae; (3) cutting off rice stubble at the roots; (4) eliminating the moths in rice straw; (5) attracting the moths to fire and burning them; and (6) unifying the planting season for rice.<sup>20</sup> These methods of eradicating pearl moths, announced in 1877, were not fully applied in the Saga Plain until 1924 when the electrification of irrigation facilities had already been completed. Nearly 50 years were required to put the techniques to use. The reason for this delay is that the sixth method listed by Masuda, the unification of planting seasons, did not become possible until the irrigation projects of Taisho had mechanized pumping systems.

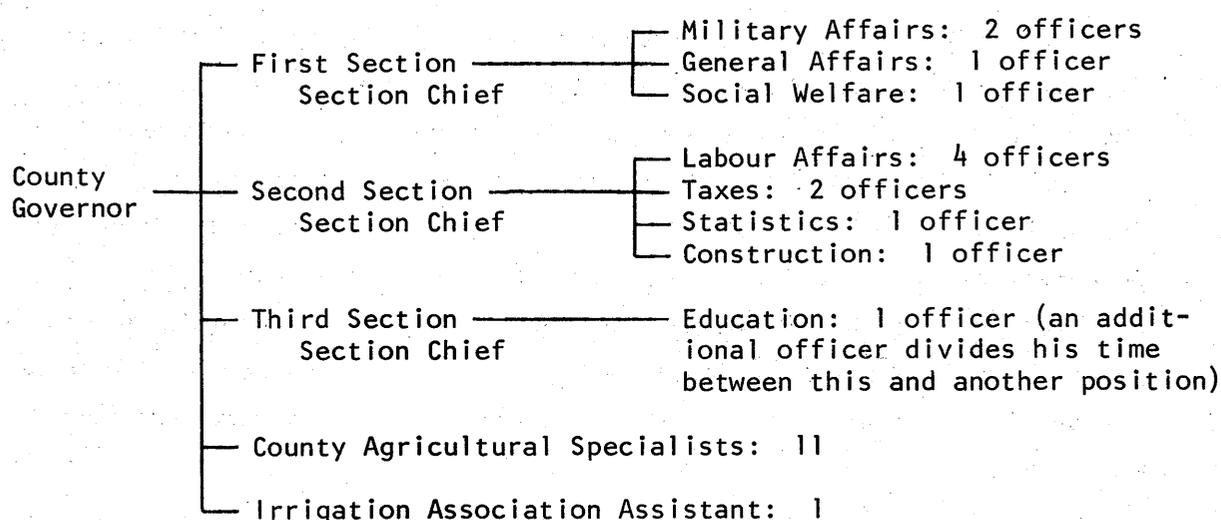
Eradication programmes aimed at improving agriculture were carried out by prefectural ordinances after Meiji but were enforced thoroughly by the use of state power, with violators being arrested and put in prison. The coercive measures to which the state resorted provoked a major peasant uprising in 1890, the "Rice-Stubble Revolt."

In Saga Prefecture, a prefectural ordinance set up committees in each district, town, and village to oversee the eradication of pearl moths. The prefecture sent technicians, specialized personnel, and even policemen to make sure the ordinance was obeyed by local farmers. While the authorities did not rely on police forces to ensure compliance, the permanent organizations set up inside the prefectural Government to promote agricultural production were not adequate to the task, and it is said that on certain occasions, the forces of order had to be called in. But such actions were restricted to specific places and the repercussions were limited.

After 1908, there was a gradual shift away from police enforcement toward economic incentives as a means of ensuring agricultural progress. As a result of reforms enacted in 1908, police officials withdrew from the eradication committees and special full-time inspectors took their place to provide leadership for and supervision over committee members throughout the prefecture. At the same time, pest eradication associations were set up in each town, village, and hamlet, and special incentives were awarded to members who distinguished themselves in

destroying pearl moths. Then, in 1911, each local jurisdiction was divided into smaller agricultural zones, and an agricultural specialist was assigned to each zone to provide guidance in general matters pertaining to agriculture. Again in 1915 and 1917, these zones were sub-divided and the number of experts increased. This time the specialists assigned to each zone were sent by the county. In those towns and villages where county specialists were absent, village agricultural technicians were encouraged to take their place, the money being paid out of the county administration's budget.

In this way, a system for the promotion of agriculture was established at the prefectural, county, and village level and full-time specialists were dispatched to each local administrative unit where they maintained direct ties with the farm population. The following chart of organization for the Saga district Government (1915)<sup>21</sup> shows the importance accorded to agricultural promotion activities.



The district administration's budget in 1914 was 17,650 yen, of which 11,457 yen, or 64.9 per cent was earmarked for the agricultural promotion fund. The annual expenditure for the 23 villages comprising the Saga district amounted to 306,000 yen of which 33.2 per cent went for education, 17.3 per cent for building and construction work, and a mere 0.3 per cent for promotion efforts. The brunt of agricultural promotion, then, was borne by the county administration office rather

than the village. The county chief in 1914 was also an officer of the local irrigation association, and the secretary of the association was the county's agricultural specialist.

Between late Meiji and Taisho, the agricultural promotion association attached to the county office received subsidies from both the prefecture and the central Government and quickly became an effective organization. The association and its activities moved away from "coercive police controls" to incentives which stimulated the economic self-interest of direct producers, a transition worthy of note. Electric irrigation projects, too, were carried out within this institutional framework. As mentioned above, Hayata Tatsuji was manager of the Oide Irrigation Association,<sup>22</sup> which initiated the first irrigation project in his region, and also the county chief of Saga. The consolidation of these associations by the prefectural and district authorities, and the irrigation projects that were carried out with their co-operation, are worth comparing with the large-scale land readjustment projects implemented by landlords in Yamagata and other prefectures during Meiji.

#### Agricultural Experimental Stations and Technical Diffusion<sup>23</sup>

The National Agricultural Experimental Station was established in 1893, and the following year, provisions were made to set up similar stations in each prefecture. The Saga Prefectural Agricultural Experimental Station was created somewhat later, in 1900. However, considering that the Saga station was only seven years behind the national station, its establishment was quite rapid when compared with other stations then being created across the country. In Fukuoka Prefecture, an experimental station for the promotion of industry and an agricultural school were created in 1879 with a staff of five, four prefectural employees and one hired worker. In 1887, Yokoi Jikei was appointed head of the Fukuoka station. At that time, a total of 11 employees were assigned to the project, eight prefectural employees and three workers. In 1895, the station changed its name to the Fukuoka Agricultural Experimental Station. In Saga Prefecture, too, an agricultural experimental station was set up at an early date (1894), and Kusubara

Shozo, a graduate of the Komaba Agricultural College in Tokyo, became its chief.

The Saga prefectural station had five prefectural employees in its service at the time of its founding. The greatest problem facing them was the eradication of the pearl moth, the biggest obstacle to improved rice farming. They immediately set about selecting out new strains of rice capable of resisting this pest. In 1895, a special laboratory was created to study fungi and insects, and research was begun on pearl moths reproducing two and three times a year. A study to determine the number of moths killed by luring them to fire, conducted after 1912, verified experimentally that moths reproducing three times per year first hatched on or about June 20. This discovery proved to be instrumental in hastening the installation of electric irrigation facilities and in unifying the planting seasons.

The experimental stations and agricultural schools were responsible for training the large numbers of technical assistants sent to staff the agricultural zones set up by local authorities after 1907. After 1910, the experimental station trained agricultural technicians and then assigned them to district, town, and village extension offices. Graduates of superior agricultural colleges who so desired were accepted for a year's practical training. In Saga Prefecture, the only agricultural school was established in 1895, becoming a superior agricultural college in 1898, but in the nine years between 1910 and 1918, it turned out a total of 38 agricultural specialists. After 1919, the school received state subsidies and set up a one-year training programme for agricultural students. After graduating as agricultural technicians, the students were obliged to work for the prefecture.

Agricultural experts familiar with western agronomy became active in Saga Prefecture in 1890, and a department for itinerant teachers was set up inside the prefectural government to which Kusubara Shozo, a graduate of the Komaba Agricultural College, was first assigned. In 1904, Nakamura Naoshi, also of Kamaba, was posted to this department. In 1905, Nakamura became principal of the just established Kani

Agricultural College and began training the first professional agricultural technicians. For the next fifteen years, until late Meiji, these technicians worked energetically inside the prefecture giving advice and guidance in agricultural matters. The group of agricultural technicians who received this training played an active role in installing electric irrigation facilities in the Saga Plain after Taisho.

#### The Activities of the Prefectural Agricultural Association

The agricultural organizations established by the prefectures after 1887 were in one sense true farmers' organizations, but at the same time, they existed outside of established administrative structures and were hierarchically organized, with landlords at the top. These associations made suggestions concerning farm policy and lobbied on behalf of their constituents while assuming responsibility for directing the diffusion of improved agricultural techniques among farmers. If instead of relying simply on uniform agricultural techniques recommended by the central authorities, the associations had tried to match these techniques to local conditions, this would have had a salutary effect on the progress of agricultural techniques in each region. This unfortunately was not the case.

The Saga Agricultural Association was set up in 1896, predating the Agricultural Association Law of 1899. A prefectural ordinance of February 1894 laid the preliminary groundwork for the association, and procedural rules for its establishment were decided in March 1895. It was recommended that the association combine the tasks of eradicating harmful insects, purchasing fertilizer collectively, providing for sideline activities, and collecting agricultural statistics with the activities traditionally engaged in by agricultural counselling organizations. Based on the procedural rules, each county set about making by-laws and preparing the establishment of district associations, for which permission was obtained from the prefecture. The counties each elected representatives, and in 1896, the prefectural association was formally created, with 27 members.

A national agricultural association was founded in 1899 under the Agricultural Association Law. The prefectural associations were placed under its control, and a national network of agricultural associations was thereby created. The associations financed their activities through a pro rata land tax levied on farmers, but the Government also granted them subventions, higher-level associations taking priority over lower-level associations, and lower-level associations shared in meeting organizational expenses, forwarding money to higher-level associations. Each prefecture also allocated a portion of its budget to the associations as subsidies, and as a result, in most instances, governors, county chiefs, and village heads also doubled as president of the agricultural association at each respective level. Although ostensibly a farmers' organization, in fact, the associations were bureaucratically structured.

However, after 1907, many local governments established organizations to promote agriculture, and agricultural experimental stations completed surveys of regional farm conditions. Local farm leaders increasingly came to replace local bureaucrats as heads of regional agricultural associations. In Saga Prefecture, Imaizumi Ryoshi, headman of Nishi-Kawaso village and former president of the Saga District Agricultural Association, was named president of the prefectural association in 1910.

In 1923, as president of the prefectural body, Imaizumi called for the unification of the rice transplanting season in order to completely eradicate the pearl moth. The following is his position on the question.

Encourage the Planting of Wheat together with a Policy  
of Eradicating the Pearl Moth

Imaizumi Ryoshi  
President of the Saga Prefectural  
Agricultural Association  
1 December 1912

The flat regions of this prefecture extend from the highest point around Saga district to Miyaki and Kanzaki in the East, Kojiro in the West, and the eastern part of Kishima, a total of five districts. From ancient times, pearl moth blight has been particularly severe in these regions, and each year, at least 10 per cent of the crop is damaged due to this pest. Every six

or seven years, the damage is very great, causing major crop losses from which large, medium, and small farmers all suffer. Many farmers in particular are ruined and quit agriculture, turning to other work. As is well known, farmers who have lived here all their lives leave home and go to work in the mines, taking their entire families with them, a most regrettable state of affairs. For this reason, when I was village headman, I proposed that the early transplanting of rice be completely abandoned and that transplanting take place only in the late season in order to put an end to this damage, but even though the entire village tried, the idea did not succeed. Although we intended to carry this plan through to completion, the time was not yet ripe, and more than 10 years have passed since then. However, every year, farmers increase their store of knowledge, and the public good is increasingly respected as a worthy goal. But although I hold out great hope, in fact, despite some progress, success seems to still be very far away.

This year, the weather seems to be very favourable for the breeding of pearl moths, and at the present time, officials and farmers are working together, devoting every effort to eradicating the moths, but judging from the fact that (in the past) despite such efforts, the cruel blight has occurred, it is necessary to take radical measures in order to reduce this pest, even though this might have some bad side effects and entail difficulties. The currently known measures include cutting rice stubble at the roots, gathering up moth eggs, pulling out rice stalks, and burning rice leaves. These have been tried by many farmers individually, which means that it is impossible to achieve full effectiveness and eradicate the moths, although some progress is made.

As mentioned earlier, planting twice is not an effective method; rather this helps the moths to breed. Unless we change this practice, farmers in the plains areas will continue to experience difficulties and suffer from the moths. But, on the other hand, trying to change everything all at once is no guarantee of success and appears doubtful, a very sorry state of affairs indeed. I therefore hope that with the understanding of the farmers concerned, we can gradually try and eliminate mid-season transplanting. I have heard that, fortunately, the farmers themselves are increasing the area under wheat this year. Now, by making a big effort in the flat regions of Saga, Kanzaki, and Kojiro districts and planting as many hectares as possible in wheat and other summer crops where late transplanted rice has been harvested, farmers can profit. If at the same time, more rice is transplanted late in the season, any losses resulting from late rather than mid-season transplanting will be offset, and no great disadvantage will be incurred. If this method is practiced little by little every year and the surface under late transplanted rice increased, what now seems difficult when thinking about it can be gradually realized.

I remember that around 1887 in the southern part of Saga district, about 60 per cent of the rice crop was planted in

mid-season and 40 per cent later, but today, the proportion is half and half. If 10 per cent of the half planted in mid-season rice is changed every year to late-season rice (in the case of large plots of land of one hectare, less than 0.5 ha. should be planted in mid-season rice and an additional 0.1 ha. changed to late-season rice each year), then after five years, an additional 50 per cent of this land will have been converted to late rice, and after 10 years, the process will be complete. As the proverb says, "Once decided, don't delay." Although it may be necessary to put up with some difficulties, I hope for the sake of the public good that this plan will be put into action without delay. Again, the proverb says, "Virtue is always rewarded." It may not be possible to do everything by next year, but I pray that a major effort will be made by everyone to achieve this goal.

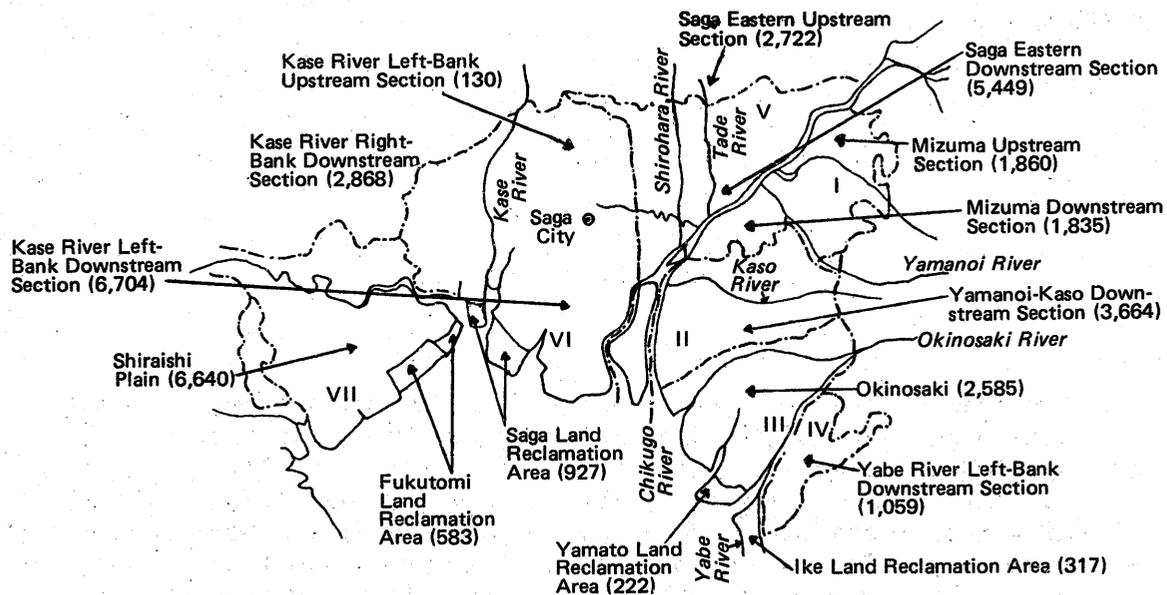
I am not the only one to share this wish. Technicians and those knowledgeable in agriculture have long desired to make this improvement. For details concerning the merits and demerits of this plan, the specialists should be consulted. If villages or hamlets wish to organize meetings about this problem, the prefectural agricultural association will send a representative to attend. If I have time, I will do my best to inform the public on this issue by explaining it at meetings and in the newspapers.

These local technicians supported by the activities of the agricultural associations installed electrified irrigation systems ten years later and succeeded in unifying the rice transplanting season in 1924.

## NOTES AND REFERENCES

1. The reason creek irrigation works were installed along the downstream sections of the Chikugo River is closely related to the special characteristics of the river itself. The Chikugo feeds into Ariake Bay. However, the difference between the rise and fall of tides in the bay is on the order to five to six metres. At high tide, the tide reaches up-river a distance of nearly 30 kilometres as far as Kurume. When the tide rises, the water is calm, but when it recedes, the surface of the water inclines toward the sea and the current becomes violent, biting into the banks of the river, gouging out parts of the riverbed. At the estuary, the water level drops five metres. The Chikugo River has a double character: It is a river, but it also forms the entrance or estuary to Ariake Bay. Because the riverbed is shallow downstream, for a long time it was not possible to take water directly out of this portion of the river, and irrigation water was normally drawn from the river's medium and small-sized tributaries. Moreover, because of the large difference in tides in Ariake Bay, natural silt deposits built up, creating new land which together with land reclamation projects has gradually extended paddyland further into the bay. As a result, water from the Chikugo's tributaries is no longer sufficient to irrigate the reclaimed part of the downstream Saga Plain. Creek irrigation is the best method of securing supplies of scarce water during the rice season.

However, not all necessary water could be obtained from small and medium streams, and even in areas where creek irrigation was the rule the methods of securing adequate supplies of river water varied greatly. Because irrigation water is in short supply in this region, smaller sub-regional divisions are responsible for irrigation. Water-use rights and customs in these sub-regions are very strict, and some of the sub-divisions would provide an interesting object of inquiry for a study dealing with water and society. The figure below depicts the irrigation network of small and medium streams in the lower reaches of the Chikugo alluvial plain. The irrigation networks for the Rokkaku, Kihara, Tade, Yamanoi, Hanamune, and Okinohata rivers are all different, as are the organization of the irrigation associations and their methods of allocating and managing scarce water resources.



Creek Region of the Lower Chikugo River

Source: Ishimaru Harusumi, Problems of Irrigating in the Creek Region.

Notes: (a) The sub-divisions inside the creek zone were determined according to the water sources and small and medium-sized streams in the area. (b) Figures inside parentheses indicate the number of hectares belonging to each section and area. (c) This region lies between Saga and Fukuoka prefectures. Fukuoka includes three cities, seven towns, and 15,000 ha.; Saga has one city, 17 towns, one village, and 27,000 ha.

2. Kyushu Agricultural Experimental Station, An Analysis of the Ecology of the Creek Irrigation Region, 1977.
3. The water wheel used to draw irrigation water from creeks and streams is said to have been developed by one Iguchi Man'emom (1743-1810) who lived in Nakamura (present-day Oki-machi) in Mizuma, Kurume fief. Before this invention, a barrel with a rope fastened to it was used to pump water into the fields. Four people working all day could only irrigate 0.4 ha. using this method, whereas with a two-man foot-operated water wheel, 1.6 ha. could be irrigated. The water wheel was therefore a major labour-saving breakthrough.
4. Yamada Tatsuo and Ota Ryuichi, A History of Saga Agriculture, 1967, chapters 8 and 9.
5. Ide Isei, A History of Coal Mining in Saga.
6. Isobe Toshihiko, "The Formation of the So-Called Saga Stage," A History of Agricultural Productivity in the Major Farm Regions, vol. 2, 1968.

7. Namiki Masakichi, "Agriculture in the Mizuma Rice Region," in The Agriculture of Fukuoka Prefecture, 1954.
8. Fukuda Minoru and Hosokawa Hiromi, "The Development of Farm Mechanization in Southern Okayama Prefecture," in A History of Agricultural Productivity in the Major Farm Regions, vol. 2, 1959.
9. Kyushu Agricultural Bureau, "Agricultural Water-Use Along the Chikugo River."
10. Ota Ryoichiro, "The Development of Agriculture in Fukuoka Prefecture and Its Regional Analysis," in A History of Agricultural Productivity in the Major Farm Regions, vol. 2, 1959.
11. Details concerning the installation of an electrified irrigation system in northern Mizuma county may be found in the published proceedings of the Mizuma Land Improvement Cooperative Association.
12. "A History of Saga City," vol. 4, 1980.
13. In the creek zone of southern Mizuma, a land improvement association was formed and irrigation electrified, but this project was related to the question of farm tenancy, the gravest problem then facing farm villages:

The area serviced by the irrigation association is geographically flat with few steep gradients, and there are scarcely any water resources for cultivated land. At present, we must store water in canals and irrigate using foot-operated water wheels. When dry weather persists for awhile, we require a series of water wheels, and the effect is similar to a drought. But after electrifying, our worries disappeared. Mechanization also helped ensure steady yields, made it easier to fertilize and kill weeds, and facilitated the eradication of harmful insects. As a result, mechanization increased the harvest and improved the quality of crops, providing substantial benefits. Local farmers used to old practices accepted damage caused by occasional drought as unavoidable and did not try to improve the situation. They were not accustomed to economic farm management techniques. However, M. was aware of the fact that mechanizing agriculture is the only way to save labour and rationalize farm management. In 1922, there was a drought accompanied by insect damage. At the same time, because of (the world political) situation, there was a major change in the way farmers thought, and in many regions, tenant problems appeared.

When M. saw this regrettable situation, he was worried and urged the authorities to persuade local gentry to intervene and save farm villages from the difficulties besetting them. Aware that the most urgent need was to abolish traditional foot-operated water wheels, extend power lines to farmland, and install small-scale motorized pumps, he organized (an irrigation project) covering ten villages and more than 3,000 ha. in southern Mizuma district. Construction was begun in

1923 and finished in May 1925. As a result of this achievement, 416 motors with a total of 588 horsepower units were installed and 2,718 ha. were mechanized. Construction costs amounted to 714,347 yen. As a result of the project, in one year 247,400 yen worth of labour was economized, and an additional 81,560 yen were saved by not using foot-operated water wheels. It is said that in all the total savings due to mechanization of irrigation facilities came to 328,700 yen. [Author's emphasis.]

14. Society for the Promotion of Elementary-School Education, Mizuma, Fukuoka Prefecture, A Local History of Mizuma District, New Research, 1953.
15. The Centennial Economic History of Saga Prefecture, 1960.
16. A History of Saga City, vol. 3, 1980.
17. A History of Saga City, vol. 4, 1980.
18. Yamada Tatsuo, Research in the History of Agriculture in Kyushu, 1978.
19. Isobe Toshihiko, op. cit.
20. Kamagata Kaoru, The Development of Agriculture in Saga — A History of Agricultural Policy in Saga Prefecture, 1950.
21. Saga District Education Association, A Local History of Saga District, 1915. With the reorganization of local government in 1899, the office of village headman was formally established, a parliament set up, and representatives appointed, but it is not clear what kind of offices were established at the village level. In the case of Taku Village in Saga Prefecture, in 1921, the following village offices were created: village mayor and deputy mayor; civil engineering committee (two persons); education committee (four persons); section (hamlet) chiefs (11 persons); and deputy section chiefs (11 persons). These were all voluntary positions. Paid officials included three secretaries and two assistants. (A History of Taku, 1964.)
22. In Saga district, the Irrigation Association Ordinance of 1890 followed by a prefectural ordinance of 1891 laid down the procedural rules for establishing ordinary irrigation associations. As early as 1892, the Kawaso Water Pipe Irrigation Association and the Oide Irrigation Association were founded. These were followed in 1894 by the Yoko-ochi Aqueduct Ordinary Irrigation Association and the Honjo and two other village associations. Irrigation associations were organized throughout the district at this time. The district chief of Saga was responsible for the management of all of these associations which were placed under his authority. Only the Hattae Irrigation Association was outside his jurisdiction, and its head was the mayor of Higashiyoka Village.

Water management in the creek region of Saga Prefecture was handled by ordinary irrigation associations set up under the Irrigation Association Ordinance. In the creek region of Fukuoka Prefecture, however, village associations were set up based on the 1899 reform of local government which allowed cities, towns, and villages to assume responsibility directly for the management of water resources.

Looking at the organization of the Oide Irrigation Association, the largest in Saga Prefecture, one finds that the area of its jurisdiction was divided into 17 zones, each of which elected one representative (with the exception of Saga City which elected four) to serve on the committee governing the association. Out of 20 members, 10 were elected as permanent representatives. Expenses were paid out of project receipts and from taxes levied within the association's area of jurisdiction and based on land values.

23. See The Centenary History of the Fukuoka Prefectural Agricultural Experimental Station, 1979, and The Fiftieth Anniversary of the Saga Prefectural Agricultural Experimental Station, 1954.