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TRANSPLANTATION OF THE EUROPEAN FACTORY SYSTEM AND ADAPTATIONS IN JAPAN: THE EXPERIENCE OF THE TOMIOKA MODEL FILATURE*

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I. *The Significance of a Government Model Factory: Our Problem*

In October of 1872, the first real steam filature in Japan began to mass-produce high quality raw silk in Tomioka, Gumma Prefecture.[1] The Tomioka Model Filature was a government-controlled training factory, which was substantially constructed and managed by French experts. This large-scale steam filature was truly epoch-making in its technology and production organization, particularly when we contrast it with the traditional raw silk production (*Zaguri*) system prevailing in those days.

The Tomioka Model Filature was designed in 1870 by the Government for the purpose of improving the poor quality of Japanese raw silk which was the most important export good in the early Meiji period. In constructing this factory, all machinery and steam engines were imported from France, and every other arrangement for construction as well, such as the selection of the site, the layout, the procurement of materials, etc. was promoted under the direction of a French head-adviser, Paul Brunat, and his associates.

Although they faced a difficult task in producing Western construction materials (e.g. bricks, cement, etc.) with indigenous techniques and raw materials, the factory was finally completed in July of 1872. Yet the more important thing to be noted in the process of this construction is the fact that the Government often encountered problems due to the anti-alienism of the masses who proved uncooperative, for instance, in providing quarters for P. Brunat, in the supplying of timber, etc.

This was quite understandable, since, under the long seclusion policy of the Tokugawa period, foreign culture and technology had been considered evil and prohibited from access. It was only a few years earlier that the new Meiji Government adopted the open-door policy and began to keenly promote industrialization by actively introducing Western culture and technology. The anti-alienism, hence, was still deeply ingrained in the masses during the early Meiji. In fact the Government had to face an even more serious difficulty immediately prior to the completion of the factory construction.

That is, the Tomioka Model Filature started recruitment of silk reeling hands in March

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[1] Gumma was then called Kumagaya Prefecture. Up to around 1890, prefecture boundaries and names were often altered in Meiji Japan. As a principle, the current name and partition of prefectures are used in this paper.

of 1872,[2] but the number of applicants was unexpectedly small. The Government sent official notes urging further applications to various prefectures, and the local governors repeatedly requested village-headmen to send skilled young girls to the Tomioka Model Filature. Despite these strenuous efforts of the Government, the Filature had to be opened with an under-utilization of the reeling machines in October. This was an inevitable result of the anti-alienism and prejudices prevailing among the people.

The public in those days was utterly ignorant of Western culture, and had strong prejudices against it. For instance, a well-known "blood-wine" rumor, it is said, played a decisive role in preventing young girls from applying to the Tomioka Model Filature.[3] It is also recorded that other similar misunderstandings and ignorance of modern technology greatly encouraged people's reluctance to work there. What is more, the migration of young girls from various prefectures to Tomioka was totally beyond most imaginations, since labor migration had been prohibited for a long time under the Tokugawa Rule, and the transportation system was then quite underdeveloped.

Thus the first full-scale transfer of Western steam filature technology had various difficulties in its economic and social receptiveness and adaptations, such as unfamiliarity with labor migration, loose work discipline, different holiday customs, public prejudice and ignorance of foreign people and technology, etc. It is the main purpose of this paper to confirm the unique Japanese overcoming ways and adaptations observed in transplanting the factory system from Europe through a case study of the Tomioka Model Filature.

II. *The Tomioka Model Filature as the First Factory in the Silk Reeling Industry*

French System of Technology and Management

As has already been mentioned, the buildings and the layout of the Tomioka Model Filature were, as much as possible, constructed after the Western style. Rather, it could be said that the Filature tried to faithfully realize a typical French filature of the largest size. Technology, too, was typically French, although the Italian system was, at the time, fairly widespread in France. For instance, the croisure was of the orthodox French Chambon system, not the tavelette system, often known as Tavelette Consono or Dubiné Tavelette, which was more popular in Europe in those days. The reeling system used was a combined type of cocoon-cooking and reeling by one attendant, not the typical Italian separate system of using cocoon-beating assistants.

[2] In Japan too, like European countries, reeling hands in the sericulture industry were without exception female laborers. The Tomioka Filature as a training factory for the Western production method aimed basically to reeducate young girls who had experience in indigenous technology.

[3] The people had believed for a while that the wine drunk by French experts was human blood. Hence, sending their daughters to the Filature meant offering immolations. The Government seriously denied this false rumor in an official note [Kannōryō, "Yukoku-sho," May, 1872: See the editor's note of Ei Wada (1976), p. 111.]. In the case of the Maebashi Filature as well, some naive criticisms about employing a foreign adviser are reported. They are said to have often originated from antipathy towards foreigners' religion and eating habits.

Although such differences in French and Italian technologies are apt to be over-emphasized, the real differences between them were quite minor when compared with differences between the European and the indigenous Japanese technologies. In other words, what was most significant in this transfer was a transplant of a completely new Western production system, i.e. the factory system, under the management of French experts. In considering the new technological system typically observable in the first several years of the Tomioka Model Filature,[4] this comparative viewpoint should be always borne in our mind.

The steam-driven filature equipped with 300 reeling basins was incredibly large and magnificent from the standard of the traditional production system. Its iron-made machines enjoyed as a matter of course much higher productivity, viz. about twice of the traditional *Zaguri* apparatus. Specifically speaking, a skilled reeling hand produced per day 150–170 g of 12^D raw silk from one basin with the 2-ends Chambon croisure, although this amount was nearly a half of the productivity in Europe where 4–5 ends were normally attended by one hand. It is also to be noted that some adapted techniques, such as the Italian hot-air pupa killing method, the indigenous re-reeling system, etc., had already been introduced from the initial stage.[5]

The Western production system and technology at the Tomioka Filature were conducted rigorously, particularly for the first several years, under the management of French supervisory staff. That is to say, 11 French experts, viz. 2 foremen, 3 assistants, 4 female reeling supervisors, 1 machinists and 1 doctor, were working under the head advisor P. Brunat and the Japanese director A. Odaka.[6] Most of them were said to be competent enough to deserve a very high salary and eagerly tried to transfer the Western systematic techniques to the young Japanese girls.[7]

The marketing policy of the Tomioka Filature was also similar to the policy broadly adopted in France. In other words, cocoons were strictly selected after machine-drying, and fine raw silk of high quality was carefully produced at the cost of reeling efficiency. Although this "quality-first" principle as well resulted in a high proportion of waste silk particularly in the case of poor Japanese cocoons, Tomioka raw silk obtained a high evaluation as early as 1873 at the Wien International Exposition. It, hence, was of great significance for future

[4] P. Brunat was employed as a head adviser by the Japanese Government for five years from Jan. 1871 to Dec. 1875. Hence, the period up to 1876 is to be considered as a period of the most pure French-type management. After Brunat's leaving, gradual adaptations to Japanese market conditions started in various aspects of the Tomioka Model Filature.

[5] In a humid country like Japan, these two were much more appropriate than the steam killing method and the direct reeling system, respectively. The Ettouffoir (a steam pupa killing machine) in the original plan was replaced by the Séchoirs (a dry-air machine) in its subsequent stage of installment. P. Brunat was said to have been flexible enough to introduce any necessary appropriate technology. See P. Brunat, "Mikomi-Sho," in *Tomioka seishijō-shi*, pp. 147–150.

[6] Seven of these supervisors, i.e. 2 foremen; J. Bellen and P. Prat, 1 machinist; Rescoe (?) and 4 female reeling hands; C. Vielfaure, L. Monier, A. Vallent, M. Charay, came to Japan with P. Brunat in Feb. 1872, when he temporarily returned to France for the purpose of purchasing various machines and steam engines for the Tomioka Model Filature. They stayed for a year and a half to two years. Others and also their replacements were recruited in Japan.

[7] For instance, P. Brunat's salary of $600 a month was equal to that of Government ministers, whereas the salary of, say, a reeling superintendent Clorinder Vielfaure, $80 a month, was about 50 times that of the standard reeling hand's. It is a matter of course that they were furthermore provided full passages out and home (1st or 2nd class), free quarters and board-allowance ($56–150 a month). In discharging two foremen, P. Brunat had some trouble with them. See *Tomioka seishijō-shi*, pp. 197–213.

demand in Europe to have wiped out at this early stage the previous image of Japanese raw silk of notoriously poor quality.

The First Steam-power Factory in the Silk Reeling Industry

Prior to the establishment of the Tomioka Model Filature, there already existed a few Western-style filatures. Yet they were all of the typical Italian traditional production system, i.e. the so-called "domestic filature." More specifically, those filatures had no steam-power arrangement, and instead wooden machines were turned by hand-power or a turner. Basins for cooking and reeling were all heated by a wood-fire furnace underneath. The croisure and the reeling system were respectively the typical Italian 3-ends tavelette and the direct winding-up method. For the cocoon-cooking as well, the standard Italian system, one cocoon beater serving for each two reelers, was adopted there.

The Maebashi Filature with 6 basins and the Tsukiji Filature with 60 basins were typical examples of such technological transplants of the Italian traditional system. Despite the fact that there already existed a great number of modern steam filatures in Italy at the time, these domestic filatures were constructed from the viewpoint of cheaper and easier transfers of Western technology, under the guidance of a Swiss, C. Müller, in 1870 and 1871 respectively. Even if its technology was rather primitive, the filature system itself was much more productive and efficient than the traditional putting-out *Zaguri* system by hand-reeling.

However, compared with these experiences, it is easy to see how the Tomioka Model Filature was a full-scale transfer of the modern factory system in various respects, such as the filature size, motive power, the managerial and supervisory system, machinery equipments and welfare facilities. On the other hand, even when compared with other factories of different industries in those days, the Tomioka Filature was still one of the earliest real factories in Japan. Almost no other factory could stand comparison with it, except for several arsenals and ironworks. It was not until around 1890 that the full-scale factory system was established even in the cotton spinning industry. In other words, the Tomioka Filature can be regarded as a first specimen of the factory system in the industrialization process of Japan.

Furthermore, French staff of the Tomioka Filature introduced an idealized Western factory management system to Japan. For instance, working hours were only 8 hours a day, and the workers had no night shift.[8] Every Sunday was a holiday, despite the "week" concept being totally unfamiliar to Japanese society. The wage was a kind of efficiency wage combining time and piece rates, whereas rewards and penalties in the wage system were lenient. Meals in the mess and housing conditions in the dormitory were far better than in the average rural life in Japan of the day. Even a medical office with a French doctor was set up in the factory.

These conditions were too idealistic for the pre-industrial society of Japan. Accordingly, the financial situations of the Tomioka Filature had, as a natural course of events, shown successive losses. Various modifications were thus required in subsequent years. In the next section, we should like to discuss these adaptations of transferred filature technology in the more general context. That is, the modified filature system realized in the silk-reeling

[8] The Tomioka Model Filature is said to have copied one of the best French filatures in regards to its facilities and management. General conditions, hence, might be superior to those of the average filature in Europe, as is shown in Table 1.

industry as a whole will be examined for the period of the first decade of the century when the Japanese raw silk industry established substantial competitive power in the international market.[9]

III. *Economic Adaptations in the Silk Reeling Industry*

Technological and Marketing Adaptations

After the turn of the century, the Japanese silk-reeling industry gradually deprived China of its hegemony in the world raw-silk export market. The establishment of this highly competitive power is to be considered mainly due to drastic adaptations of the imported Western production system and technology. Although similar European technology was transferred to China as well, the adaptations of it were rather exceptional.[10] In sharp contrast to this, modern French and traditional Italian techniques were mixed together, and the intermediate production system of the Western filature and the indigenous *Zaguri* systems was brought forth in Japan.

It was of great significance for entrepreneurial reelers to produce cheaper filatures with appropriate technology. For the Tomioka system, which was copied from the most modern French filature, was too expensive and sophisticated for the Japanese raw-silk production market. Thus various modifications in technology, marketing policy and the institution were introduced to the industry particularly after 1900. Of all things, the fact that the quality of Japanese cocoons were much inferior to those of Europe was the starting point of adaptations in technology and the marketing policy.

For instance, it was realized that it was not an efficient policy to produce 12^D raw-silk from Japanese cocoons. As had already been pointed out, the production of fine sizes from poor cocoons is accompanied by a high proportion of waste silk. The main product in the Japanese silk-reeling industry, therefore, was rapidly shifted to a thicker size raw-wilk, e.g. 14^D, 17^D or 21^D. These products were welcomed in particular in the U.S. market where Japanese re-reeled raw silk was in demand mostly for the weft of power looms. In subsequent years four-fifths of Japanese raw-silk exports were consumed in the U.S. market because of the low price for its level of quality.

In the process of this shift in main products, other related adaptations were also discernible. The Chambon croisure system was appropriate for the production of quality raw silk in fine sizes, whereas its reeling efficiency per worker was much less than that of the tavelette system. Hence, despite the initial popularity of the former, the latter came to account for 80 per cent of all croisures in Japan by 1905.[11] A switchover from the quality-first to the quantity-first principle immediately encounted a serious problem, namely the insufficient supply of cocoons. Yet this difficulty was gradually solved in the first decade of the century by the rapid development of bi-voltine silkworm varieties and their summer-

[9] This implicitly includes also the adaptations in the Tomioka Filature which came to take, after the French staff's departure, almost the same pattern as other filatures in the private sector. This tendency was still further accelerated by the selling of the Tomioka Filature (from the Government) to the Mitsui Co. in 1893.

[10] See, for example, Y. Kiyokawa (1975b).

[11] I. Honda, *et al.* (1935), p. 356.

autumn rearings.

Although the production of high-quality raw-silk sharply declined, this did not result in a disregard for the quality control of products. Rather special attention was paid more to the standardization problem of export raw-silk in order to remove the notorious estimation on the irregularity of Japanese raw-silk. Consequently, the national conditioning house was founded in Yokohama and Kōbe in 1896. Other improvements based on the users' demand, such as the re-reeling system, the bundling style, etc. were swiftly introduced as well. Furthermore, with the aid of the Government, the industry steadily promoted the standardization movement of cocoon varieties to produce more homogeneous raw-silk. All these efforts were said to be quite effective in obtaining the competitive power over Chinese raw-silk in the U.S. market.[12]

Institutional Adaptations

The above-mentioned adaptations were reinforced with institutional modifications of the Western factory system by a specific Japanese management. In other words, the Tomioka system was replaced by the production-first principle at the cost of working conditions, more specifically, under the management of strengthening work-intensity. The production-first principle was on the other hand the tail of the coin, viz. the cheap-filature principle.

Most Japanese filatures in subsequent years were of a smaller size than the Tomioka Model Filature. Their wooden buildings were humble in comparison with Tomioka's buildings. The great majority of them installed home-manufactured wooden machines and operated them not by steam but by water power, although the basins for cocoon-cooking and reeling were heated by steam. That is, the sophisticated system of Western filatures retrogressed in Japan to the simple-structured filature with water power in its diffusing process. Nevertheless such a plant still enjoyed much higher productivity than the traditional *Zaguri* system.

Among various modifications of the Western factory system, the most specific Japanese change is to be found in its labor management. Long working hours, e.g. 13–14 hours, prevailed in most filatures. Although there hardly existed night shifts, one holiday or none per month was not uncommon in the busy season. Almost all workers stayed in humble dormitories where they were offered poor meals and extremely bad housing conditions.[13] The dormitory system was indispensable for the Japanese silk-reeling industry, since most filatures had to recruit unskilled young girls from far distant rural areas. What is more, the dormitory system was quite effective in forcibly deriving a low absentee rate, which was demanded to offset the extremely high turnover rate peculiar to this industry.

In other words, the majority of young girls came to the filature as unexperienced workers, notwithstanding they were, in the case of Japan, normally regarded as so-called disciplined labor with some education. Hence, whether they could realize high labor productivity was dependent decisively upon the labor management system. More specifically, the high pro-

[12] But standardization efforts appeared to still be unsatisfactory from the viewpoint of American buyers. See L. Duran (1921), pp. 119–35.

[13] Whether their meals were inferior to those in their home-villages or not is a controversial problem in the Japanese economic history. I am inclined to consider them still slightly better or almost equal, although they were terribly coarse. See S. Yamamoto (1968) and also S. Yamamoto (1980).

TABLE 1. STYLIZED JAPANESE MODIFICATIONS OF THE EUROPEAN FILATURE SYSTEM

		Standard Japanese Filatures[a)]	Tomioka Model Filature	Standard European Filatures[b)]
1	Average filature size	50–100 basins	300 basins	50–150 basins
2	Filature buildings	simple wooden	typical French	massive brick
3	Motive power	water	steam	mostly steam
4	Machinery material	wood	iron & steel	iron & steel
5	Croisure system	mostly tavelette with 2–3 ends	Chambon with 2 ends	mostly tavelette with 4–5 ends
6	Raw-silk size	14, 17, 21 D	12 D	10–12 D
7	Dormitory system	mostly	complete	partly, many commuters
8	Age of workers	15–20 yrs old	15–20 yrs old	15–20 yrs old
9	Employment contract	1–3 years	3 years	1 year
10	Operating days	230–280 days	280–290 days	240–260 days
11	Holidays	2 days a month	Sunday	Sunday
12	Working hours	13–14 hours	8–9 hours	11–12 hours
13	Wage system	strict piece rate	time & piece rates	mostly time rate
14	Reward & penalty	very strict	loose	very loose
15	Supervisory system	strict	typical French	reasonable
16	Night works	none except for the busy season	none	not rare in the busy season

Source: See the reference of pp. 37–39. The above also based upon various other information.
Notes: a) Average filatures in the 1st decade of the 20c.
b) Average filatures in the 2nd half of the 19c.

ductivity and intensification of labor in the Japanese silk-reeling industry were derived as a result of the strict wage-incentive system and the very specific Japanese method of overseeing workers.

Most filatures formally adopted the combined wage system of piece rates and skill-wise time rates.[14] Yet in actuality, the proportion of itemized piece rates with high penalty charges absolutely overwhelmed the latter. Every worker was encouraged to compete with each other for exceeding the average efficiency of the factory as a whole, since her piece rate wage was paid in proportion to deviates from the average. On the other hand, the strict overseeing by male superintendents was shared as well by skilled female hands with high seniority under the gang production system. And each gang (usually composed of 20–50 workers) often had to compete with each other in the production race under the direction and guidance of each leader.

These various adaptations widely observable in the Japanese silk-reeling industry in the first decade of the century are summarized in stylized form in Table 1. The above modifications, however, are to be considered as adaptations in the narrow sense, viz. purely economic adaptations from the managerial viewpoint. Finally we should like to touch upon the social adjustments to this transplant of the Western factory system from a little broader perspective.

[14] This time rate in effect meant the daily wage. In the case of the Tomioka Filature, a worker's skill was classified into 3 (later 7) classes. In subsequent years the finer (e.g. 12 or 15) classes became more popular.

IV. *Implications to Social Adjustments*

Rapid Diffusion of the New System

As is previously mentioned, the direct purpose of the Tomioka Model Filature was to train experienced reeling hands with the new European filature system. Although the original plan was to constantly employ 460 workers as a continuous stream of trainees for the 300 reeling basins and other sections, the Filature continually suffered from a shortage of workers, despite its offering favorable working and welfare conditions, a travel-allowance, etc. This was considered to be due to the following two reasons: (1) people's prejudice and ignorance of Western culture and technology, as is symbolically indicated by the "blood-wine" rumor; and (2) social resistance to young girls' migration under the traditional value system and the locally divided labor market situations.

These difficulties, however, were steadily removed up to the end of the previous century by strenuous efforts of the Government and many entrepreneurs in the industry. In order to promote rapid industrialization, the Meiji Government took on powerful enlightment policies to remove the prejudice against Western culture and technology by consolidating the educational system and providing a great number of industrial exhibitions and sample fairs.[15] As well, entrepreneurs in various localities established the specific Japanese dormitory and recruiting systems to supplement the underdevelopment of the labor market.[16] All of these can be considered to have been quite effective in forming a domestically integrated labor market.

Consequently, more than 1,500 filatures with water or steam power were constructed by 1895, according to the first filature survey of the Government. This is to be regarded as an extraordinarily rapid diffusion of the filature system, considering the firm prevalence of the previous *Zaguri* system, or similar experiences in other countries. We, hence, should like to statistically confirm the impact of the Tomioka Model Filature upon this diffusion.

Fig. 1 provides us with the prefecture-wise information on which prefectures: (1) dispatched trainees to the Tomioka [T];[17] (2) had a direct technological influence from Tomioka Filature [0]; and (3) had any large scale (more than 100 basins) filatures in 1895 [F]. A sign test (under the binomial distribution) for matching of the trainee-dispatch and the direct technological influence reveals no positive relationship between them (26 vs. 21), whereas the correspondence between the trainee-dispatch and the existence of large-scale filatures is highly statistically significant (at a 1% level; 35 vs. 12).

In other words, dispatching trainees to the Tomioka Filature did not necessarily imply

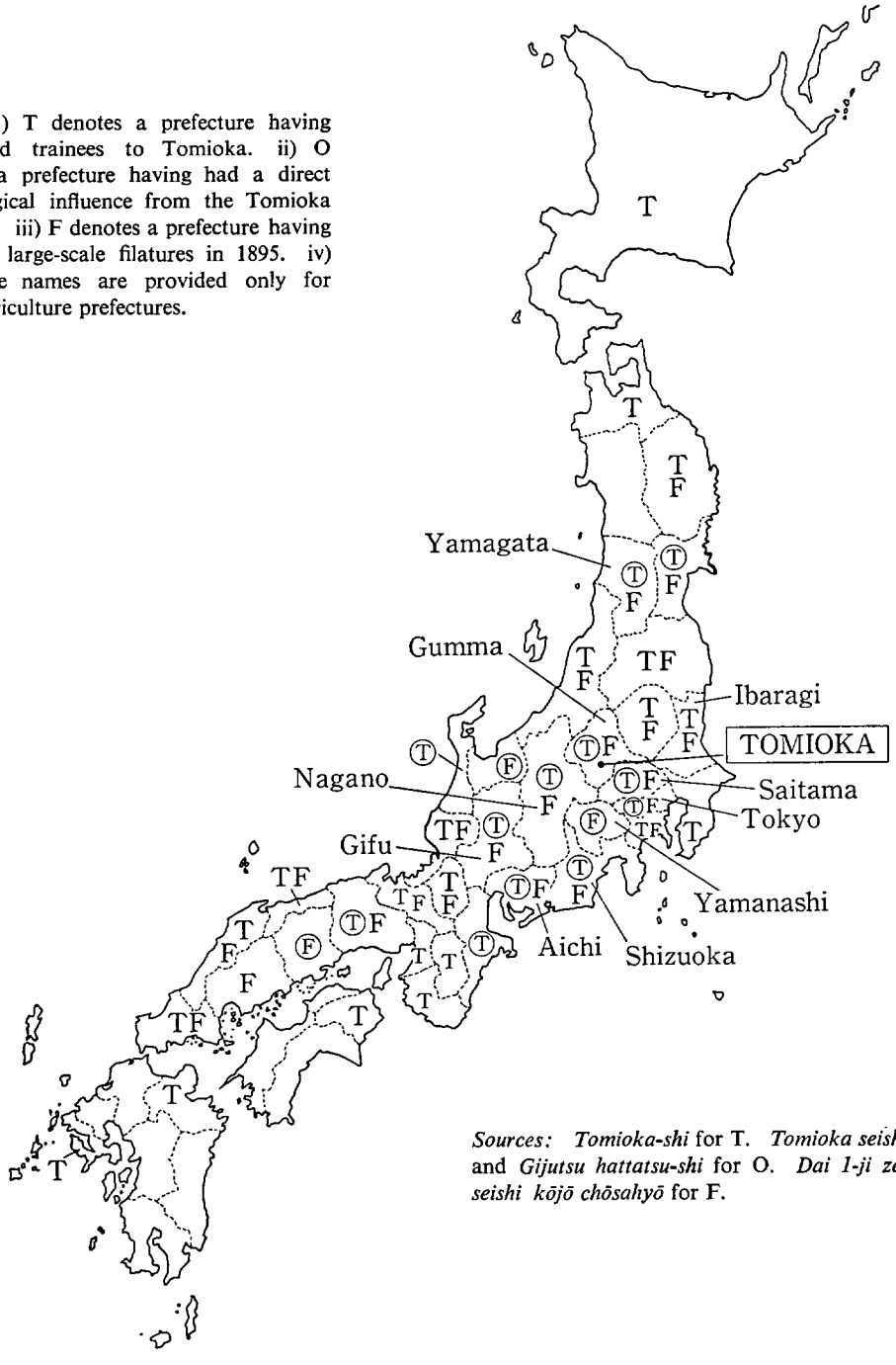
[15] Prejudices against Western civilization were rather easily remedied in a decade or so, and conversely any thing Western was enthusiastically welcomed by the public. For instance, the first winery in Japan was set up in Yamanashi Pref. only a few years after the "blood-wine" rumor.

[16] These systems were efficient in a sense, whereas they were also notorious because of their abuse and exploitation of workers.

[17] The muster rolls of workers in the Tomioka Filature are available for the years 1873 to 1884 except for 1874, 1875, 1877 and 1880. That is, our information on the prefectures having dispatched trainees is not perfect, but we conjecture from other evidences that most of those prefectures are covered. For detail, see *Tomioka-shi*, pp. 750–52, and T. Takase (1979).

FIG. 1. THE TOMIOKA MODEL FILATURE AND THE DIFFUSION OF THE FILATURE SYSTEM

Notes: i) T denotes a prefecture having dispatched trainees to Tomioka. ii) O denotes a prefecture having had a direct technological influence from the Tomioka Filature. iii) F denotes a prefecture having had any large-scale filatures in 1895. iv) Prefecture names are provided only for major sericulture prefectures.



Sources: *Tomioka-shi* for T. *Tomioka seishijō-shi* and *Gijutsu hattatsu-shi* for O. *Dai 1-ji zenkoku seishi kōjō chōsahyō* for F.

the adoption of French filature technology. However, it definitely did have a great influence on introducing the Western filature system, apart from the French or Italian type of technology. The technological difference between them was, as already confirmed, not crucial, but what is of greatest importance was the transplant of a new production system, i.e. the Western factory system, into the indigenous silk-reeling industry. The Tomioka Model Filature directly contributed a great deal in this sense to diffusing the knowledge of the new filature system. On the other hand, the rapid diffusion of the system was indirectly supported by the swift social adjustments due to active entrepreneurship and the flexible social value system.

Gradual Changes in Social Institution

The Tomioka Model Filature is well known as the first factory to have adopted the rigorous "Sunday-holiday" system which was completely unknown to the Japanese society.[18] The public in those days lived a daily life according to the lunar calendar. Although the solar calendar system was officially adopted from 1873 (Gregorian, from 1898) in Japan, the great majority of the people in rural areas was utterly unconcerned about it. It was, though not necessarily correct, believed then that the lunar calendar which was closely connected with seasonal activities in argiculture was much more practical and convenient for them. Only a quite limited number of people in and around foreign concessions in large cities could correctly understand the concepts of the week and Sunday based upon Christianity.

Expressing in a different way, artisans and workers of those days were ill fitted for regular attendance and systematic work under time control. As most of the people were not accustomed to the regular holiday and had never even seen a clock, a high absentee rate, frequent loitering and tardiness, etc. were said to be quite common in the earliest factories. Yet the discipline of factory workers was rather easily built up through the strict labor management system peculiar to Japan, whereas the Sunday system as a weekly holiday took a long time to infiltrate into the Japanese society since the system had no sufficient base in this non-Christian society.

In 1876, the Government finally and rigorously introduced the Sunday system into public schools and government offices.[19] However, its diffusion to factories in the private sector was extremely slow because of their production-first principle. Most of managers in those days regarded holidays merely as operating losses, and hence factory holidays were usually limited to, at most, two days a month. For instance, the Japanese Factory Law (enforced from 1916) as well justified this situation by stipulating that every factory had to give workers at least two holidays a month. This must have been the single feasible requirement judging from the prevailing state of working conditions at that time.

Even in the 1920's, some factory surveys report that the two-holiday system, e.g. the

[18] In the earlier factories, e.g. Nagasaki Ironworks, Yokosuka Ironworks, etc., the week system had been already introduced there. But it is known that the Sunday system as a weekly holiday was applied only for foreign advisers. In other words, Sunday implied neither a "holy-day" nor a non-workday for Japanese workers.

[19] Previously, the Government had introduced (in 1868) the so-called "one & six day" holiday system, viz. the first, eleventh, twenty-first, thirty-first, sixth, sixteenth and twenty-sixth days of the month all being holidays, since Sunday was considered a holiday only for Christians in the Japanese society of those days. As this new system had too many holidays in a month, the Government switched over to the Sunday system by emphasizing its irrelevance to Christianity. Nevertheless, it was unpopular and was called a holiday for government officials.

first and third Sundays or the first and fifteenth days of the month,[20] was most common among Japanese factories. Thus it may be concluded that the Sunday system as a weekly holiday eventually diffused to most factories only in the 1940's with the shift to prevalence of the salary system from the daily wage system. That is to say, this fact tells us that the introduction of the Western social system, e.g. the Sunday system, required a long time to be transplanted, whereas the Western economic system, e.g. the factory system, was rather easily transplanted into the Japanese economy with some efficient modifications. Finally it is to be emphasized that a key factor in clarifying the rapidness of the latter transplant can be found in the active entrepreneurship under the competitive social value system of Japan.[21]

Finally, viewed from a different standpoint, the above all observations in Japan are consistent with the extended Firth's hypothesis on the time-sequence of adaptations in transplanting foreign culture (including technology). More specifically speaking, when we encounter foreign culture, the acceptance of it can be considered to proceed from commodities to technology; then organizations; and finally institutions and beliefs.[22] This was also the case for the last three stages in our Japanese experience although the commodity (raw silk) itself was already popular before encountering Western culture at the early Meiji.

That is, the steam-reeling technology first settled down by the end of the nineteenth century after various modifications; then the filature system put down roots in the first decade of this century in the silk-reeling industry. It, however, was not until the 1940's that the weekly holiday system of Sunday diffused firmly into the industry. Thus the extended Firth's hypothesis is broadly applicable, but we consider on the other hand the more precise patterns of technological and market adaptations in transplanting foreign culture are to be formulated particularly in the cases of late-industrializing countries.[23]

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[20] The first and fifteenth days of the month corresponded respectively to the new moon and full moon days in the lunar calendar. These two days were often regarded as *de facto* holidays in the traditional society.

[21] For the problem of Japanese entrepreneurship and technological innovations, see for example Y. Kiyokawa (1984).

[22] See R. Firth (1929), Chap. 14.

[23] For instance, we may point out a stylized pattern of technological and market adaptations for transferred technologies based on a technological gap hypothesis. See Y. Kiyokawa (1975a).

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