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The United Nations University: 29th Floor, Toho Seimei Building, 15-1, Shibuya 2-chome, Shibuya-ku, Tokyo 150, Japan. Tel.: (03) 499-2811; Telex: J25442; Cable: UNATUNIV TOKYO

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TRANSFORMATION AND DEVELOPMENT OF TECHNOLOGY IN THE JAPANESE COTTON INDUSTRY

Takeo Izumi

Associate Professor
Department of Economics
Senshū University
Tokyo, Japan

CONTENTS

PREFACE: AN ANALYTICAL VIEWPOINT

The objective of this paper is to examine the latter half of the rationale of the UN University project, "Transformation and Development of Technology," in relation to the Japanese cotton industry. The period discussed in this paper is thus limited to the years since 1910.

The following is an analytical viewpoint underlying this paper. The modern cotton-spinning and cotton-weaving industries in Japan did not develop from the traditional production pattern which had existed from the Tokugawa period. They were created as a result of large-scale mechanized plant transfer which in itself is a uniquely capitalistic form of production. Moreover, spinning and weaving were, in many cases, operated at the same time by one management, and this evolved into the spinning and weaving industry. The modern cotton-spinning industry in Japan can be defined as the "transfer type" as against the cotton textile industry of the "endogenous type" which existed from the Tokugawa period. The first element in a discussion of the Japanese cotton industry must, therefore, be to take these two separate types as a basis.

Spinning, which was another category of the endogenous type, disappeared as it was overrun by the technology of the transfer type. Cotton textiles, however, maintained a strong foothold in the domestic market and developed independently in spite of the fact that the supply of cotton yarn was dependent upon the cotton-spinning industry of the transfer type. Furthermore, the "endogenous" cotton textile industry relied upon domestic power looms which were developed due to the technological stimulation caused by the cotton textile industry of the transfer type. This brought about the modernization and self-sufficiency of the weaving sheds even on a small-scale basis. There emerged some endogenous weaving-shed

managers who later aimed at production for the export market. Consequently, the technological interaction or mutual influence between the "endogenous" and the "transfer" types of the cotton textile industry must be the second element in our discussion.

The third is a problem pertaining to the quality of engineers and workers. The quality of engineers who were able to digest and transform the system of transferred technology, and their ability to develop new technology, must be discussed. Moreover, the quality of operatives who were able to keep up with the innovated system of technology, and the fact that they made the technical change and development possible by smooth operation of machines, should be taken into account.

The fourth element is the attitude of managers. Managers contributed greatly because they were eager to absorb and develop new technology and they pursued rationalization and stabilization of management. Their attitude was based upon the philosophy of "enrich the nation and strengthen the military" which led to another slogan exhorting people to "promote industry and enhance productivity" so that excessive imports could be prevented and a self-sufficient economy could be achieved. On the other hand, their attitude was also nurtured by the competition to secure as great a share as possible of both domestic and foreign markets.

The fifth topic to be discussed is that of the characteristics which accompany such technological change and development, and their limitations.

I. COPING WITH TECHNOLOGICAL TRANSFORMATION

Technological Transformation in the Spinning Process

(i)

The transfer from steam to electric power must be pointed out as a premise for dealing with the theme of technological transformation in the Japanese cotton-spinning industry. From the standpoint of world history, steam power became widespread after the steam engine was patented in 1769. The shift from steam to electric power began when an electric generator was operated for profit for the first time in 1880 in the midst of the great depression period.[1] In Japan, electric power prevailed from 1906 when hydroelectric power generation surpassed thermoelectric power generation. Its prevalence became especially marked after 1914 when the Inawashiro Hydroelectric Power Plant was completed, as this was the starting point for the era of the transmission of long-distance high-voltage current.[2]

In direct relation to this process, the electrification of the Japanese cotton-spinning industry progressed rapidly. In 1922, the average actual rate of hydro, gas and electric power consumed per day was 69,000 horsepower (52.4 per cent of the total actual horsepower), thus exceeding thermoelectric power which accounted for 63,000 horsepower. By the 1930s the former category predominated.[3] A breakdown according to engines (Table 1) reveals that although the number of electric motors completely surpassed that of the others in 1920, the actual horsepower supplied by them was about the same as that supplied by steam engines and steam turbines. Moreover, a breakdown according to the amount of electricity usage based upon industries (Table 2) reveals that electricity consumed by the dyeing and weaving industry compares remarkably with that of the chemical, machine, and mining and refining industries, which by their

TABLE 1. The Number of Motors and the Actual Horsepower in the Cotton-Spinning Industry

(unit: 1,000 horsepower)

	1920		1923	
	Number	Actual h.p.	Number	Actual h.p.
Steam Engine	145	56.4	199	56.9
Steam Turbine	26	32.6	36	53.6
Gas Engine	22	1.9	21	2.2
Oil Engine	21	0.1	5	0.0
Various Water Wheels	96	2.4	28	0.6
Electric Motor	2,337	92.0	3,199	140.0

Source: Izumi, "Taishō-ki Menbō no Rōdō Jijō to Gōrika...," p. 9.

TABLE 2. Electricity Consumption According to Industries

(unit: 1,000 horsepower)

	Dyeing & Weaving	Machine	Chemical	Foodstuffs	Mining & Refining	Others & Total
1914	60	93	61	37	100	391
19	180	318	201	98	217	1,130
21	274	413	252	149	272	1,552
23	315	388	300	176	284	1,726
26	322	369	365	294	524	2,292
28	553	687	545	304	449	3,050
30	737	592	659	341	632	3,577
31	665	531	762	333	892	3,832

Source: Mori, op. cit. Nippon Kōgyō Kōseishi, p. 372.

very nature would consume a high ratio of electricity. This demonstrates that the power source of the cotton-spinning industry was transferred from steam power, the basic productive power during the period when industrial capitalism was established, to electric power, which yielded the higher productivity necessary for the stage of capitalistic monopoly.[4] The rapidity and high ratio of electrification in the Japanese spinning industry deserves special attention in view of the fact that the ratios of electrification in the spinning industry in Britain, the USA and Germany in 1924 were 19 per cent, 59 per cent and 59 per cent respectively.[5]

The advantages of electrification for the spinning industry are considered to be as follows: 1) unit driving, 2) economy of power, 3) simple distribution of power, 4) liberation of the mill plan from the engine room, 5) easy handling of power motors, 6) lighting, and 7) substitution of gas burners.[6] The greatest merit, however, is said to be unit driving. In comparison to group driving run by steam power which was transmitted through a long shaft installed along the centre of the ceiling to belts attached to individual spinning frames, unit driving, made possible by the use of motors attached to individual spinning frames, offered the following merits: 1) increased productivity per spinning machine, 2) economy of installation, 3) reduction in number of female operatives, 4) improved quality of yarns, 5) decreased possibility of impediments and danger, 6) reduction of dust and 7) easy ventilation in winter.[7]

With regard to the productivity of spinning machines, the spindle frequency around 1910 was about 7,000 to 8,000 revolutions per minute. However, this was increased through the use of unit driving, and while foreign ring-spinners were designed to take a maximum frequency of 9,000 revolutions, an epoch-making Japanese spindle called N.S. ring-spinner which was developed in 1928 allowed for a frequency of more than 10,000 revolutions. In addition, the spindle frequency was maximized at 14,000 revolutions which was the limit of rotational frequency without imposing danger to human bodies.[8]

As far as the quality of yarns was concerned, a method which regulated the motor speed by degrees was adopted in order to stabilize the cop-winding speed, because the faster the cop-winding speed, the more easily the yarn snapped.[9] Because there was a tendency for yarns to snap during the dry winter season and during summer when temperature and humidity are high, the carrier system which regulated the temperature and humidity within mills at a steady level was introduced at the end of the 1920s so that seasonal fluctuation in yarn quality and efficiency could be eliminated.[10] An additional significance of unit driving was the fact that the Japanese cotton-spinning industry freed itself from uneconomical operations such as only a few spinning frames being used at the very end of a long shaft.[11] Furthermore, unit driving became the technical founda-

tion for labour reinforcement based upon the completion of efficiency among units, which was closely related to the contractural labour system (the wage system according to output rating). This factor pertaining to unit driving is said to be the "greatest merit for capitalists."[12]

With regard to unit driving, although the case of the Nisshin Bōseki Co. Ltd.'s Kameido Plant is considered to be the beginning, its actual introduction should be considered to be from 1915 onwards, in view of the examples provided by Fuji Gas Bōseki's Kawasaki Plant, Kurashiki Bōseki's Manju Plant and Osaka Gōdō Bōseki's Kamizaki Plant.[13] Furthermore, it was installed at newly constructed or added plants as well as at those with conventional spinning machines, since these old models were remodelled to run on unit driving.[14] The prevalency rate of unit driving cannot be shown quantitatively. In the case of Tōyō Bōseki Co. Ltd., the power supply depended entirely upon steam engines for the purpose of group driving until about 1910. From the 1920s, however, steam engines were replaced by electric motors. By the end of that decade, it was stated that the conventional long shaft had disappeared from the plant because not only spinning machines, but also roving machines, drawing machines, carding machines, winders and looms were all transferred to unit driving.[15] It appears, therefore, that the Japanese cotton-spinning industry plunged into the installation of unit driving very rapidly in the 1920s.

Lastly, it must be pointed out that the prevalency of unit driving enlarged the scale of the plants because space no longer had to be given up for the shafts. As Table 3 reveals, there was already a definite tendency for the plants to be on a large scale as of 1914. However, plants with 10,000 to 30,000 spindles were predominant. In 1937, the predominant scale rose to more than 30,000 spindles, and 35 plants out of 209 plants (17 per cent) had more than 100,000 spindles. In comparison to the beginnings of modern Japanese cotton spinning, at Osaka Bōseki Co. Ltd., which in 1882 had 10,500 spindles, such large-scale plants reveal the rapid growth of the industry. As a result of this enlarged scale, the reduced cost of building plants and transporting goods within them led to a reduction in production costs.

TABLE 3. The Scale of Spinning Plants

	(1) 1914.12.30 Plant	%	(2) 1928. 6.30 Plant	%	(3) 1937.12.31 Plant	%
Less than 10,000 Spindles	16	9.4	12	6.6	9	4.3
More than 10,000 Spindles	53	40.6	45	31.5	19	13.4
" 20,000 "	33	60	41	54.2	17	21.5
" 30,000 "	31	78.2	29	70.2	31	36.3
" 40,000 "	9	83.5	16	79	22	46.8
" 50,000 "	9	88.7	11	85.1	28	60.2
" 60,000 "	6	92.2	8	89.5	19	69.3
" 70,000 "	5	95.1	8	93.9	13	75.5
" 80,000 "	2	96.3	4	96.1	10	80.3
" 90,000 "	3	98.1	3	97.8	6	83.2
" 100,000 "	2	99.3	2	98.9	31	98
" 150,000 "	1	100	2	100	4	100
Total	170		181		209	

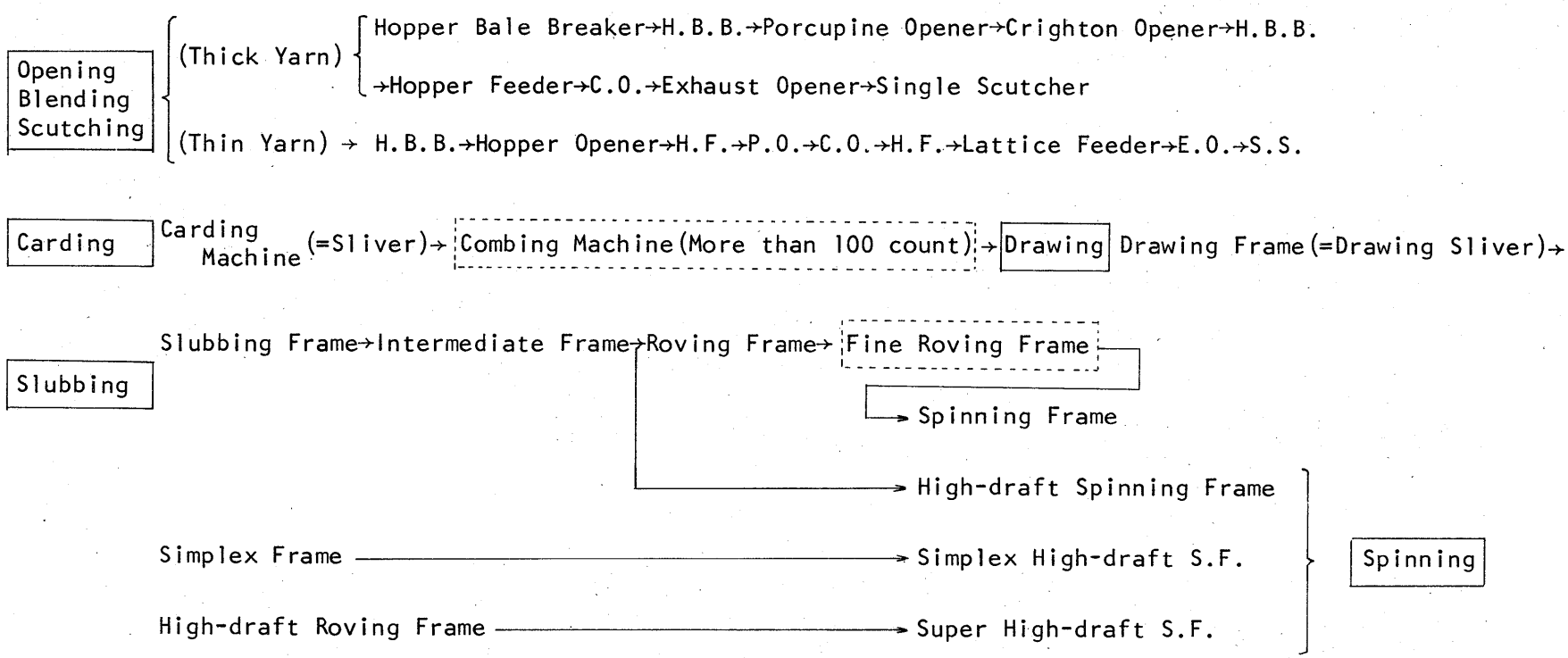
Source: (1) and (2) Arisawa, Abe, op. cit., p. 568.

(3) Dainippon Bōseki Rengōkai, Dai Nanajūji Menshi Bōseki Jijō Sankōsho (1938), pp. 1-20.

(ii)

The process of spinning was itself shortened on the basis of unit driving. The process of spinning consists of , successively : opening, blending, scutching, carding, drawing, slubbing (initial slubbing), slubbing, intermediate slubbing, roving, fine roving and spinning. Diagram 1 illustrates the process and the names of machinery used at each level.[16] The most time-consuming is the opening, blending and scutching process, and the process which can most easily be eliminated is roving as it is a matter of procedure.

DIAGRAM 1.



Source: Nippon Bōseki Kyōkai Tōkei Bunkakai, ed. Menka Kara Menori Made, the same association (1955) pp. 85-104, and Yūhei Washio, "Menshi Bōseki Kōjō ni Tsuite," Songai Hokengyō Kenkyūsho, Kōen-shū, vol. 2, the same Kenkyū-shō (1936), pp. 225-239.

The shortening of the blending and scutching process took place in the 1920s when the blending and scutching machines were directly connected, thus eliminating the intermediate scutching machine. This system combining the blending and scutching process became prevalent at the end of the 1920s.[17] The simplification of the roving process was achieved by the introduction of high-draft ring spindles which increased the draft rate of cotton. The simplification process depended upon each individual case. While some eliminated an intermediate roving frame or a roving frame, others slightly shortened the hours spent on three frames. The most common way of simplification was to eliminate a roving frame. According to a description of a mill with 74,000 spindles owned by Platt Brothers (Table 4), 56 units of roving frames became totally unnecessary. It was estimated that 15 per cent of machinery cost, 10 per cent of plant floor space and 10 per cent of labour would be saved by this simplification.[18]

TABLE 4. A Comparison of the Number of Machines Needed According to Draft

	Regular-draft (unit)	High-draft (unit)
Hopper Bale Breaker	3	3
Hopper Opener	3	3
Hopper Feeder	3	3
Crighton Opener	3	3
Exhaust Opener	3	3
Single Scutcher	8	8
Roving Waste Opener (1)	1	1
Single Carding	144	144
Draw	12	12
Slubbing Frame (100 spindles)	12	12
Intermediate Frame (144 spindles)	24	24
Roving Frame (184 spindles)	56	-
Spinning Frame (480 spindles)	154	154

Source: Arisawa, Abe, op. cit., pp. 559-560.
Note : (1) Only when waste sliver is used.

Although in the West the device of high-draft ring spindles materialized prior to World War I, it was not until the postwar period that the device was transferred to Japan.[19] In spite of the fact that the yarn count was

increased to medium and high, high-draft spindles developed in the West were not directly applicable[20] to Japanese cotton spinning. This was because the main portion of Japanese production was made up of low count yarns, and a unique blending method[21] using short-fibre Indian cotton was prevalent. Thus each spinning company became intent on developing a high-draft spindle suitable for Japanese cotton spinning through the remodelling of aproned spindles. As a result of this, Kusuo Imamura of Dai Nipponbō devised an ECO-type high-draft spindle, Takuya Nakamura of

TABLE 5. Consumption According to the Classification of Cotton

(unit: 10,000 kan, %)

	Indian Cotton	American Cotton	Egyptian Cotton	Chinese Cotton	African Cotton	Korean Cotton	Others & Total
1910	2,494(38)	1,333(20)	67(1)	951(15)			6,523(100)
11	3,574(55)	1,338(21)	162(3)	1,322(20)			6,470(100)
12	4,417(58)	2,571(34)	181(2)	380(5)			7,635(100)
13	5,216(61)	2,429(28)	200(2)	559(7)			8,546(100)
14	6,598(70)	2,045(22)	182(2)	438(5)			9,406(100)
15	6,712(69)	2,509(26)	161(2)	221(2)			9,694(100)
16	7,128(66)	2,827(26)	197(2)	354(3)		81(1)	10,743(100)
17	7,086(65)	2,906(27)	177(2)	508(5)		98(1)	10,871(100)
18	5,437(53)	3,365(33)	177(2)	997(10)		141(1)	10,239(100)
19	4,520(42)	4,267(40)	187(2)	1,572(15)		138(1)	10,771(100)
20	5,795(57)	3,724(36)	139(1)	368(4)		113(1)	10,228(100)
21	6,264(61)	3,657(35)	175(2)	37(0)		105(1)	10,327(100)
22	7,383(59)	4,677(37)	236(2)	44(0)		100(1)	12,575(100)
23	7,834(64)	3,557(29)	266(2)	310(3)		145(1)	12,236(100)
24	6,768(58)	3,386(29)	314(3)	707(6)	120(1)	245(2)	11,628(100)
25	7,684(56)	4,561(34)	314(2)	567(4)	103(1)	229(2)	13,606(100)
26	7,976(54)	5,838(39)	365(2)	240(2)	158(1)	150(1)	14,843(100)
27	6,619(46)	6,745(47)	374(3)	190(1)	99(1)	117(1)	14,270(100)
28	6,179(45)	6,189(45)	340(2)	737(5)	106(1)	133(1)	13,791(100)
29	7,782(49)	6,841(43)	371(2)	351(2)	149(1)	180(1)	15,768(100)
30	7,591(54)	5,670(40)	309(2)	138(1)	111(1)	245(2)	14,165(100)
31	7,027(48)	6,809(47)	393(3)	31(0)	30(0)	170(1)	14,534(100)
32	4,011(26)	10,993(70)	452(3)	25(0)	2(0)	61(0)	15,637(100)
33	5,579(33)	10,527(61)	492(3)	95(1)	134(1)	201(1)	17,165(100)
34	7,361(38)	10,366(54)	641(3)	138(1)	225(1)	195(1)	19,322(100)
35	8,142(41)	10,147(51)	821(4)	53(0)	107(1)	268(1)	20,032(100)
36	8,748(43)	8,335(41)	765(4)	256(1)	454(2)	371(3)	20,273(100)
37	9,733(44)	8,382(38)	1,048(5)	400(2)	424(2)	181(1)	22,153(100)
38	5,557(35)	5,768(36)	726(5)	1,730(11)	144(1)	96(1)	15,829(100)

Source: Dainippon Bōseki Rengōkai, Dai Yonjūgoji, Dai Nanajūniji Menshi Bōseki Jijō Sankōsho.

Tōyōbō an F.N. aproned spindle, and Masurō Kobayashi of Kurabō an independent device in the early 1930s. There were additional models such as an OM type and a Nittō type.[22] Consequently, high-draft spindles became prevalent during the 1930s, and in particular the ECO-type is said to have become "extremely prevalent in view of the fact that it is well suited for the spinning technology existent in Japan, and it can easily be attached to a remodelled Platt spinning frame which is most commonly used in the Orient."[23]

Kusuo Imamura, a graduate of Kyoto Imperial University with a Bachelor of Engineering degree, studied at Massachusetts Institute of Technology, USA, and subsequently entered Settsubō.[24] He was, therefore, an engineer with the best technological knowledge possible in Japan at the time. Furthermore, Imamura remodelled an English intermediate roving frame with six-line rollers which did not become prevalent due to its inconvenience. He devised a four-pair roller to enhance the draft rate, and completed a simplex frame which resulted in the shortening of the roving process.[25] This was the simplex high-draft spinning frame. In consequence, as shown in Table 6, it became possible to reduce the number of machines and operatives. In comparison to a conventional spinning machine, the ratio

TABLE 6. A Comparison of Plants with 30,000 Spindles According to their Equipment and Operatives

	Regular-draft		Simplex High-draft	
	No. of Units	No. of Operatives	No. of Units	No. of Operatives
Blending and Scutching	9	28	9	17
Carding	120	19	120	16
Drawing	12	23	12	16
Initial Slubbing	12	14		
Intermediate Slubbing	18	24	24	14
Roving	38	33		
Spinning	75	117	75	80
Total	284	258	240	143

Source: Toyota Jidō Shokki Seisakusho, op. cit., p. 161.

of operatives reduced was as much as 44.6 per cent. Although Tōyōbō purchased a super-draft spinning frame made by Hartmann of Germany, together with a sliver condensing machine, and installed them at the Tomita Plant on a test basis, they were cancelled because of the difficulty of handling and the high costs.[26] It appears that super-high draft spinning frames were not put to practical use in the prewar period.

NOTES

1. Moritarō Yamada, Nippon Shihon-shugi Bunseki, Iwanami Bunko (1977), p. 203.

2. The supply of electricity grew from 716,000 kw in 1914 to 1,133,000 kw in 1919 (58.2 per cent increase), to 2,063,000 kw in 1923 (82.1 per cent increase), to 3,822,000 kw in 1928 (85.3 per cent increase), and to 4,657,000 kw in 1931 (21.8 per cent increase).
Ki-ichi Mori, Nippon Kōgyō Kōseishi, Itō Shobō (1943), p. 371.

3. Takeo Izumi, "Taishōki Menbō no Rōdō Jijō to Gōrika-Nippon no Genseiteki Rōdō Kankei tono Kanrende," Senshū Keizaigaku Ronshū, vol. 10, no.2 (Feb. 1976), p. 8.

4. The significance of electricity as an energy source lies in the fact that it has incomparable concentration, divisibility, efficiency and inexpensiveness.

5. Hiromi Arisawa, Isaku Abe, "Sangyō Gōrika", Keizaigaku Zenshū, vol. 43, Kaizōsha (1930), p. 555.

6. Ibid., pp. 556-557.

7. Ibid.

8. Noriro Moriya, Bōseki Seisanhi Bunseki, rev. ed., Ochanomizu Shobō (1973), pp. 74-75.

9. Hataji Iijima, Nippon Bōseki-shi, Sōgensha (1949), p. 235.

10. Moriya, op. cit., p. 91.

11. It is stated that, when a mill operates only one spinning frame due to reduced operations, even though the mill is equipped with a shaft to run 25 spinning frames, it still requires 10 horsepower for the frame and 50 horsepower for the shaft.
Iijima, op. cit., p. 202.

12. Moriya, op cit., p. 76.

13. Izumi, "Taishōki Menbō no...," pp. 9-10.

14. Ibid., p. 10, Table 3.

15. Tōyō Bōseki Kabushiki Kaisha, Sōritsu Nijūnen Kinen Tōyō Bōseki Kabushiki Kaisha Yōran (1934), pp. 60-61.

16. The following is a brief explanation of each process. During the process of opening, blending and scutching, all admixtures such as residual leaves, seed and cauline fragments, waste fibre and sand are eliminated so that raw cotton is made into clean laps. Raw cotton must be put through the same machine and other machines several times. During the process of carding, short fibre and fibre lumps are eliminated by a card cloth (as twisted fibre and alien fibre are still mixed in the laps) in order to make stringed slivers by arranging the fibre in parallels. The drawing process is a process to make drawing slivers with even thickness by combining several slivers with uneven thickness. In view of the fact that drawing slivers are top thick and difficult to be immediately spun, the slivers are drafted during the process of roving in order to produce rough yarns which can then be sent to the spinning process.
Nippon Bōseki Kyōkai Tōkei Bunsekikai ed., op. cit., pp. 87-102.

17. Moriya, op. cit., p. 80.
Dai Nippon Bō's Ōgaki Plant succeeded in combining these into one process in 1921 (ibid., p. 80). Moreover, Kanegafuchi Bōseki was able to combine the blending and scutching frames into one in 1926 and thus an intermediate scutching frame was eliminated.
Holdings of Kanegafuchi Bōseki Kabushiki Kaisha, Gijutsu Kaishō, no.9.

18. Abe, Arisawa, op. cit., p. 560.

19. Those that were introduced into Japan were Casablanca's apron type with an aproned leather, Richter's three-line roller type, Platt's four-line roller type with soft rollers and Dobson's three-line roller type.
Holdings of Tōyō Bōseki Kabushiki Kaisha, Tōyōbō Nanajūnen Shiryō.
Kurashiki Bōseki imported 25 units of Richter's high-draft spindle and began production at the Hayashima Plant in 1926.
Kurashiki Bōseki Kabushiki Kaisha, Kaiko Rokujūgonen (1953), pp. 408-409, 430.

20. It is said that although Kurabō attempted to produce low-count yarns on an experimental basis by the use of high-draft frames, they failed. They succeeded in production only after adding a great quantity of American cotton. Kurabō, op. cit., p. 430.

21. With regard to the ratio of blending, refer to Izumi, "Taishōki Menbō...," p. 16, and Izumi, Shakai Kagaku Nenpō, vol. 13, "Dokusentaiteki Kyodai Menbō Shihon no Seisan Kōzō to Sakushu Kiban," Senshū Daigaku Shakai Kagaku Kenkyujo (1979), p. 315.

22. Izumi, "Taishōki Menbō...," p. 14.

23. Toyota Jidōshokki Seisakusho, Yonjūnen-shi (1967), p. 157. Kusuo Imamura not only devised the roller part and cradle, but also specially designed the position of the rollers and the spindle beams to improve the frame itself.

24. Ibid., p. 159.

25. Nichibō Kabushiki Kaisha, Nichibō Nanajūgonen-shi (1966), p. 198. This was first adopted on a test basis by Dai Nipponbō's Ichinomiya Plant in 1931. In 1932, Kurehabō's Inami Plant and Tenman Orimono's Sasazu Plant changed their entire units to this model. However, it became prevalent in the latter half of the 1930s. Moriya, op. cit., p. 79.

26. Tōyō Bōseki Kabushiki Kaisha, Tōyōbō Nanajūnen-shi (1953), p. 191.

Technological Transformation in the Weaving Process

(i)

With regard to technological transformation in the weaving process, the transfer type, comprising the modern cotton-spinning and -weaving and textile industries, must be grasped separately from the endogenous type of cotton weaving. In view of the fact that, from the beginning, the former depended upon imported power looms and automatic looms[1], which constituted the basis for the mechanization of the endogenous cotton textile industry, the steps leading to the usage of power looms will be dealt with here. The prevalence of electric motors was a prior condition for the mechanization of the endogenous cotton textile industry, using looms (Table 1). In this case, however, the capacity of the motors was no more than about 10 horsepower.

In the Enshū region of Shizuoka prefecture, which had been one of the major centres of endogenous cotton weaving, a "tall" hand loom (Takabata) with a built-in seating board and a treadle was popular around the time of the Meiji Restoration, and a "slam" loom (Battanbata) was introduced at the end of the 1870s. The cotton textile industry in the Enshū region was operated on a small-scale basis and appears to have been at the initial stage of capitalistic management. After the introduction of Matsuda

TABLE 1. Engines and Horsepower in the Cotton-Weaving Industry

(unit: No. of Looms, 1,000 horsepower)

	Steam Engine		Steam Turbine		Electric Motor		Others	
	No.	h.p.	No.	h.p.	No.	h.p.	No.	h.p.
1909	197	17	15	0	108	2	528	3
14	244	15	28	4	660	8	806	10
20	275	21	14	3	4,431	50	1,141	19
24	290	24	13	7	7,697	82	579	11
36	42	3	6	8	13,288	144		

Source: Kōgyō Tōkei Kenkyūkai, Kakunen Kōjō Tōkeihyō, Chikuma Shobō.

Model treadle looms in the 1890s, weaving became a specialized occupation rather than part-time work for farmers, and it moved toward the wholesale cottage industry or manufacture stage.[2] Although the endogenous cotton textile industry totally relied upon the modern cotton-spinning industry of the transfer type for the supply of raw material, it managed to make distinct progress due to its strong share in the domestic cotton fabric market. The cotton textile industry in the Enshū region, which developed into a manufacturing-type industry and established an extensive network of weaver and waged piece-work relationships on the basis of such hand looms, came to adopt power looms. By 1915, the number of power looms greatly exceeded that of hand looms and treadle looms in this region. (There were 3513 power looms as against 5680 hand and treadle looms in 1910, 6939 as against 4597 in 1912, and 8119 as against 2627 in 1914.)[3]

The introduction of power looms in the Enshū region tended to be more on a test basis prior to the Russo-Japanese War, with full-scale introduction coming afterwards. The types of loom existent in the Enshū region at this time were Toyota Model(676 looms), Suyama Model(160), Nakamura Model(142), Iida Model(122), Nakayama Model(107), modified treadle looms(657), and others such as Iketani Model and Suzumasa(Masataro Suzuki)Model.[4] The above reveals how many types of power looms were devised. It is probably accurate to state that there was definitely a phase similar to the Industrial Revolution within the endogenous cotton textile industry. As an extension of the successful transfer from hand

looms to power looms, the Enshū cotton textile industry not only gained its position in the domestic market, but was also on its way to making inroads into the export market.

Table 2 illustrates the nationwide trend of a transfer to power looms. Note the rapid progress of facilitating power looms from the latter half of the 1920s, which at the same time denotes the progress of transfer from the narrow-cloth power loom to the broadcloth power loom. The average per capita annual cotton consumption grew from 1 yen 19 sen for the period 1895 to 1899 and 1 yen 32 sen for 1900 to 1904 to 2 yen 3 sen for the period 1905 to 1909 and 2 yen 51 sen for 1910 to 1914.[5] Such increased cotton demand must be taken into consideration as one of the underlying factors which led to the adoption of power looms by the endogenous cotton textile industry.

(ii)

Those who devised these power looms were house or loom carpenters who were, at the time, small producers and engineers in Japan. Sakichi Toyota, who in 1906 founded Toyota-shiki Shokki Kaisha as well as Toyota Jido Shokki Seisakusho, was a house carpenter. Ishimatsu Kubota, who produced the first iron power loom in Japan (1903), was also a carpenter. Masajirō Suzuki, who founded Suzumasa-shiki Shokki Kaisha and later established Enshū Shokki Seisaku Kaisha, switched from house carpentry to loom carpentry in 1904 and completed an iron narrow-cloth power loom in 1908. Moreover, Michio Suzuki, who founded Suzuki-shiki Shokki Kaisha, the predecessor of Suzuki Jidōsha Kōgyō, was formerly a carpenter and made his model power loom in 1913.[6]

Sakichi had come to invent the power loom and the automatic loom after going through many hardships, as is often the case with inventors. He was born the son of a carpenter in 1867 in Hamana County, the centre of the Enshū cotton textile industry. Although he himself became a carpenter, he was intent on developing a power loom. He was motivated in this direction after seeing the textile industry operated by farmers as part-time work. In addition to his environment, such factors as the

TABLE 2. The Transition of Loom Facilities

(1)

	Narrow-cloth Power Loom		Broad-cloth Power Loom		Hand Loom		Total	
1914	123	19.8%			499	80.2%	622	100%
15	137	20.1			544	79.9	681	100
16	156	20.2			616	79.8	772	100
17	179	21.1			671	78.9	850	100
18	205	23.0			686	77.0	891	100
19	285	29.5			682	70.5	967	100
20	290	31.2			639	68.8	929	100
21	330	35.0			612	65.0	942	100
22	176	25.1	147	21.0	378	53.9	701	100
23	185	25.9	163	22.8	367	51.3	715	100
24	178	26.0	168	24.6	338	49.4	684	100
25	164	24.9	188	28.6	306	46.5	658	100
26	161	26.3	199	32.5	252	41.2	612	100
27	164	26.7	212	34.5	238	38.8	614	100
28	165	26.8	223	36.2	228	37.0	616	100

(2)

	Narrow-cloth Power Loom		Broad-cloth Power Loom		Of which Jointly Operated Textile		Hand Loom		Total	
1922	122	31.8%	96	25.0%	61	63.5%	165	43.0%	384	100%
23	134	33.0	113	27.8	64	56.6	159	39.2	406	100
24	124	32.0	117	30.2	69	59.0	147	38.0	387	100
25	110	30.1	129	35.3	73	56.6	126	34.5	365	100
26	116	31.7	146	39.9	77	52.7	105	28.7	366	100
27	114	30.9	155	42.0	78	50.3	100	27.1	369	100
28	110	29.7	162	43.8	81	50.0	99	6.8	370	100
29	106	29.2	171	47.1	78	45.6	86	23.7	363	100
30	100	28.7	173	49.6	79	45.7	76	21.8	349	100
31	94	27.5	172	50.3	78	45.3	76	22.2	342	100
32	88	25.0	197	56.0	79	40.1	67	19.0	352	100
33	83	22.9	220	60.6	86	39.1	59	16.3	363	100
34	80	21.2	241	63.9	91	37.8	55	14.6	377	100
35	80	20.7	253	65.5	96	37.9	53	13.7	386	100
36	76	19.3	266	67.7	101	38.0	51	13.0	393	100

Source: (1) Hiromichi Kōda, Honpō Mengyō no Tokeiteki Kenkyū, Nippon Mengyō Club (1931), pp. 158-159.

(2) The data for Jointly Operated Textile from: Dainippon Bōseki Rengōkai, Dai Nanajūniji Menshi Bōseki Jijō Sankōsho (1939), p. 24.
Other data from: Nippon Mengyō Club, Naigai Mengyō Nenkan (1931 ed.), p. 364, (1938 ed.), pp. 124-125.

Note: The number of broadcloth power looms at weaving sheds attached to spinning mills is provided here as it is assumed that the data for broadcloth power looms include those at the weaving sheds attached to spinning mills. The percentage denotes the ratio to the broadcloth power looms.

establishment of the Monopoly Patent Act in 1885 (revised as the Patent Act in 1888), and the holding of the Third Domestic Industrial Promotion Exhibition as part of the campaign to "promote industry and enhance productivity," appeared to have greatly influenced Sakichi's invention.[7] In 1890, he invented the Toyota Model Manual Loom (a wooden manual loom) which was classified together with the hand loom.[8] He then made an improved treadle loom with a thread feeder. It was in 1897 that he invented the first narrow-cloth power loom, called the Toyota Model Wooden Power Loom, operated by an oil engine. In the autumn of the same year, he and Tōhachi Ishikawa, who was a cotton fabric broker (weaver), founded Otogawa Menshi Gōshi Kaisha, which was equipped with 60 power looms. The first domestic power looms began production in the following year in the cotton-producing area of Chita.

Furthermore, Sakichi established a general partnership with Mitsui Bussan and founded Igeta Shokai in 1900. Here, he invented a thread feeder and a device to supply the woof threads while the loom was running. After the partnership with Mitsui was cancelled, he went into the cotton textile industry by establishing Toyota Shōkai with 138 looms. Using the profit gained from this textile company, he manufactured such models as '38 Model, '39 Model and the Handy Model. In 1907 he founded Toyotashiki Shokki Kabushiki Kaisha (capital: one million yen), with capital accumulated from financial leaders in Tokyo, Osaka and Nagoya, so that power looms would come into general use. Table 3 illustrates the number of plants equipped with Toyota looms and other looms as of March 1909, after the company had operated for a full two years. The fact that Toyota looms were particularly widespread in the category of narrow-cloth looms used by the endogenous cotton textile industry can be clearly seen.[9]

After leaving the company in 1910[10], Sakichi went to the USA and Europe to do research on automatic looms, and became confident that he would be able to materialize his long-cherished desire.[11] He founded Toyota Bōshoku Kaisha in 1911, and started a full-scale project to develop an automatic loom using the profit gained from this company. Although this was not completely automatic, Sakichi, who had invented the automatic shuttle switch, devised the automatic shuttle receiver, the warp release

TABLE 3. The Number of Plants with Toyota Looms and Other Looms as of March, 1909

(1) No. of Looms Installed	Less Than 10	Less Than 20	Less Than 30	Less Than 40	Less Than 50	Less Than 100	Less Than 150	More Than 200
No. of Plants	44	62	36	15	29	24	1	5

(2) Types of Looms	Broadcloth		Narrow-cloth				
	Suzuki Model	All Iron Model	Suzuki Iron and Wood Model			All Iron Model	
			'38 Model	'39 Model	Handy Model		
No. of Looms	68	175	947	2,307	4,021	511	

Source: Toyota-shiki Shokki Kabushiki Kaisha, Sōritsu Sanjūnen Kinen (1936), p. 24.

and the tension mechanism in 1914, and the safety mechanism in 1916. Thus the new automatic loom, which bore no comparison to the old incomplete one, was put on a test operation in 1923, and in 1926 Sakichi completed the Toyota automatic loom which was far superior to those found in the rest of the world. He subsequently established Toyota Jidō Shokki Seisakusho in order to produce and propagate his automatic looms.[12]

(iii)

Table 4 shows the number and types of looms manufactured by Toyota-shiki Shokki Kaisha up to October 1935. There is a marked increase in the number of looms produced between 1910 and 1920s. In particular, the prevalence of broadcloth looms can be recognized. In such a relatively progressive endogenous cotton textile area as Enshū, textile manufacturers of this period not only operated narrow-cloth looms but also began to install broadcloth looms (Table 5). Thus, not only Toyota Model broadcloth looms but also many other models were produced, as can be seen in Table 6.

TABLE 4. The Number of Looms Manufactured by Toyota

Sales Date	Model	No.
Feb. 1907	A-Model (the first narrow-cloth loom made partly of iron and wood)	1,846
"	B-Model (Handy narrow-cloth loom made partly of iron and wood)	4,731
"	G-Model (Handy broadcloth loom made partly of iron and wood)	180
May 1908	K-Model (Iron narrow-cloth)	213
Nov. "	H-Model (Iron broadcloth)	3,742
May 1909	I-Model (Improved iron and wood narrow-cloth)	6,088
Dec. 1909	L-Model (Iron broadcloth and narrow-cloth)	15,247
Jun. 1914	N-Model (Iron broadcloth)	87,114
Dec. 1915	Y-Model (Iron narrow-cloth)	42,783
Sept. 1927	S-Model (Iron broadcloth loom for silk)	173
May 1932	L.T-Model (- " - for synthetic fibre)	901
Jun. 1934	M-Model (- " - for wool)	444
Total	As of Oct. 1935	163,462

Source: Toyota Shokki Kabushiki Kaisha, op. cit. pp. 99-100.

TABLE 5. The Increased Broadcloth Looms in the Enshū Region

	Number of Looms	Index
1913	238	86
1914	276	100
1915	786	284
1916	524	190
1917	1,082	392
1918	3,574	1,295
1919	5,009	1,815

Source: Makoto Tanaka, ed., Enshū Yushutsu Orimono-den, Enshū Orimono Kogyō Kyōdō Kumiai (1950), pp. 22-23.

TABLE 6. Classification of Power Looms used by the Members of the Enshū Export Cotton Textile Industry Trade (as of March, 1937)

Inches	Less Than 36"	Less Than 39"	More Than 40"	More Than 50"	More Than 60"	More Than 70"	Total
Toyota Model (Nagoya)	667	730	5,961	1,014	56	14	8,442
Enshū Model (Hamamatsu)	40	297	1,136	72	57	-	1,602
Suzuki Model (Hamamatsu)	202	188	522	952	290	55	2,209
Hirano Model (Nagoya)	1,160	547	746	566	102	17	3,138
Iida Model (Hamamatsu)	674	104	765	90	54	-	1,687
Suyama Model (Hamamatsu)	243	600	217	-	-	-	1,060
Nisshin Model (Hamamatsu)	364	368	330	4	16	-	1,082
Sakai Model (Hamamatsu)	48	670	224	8	-	-	950
Nogami Model (Nagoya)	256	220	248	12	-	-	736
Others	419	200	839	500	56	73	2,087
Total	4,073	3,924	10,988	3,218	631	159	22,993

Source: Makoto Tanaka, op. cit., p. 94.

Domestic power looms thus contributed to the mechanization of the endogenous cotton textile industry. Moreover they were adopted by the transfer type of spinning and weaving mills or by the sections of the textile industry, which used to depend upon imported looms. Consequently, imported looms began to be replaced by domestic ones. As is shown in Table 7, which illustrates the mills which bought more than 500 looms from Toyota between 1923 and 1929, most Japanese spinning companies and textile companies purchased a large quantity. Furthermore, the Toyota automatic loom rapidly prevailed after its completion (Table 8).[13] Thus, starting with the improvement of hand looms, Sakichi Toyota invented the power loom and contributed to the factory weaving of the endogenous cotton textile industry. He also promoted automated production in the transfer-type sections of the spinning and weaving and

TABLE 7. The Purchasers of Toyota Regular Looms

Purchaser	No. Sold	No. of Looms Owned in 1929	% of Toyota Models
Dainipponbō	3,248	8,445	38.5
Tōyōbō	3,200	9,728	34.5
Hattori Shōten	2,600	2,670	97.4
Naigai Men	1,986	811	
Kanegafuchibō	1,800	8,584	21.0
Osaka Gōdōbō	1,750	4,576	38.2
Izumi Orimono	1,530	1,501	101.9
Fuji Gasubō	1,514	2,772	54.6
Kurashikibō	1,455	1,811	80.3
Kondōbō	1,398	1,035	135.1
Tokyo Muslin	1,200	1,720	69.8
Toyota Bōshokushō	1,052	1,296	81.2
Toyota Kōbō	1,040	1,040	100
Toyota Bōshoku	1,008	1,916	52.6
29 Others	15,972		

Source: Toyota Sakichiō Seiden Hensanjo, op. cit., pp. 140-143, and Dai Gojūyonji Menshi Bōseki Jijō Sankōsho

Note : 1) Data only reveal those who purchased more than 500 looms during the period of 1923 to 1929.

2) Toyota Bōshokushō and Toyota Kōbō were Chinese-based spinning companies. Naigai Men was also predominantly Chinese-based.

TABLE 8. The Sales Quantity of Toyota Automatic Looms

(unit: No. of Looms)

Period	Orders Received	Orders Delivered	Remainder
Prior to Founding	2,835	1,203	1,632
Latter half of 1926	4,090	744	4,978
1927	2,173	3,418	3,733
1928	2,801	4,132	2,402
1929	4,026	4,004	2,424
1930	2,468	1,992	2,900
1st Half of 1931	633	1,475	2,058
Total	19,026	16,968	2,058

Source: Toyota Jidō Shokki Shashi Henshū Iinkai, Yonjūnen-shi, Toyota Jidō Shokki Seisakusho (1967), p. 116.

cotton textile industries with the use of domestic automatic looms.

The Toyota Automatic Loom Factory not only manufactured looms but was also involved in the production of the ECO-type high-draft spinner devised by Kusuo Imamura, and thus ventured into the full-scale production of spinners. They made a narrow-cloth spinner in 1934, developed a JL-type of improved high-draft mechanism in 1936 and completed the four-line super high-draft spinner which increased the draft ratio by one hundred times in 1937.[14] Table 9 shows the sales quantity of the Toyota spinners. Toyota's automatic looms and spinners became widespread domestically as well as abroad, as they began exporting mainly to China and India (Table 10),[15] which contributed to the promotion of a self-sufficient industry by preventing the excessive importation of spinning frames and looms. Table 11 illustrates the trend of excessive importation. Toyota Jito Shokki Seisakusho, moreover, had sold the patent right for ₤100,000 in 1929 to Platt Brothers Co., Ltd., which had been the world's largest cotton-machinery maker, so that Platt Brothers could produce and sell the Toyota automatic looms in countries excluding Japan, China and the USA.[16] This is significant in the sense that Japan was able to export technology to an advanced capitalist nation.[17]

TABLE 9. The Sales Quantity of Toyota Spinners

(unit: No. of Spinners)

Period	Orders Received	Orders Delivered	Remainder
1929	45	0	45
1930	176	44	177
1931	430	217	390
1st Half of 1932	386	195	581

Source: Toyota Jidō Shokki Seisakusho Shashi Henshū Iinkai, op.cit., p. 157.

TABLE 10. The Export Quantity of Toyota Looms and Spinners

(1927 - 1942)

	Loom	Spinning Frame		Slubbing Frame	Drawing Frame	Carding Frame	Scutcher
		1,000					
	No.	Spindles		No.	No.	No.	No.
China	23,236	1,095	460	102	140	897	186
India	452	218	88	33	36	192	166
Korea	1,887						
Thailand	270						
Indonesia	41						
Great Britain	2						
Total	25,888	1,313	548	135	176	1,089	352

Source: Toyota Jidō Shokki Seisakusho Shashi Henshū Iinkai, op. cit., p. 702.

TABLE 11. The Import/Export Transition of Spinning and Weaving Machines

(Unit: 10,000 yen)

	Import		Export	
	Spinning Machinery	Weaving Machinery	Spinning Machinery	Weaving Machinery
1920	1,816	137	339	
1921	2,918	297	443	
1922	3,060	133	504	
1923	2,236	134	380	
1924	1,204	80	359	
1925	771	61	345	
1926	502	57	262	
1927	1,020	36	288	
1928	1,043	43	307	
1929	1,449	64	366	
1930	637	65	385	
1931	351	22	516	
1932	800	45	365	
1933	352	13	488	
1934	639	10	628	210
1935	461	49	898	357
1936	228	24	1,015	497
1937	310	38	1,758	786
1938	163	3	2,167	833

Source: Dainippon Bōseki Rengōkai, Dai Sanjūnanaji-Dai Nanajūniji Menshi Bōseki Jijō Sankōsho (but data on 1920-1929 Exports from Nippon Ginkō Tōkeikyoku, Honpō Shuyō Keizai Tōkei).

TABLE 12. The Number of Spinners and Looms According to the Country and Company of Production

(1) Spinners

Country	Name of Company	No. of Frames	No. of Spindles
Great Britain	Platt Brothers	6,630	2,648,699
	Howard	582	237,604
	Azalees	387	161,444
	Dobson and Harlow	403	149,803
	Grux and Duxy	373	134,832
	Twidels and Smouley	256	98,224
	Heatherington	199	78,884
		485	162,352
USA	Sacco Lowell	121	38,720
	Howard	66	21,528
	Whiting	23	7,728
	Mason		
Germany	Hartmann	3	1,350
Japan	Toyota-shiki Shokki Co., Ltd.	13	5,376
	Usuya Tekkōjo	5	1,686
Total	14 Companies	9,546	3,748,230

Source: Dainippon Bōseki Rengōkai Geppō (Nov. 1920), No. 339, p. 69.

Note : (1) The figures include mule spindles of 24 frames with 20, 280 spindles by Platt Brothers, 1 frame with 420 spindles by Azalees and 3 frames with 1,350 spindles by Hartmann. The others denote ring spindles.

(2) Looms

Country	Name of Company	No. of Looms
Great Britain	Platt Brothers	20,809
	Dickenson	5,788
	Henry Lipsy	946
	Hattersley	824
	Robert Hall	704
	Dugdale	414
	John M. Somesy	10
	Cropton & Norrace	6
USA	Draper	1,818
Japan	Toyota-shiki Shokki Co., Ltd.	16,567
	Kaji Tekkōjo	570
	Harada-shiki Shokki Co., Ltd.	314
	Nakajima Tekkōjo	286
	Hiraiwa	98
	Nakamura Shokki Co.	50
	Tsuji Tekkōjo	32
	Matsui Shokki Co.	4
	Hasegawa Tekkōjo	3
	Kumagai Tekkōjo	1
Total	19 Companies	49,244

Source: The same as (1).

TABLE 13. The Sales Details of Spinning Machinery According to Classification Produced by Toyota Automatic Loom Factory

	Loom			Spinner			Slubbing Frame		Drawing Frame		Carding Frame		Scutcher	
	Domestic I	Export II		I		II	I	II	I	II	I	II	I	II
				1,000 spindles		1,000 spindles								
1926	744												2	
1927	3,418												115	2
1928	4,007	125											136	
1929	2,590	1,414											63	11
1930	859	1,133	38	15	6	3							15	24
1931	757	1,869	189	76	28	11							47	20
1932	2,984	716	352	145	20	7					180		8	29
1933	3,993	40	457	197	18	7					320	2	32	24
1934	3,777	2,973	650	282	159	65	2		15		307	56	18	5
1935	4,584	1,800	1,063	464	124	53	49	16	70	12	487	193	29	42
1936	1,812	6,876	1,118	486	219	89	68	1	69	18	438	124	13	42
1937	7,044	5,060	655	289	280	121	60	9	78	21	560	69	28	85
1938	3,695	2,547	486	212	173	76	44	33	63	62	261	205	18	29
1939	273	1,021	115	51	99	42	21	22		9	50	209	5	16
1940	211	257			124	49	9	45		42	38	140		12
1941	1	56	70	30	63	25		9	34	12		91		11
1942	1	1	50	21					8					
Prewar Total	40,750	25,888	5,243	2,268	1,313	548	253	135	337	176	2,641	1,089	529	352

Source: Toyota Jidō Shokki Seisakusho Shashi Henshū Iinkai, op. cit., pp. 700-701.

In concluding this chapter, the names of the producers and their countries together with the number of spinning frames installed at spinning mills and the number of looms installed at spinning and weaving mills as of November 1920 are shown in Table 12. The production of spinning frames in Japan was so negligible that it can be said to have been nothing more than experimental. On the other hand, domestic looms occupied 36.4 per cent of the total number of 49,244, and it can thus be seen that they had achieved fairly positive results.

NOTES

1. It was about 1904 and 1905 that automatic looms were imported, and there were types made by Northrop, Stafford and Draper. Later, looms made by Schlieken, Hartmann, Luchie and Henry Bayer were imported. Nevertheless, they could not be used as automatic looms from the beginning. The automatic device was detached and they were used as power looms. It was in the latter half of the 1920s that they could be used as automatic looms. Moreover, it was during this period that power looms began to be remodelled into automatic looms. Tōyōbō Nanajūninen-shi Shiryō.

2. Takeo Izumi, "Tenkanki ni Okeru Nippon no Mengyō-Meiji Makki ni Okeru Sono Kōzō Henka Bunseki...," Senshū Keizaigaku Ronshū, no.8 (June 1969), pp. 161-162.

3. Ibid., p. 173.

4. Ibid., p. 172.

5. Ibid., pp. 152-153.

6. Toshiaki Chokki, "Meiji Taishōki no Sangyō Kikai", Keizai Shigaku, vol. 7, no.1, Tōdai Shuppankai (1972), pp. 49-52.

7. Mitsuhaya Kajinishi, Toyota Shokki, Yoshikawa Kōbunkan (1963), pp. 14-16 and 31-32.

8. Although productivity was increased by about 40 to 50 per cent in comparison to the conventional hand loom, this model did not at all become prevalent due to the depression of 1890.

9. The greatest factor which contributed to the sudden prevalence of domestic power looms was the inexpensiveness of the Toyota power loom which cost 93 yen as against 872 yen for the four-shuttle power loom made by Hartmann, Germany.

10. It is said that Sakichi left this company because his enthusiasm for inventions conflicted with company policy which was aimed at profit-making only.
Toyota Sakichi-ō Seiden Hensanjo, Toyota Sakichi Den (1933), pp. 112-113.

11. Although Sakichi was amazed to see in America that one operative could handle 18 to 24 looms, he discovered the following regarding the American looms: 1) slow rotational speed, 2) easily broken, 3) much vibration, 4) the warp threads snapped frequently, and 5) the textile quality was inferior. Thus he came to the conclusion that "American looms are nothing to be feared."
Ibid., pp. 115-116.

12. Ibid., pp. 112-131.

13. The major purchasers are as follows:
Toyota Bōshoku (20,846 looms), Kikui Bōshoku (1,662), Osaka Gōdō (1,378), Kanegafuchi (1,160), Kishiwada (1,045), Aichi Orimono (1,028), Kureha (712), Izumo Seishoku (681), Toyota Shokufu (600), Fukushima (508), Kawachi Bōshoku (500), Utsumi Bōshoku (400), Kurashiki (250), Tōyō (240), Fuji (156) and Dai Nippon (72). Thus most of the major companies in Japan had adopted the Toyota model.
Toyota Jidō Shokki Seisakusho Shashi Henshū Iinkai, op. cit., p. 117.

14. Ibid., p. 158.
Moreover the first spinning frame in Japan was produced by Toyota Power Loom Company. Toyota had produced an entire line of spinning machinery. This ranged from the opener to the spinner, which came to over ten kinds of frames in 1921. These were used by the China plant, Toyota Kōbō, which was then under construction, having a capacity of 30,000 spindles. Thus the plant was totally equipped with domestic machinery without using a single imported machine.
Toyota-shiki Shokki Kabushiki Kaisha, op. cit., p. 32.

15. The details of the sales quantity of the spinning machinery produced by Toyota are as shown in the attached Table.

16. Toyota Jidō Shokki Seisakusho Shashi Henshū Iinkai, op. cit., pp. 138-141.

17. Platt Brothers purchased the patent on the Toyota automatic loom, however, with the aim of buying up the patent fees. When Toyota began exporting automatic looms from 1937, Toyota had to pay the following patent-handling fees to Platt Brothers. In the case of exports to India the fee was £3.10 per loom, £1.15 per loom when it was exported to countries with the registered patent on the automatic loom other than India, and £1.00 on the export to countries without the patent.
Ibid., pp. 150-151.

II. THE RECRUITMENT OF OPERATIVES AND THEIR TRAINING

The System of Operative Recruitment

(i)

In the latter half of the 1920s, the modern Japanese cotton-spinning industry of the transfer type employed approximately 200,000 workers, the majority of whom were females. About 70 per cent of these were boarding female operatives. The age distribution of female labour reveals that, as of 1927, 24.3 per cent of the 181,000 women were aged 16 and 17, the largest age group. 20.6 per cent were aged 18 and 19 and 16.6 per cent were aged 14 and 15. Consequently, the highest concentration, 63.5 per cent, was made up of females aged between 14 and 19. If the age group included those up to 24 years of age, the proportion would be 85.8 per cent, revealing the characteristic reliance of the Japanese cotton-spinning industry upon unmarried young female labour. The majority of them were employed for less than three years, and even if the years of re-employment were included, the years of employment were no more than five years. It was rather exceptional to work for more than five years. The wage system was set up to suit short-term employment. While the wage-increase rate up to three years was high, the rate stagnated for those who worked any longer. The rate of wage increases according to age distribution reveals that there was a steady increase up to age 19. However, the increase rate stagnated for those who were older than 19. In fact the wage decreased for those who were over 24. It can, thus, be said that the wage system was again geared to young labour.[1]

Due to the structure of the Japanese cotton-spinning industry, which consumed young female labour en masse on a short-term basis, girls left the mills after three years (or five years in the case of re-employment).

In other words, because over 30 per cent of the female operatives left the mills annually, the same ratio had to be supplemented, revealing the high mobility rate of workers in the Japanese cotton-spinning industry.[2] Table 1 (the spinning mill) and Table 2 (the weaving shed) show the labour mobility rates at Kanegafuchi Bōseki Kaisha (Kanegafuchi Spinning Co.), which had been recognized for its progressive welfare policy. As the workers were employed for three years, there would be a steady mobility rate of at least 60 per cent, and the tables reveal that it was exceptional for the mobility rate to be lower. In some cases the rates exceeded 100 per cent. Consequently, as mentioned above, at least one third of the workers had to be supplemented every year.

(ii)

The recruitment of operatives becomes, in consequence, an important issue. The operative recruitment extended as far out as 1,000 km from the mills. It was already stated in the establishment period of the cotton-spinning industry in Japan that "the majority of operatives working at each mill are recruited out in the country and an extremely small number are recruited directly at the mills."[3] The system of operative recruitment thus becomes increasingly important. According to a survey on the recruitment routes of 21,852 female operatives in 1927, those who were recruited by company-designated recruitment agents accounted for 62.8 per cent; 8.3 per cent were recruited directly by the company; 5.6 per cent were recruited through family members; 5.1 per cent by acquaintances and 0.2 per cent through the employment offices. The percentage recruited by the recruitment agents was thus incomparably high. Although the Employment Exchanges Act was promulgated in 1921, and public employment exchange offices were functioning, female operatives did not use their services at all.

The recruitment agents can be classified into the following categories depending upon their contract.[5]

(1) Recruitment agents hired on a salary basis by a mill. One or several agents were allocated to an area and they recruited operatives whenever they were needed. They were paid well and acted as functionaries to the mill managers.

TABLE 1. The Number of Recruited, Retired and Presently Employed Workers at Kanebō (the Spinning Mill)

	Boarding Female Operatives							
	No. of Operatives at the End of the First Half	Recruited During this Period	Retired During this Period	Those Transferred in	Those Transferred out	Presently Employed	Mobility Rate %	Transfer Rate %
1912(F)	8,629	4,303	3,307	519	873	9,271 (61.6)	104.3	16.1
(L)	9,271	3,969	3,295	388	456	9,877 (63.8)	87.5	9.1
1913(F)	9,877	4,823	3,779	270	665	10,526 (65.0)	96.6	9.5
(L)	10,526	3,391	3,768	331	1,091	15,676 (73.6)	81.5	13.5
1914(F)	10,106	3,395	3,441	268	429	9,899 (62.9)	74.5	6.9
(L)	9,899	2,900	3,463	443	707	9,072 (62.1)	75.9	11.6
1915(F)	(1) 9,711	2,150	3,288	308	577	8,304 (60.2)	65.1	9.1
(L)	(2) 8,295	3,036	2,733	255	385	8,468 (61.0)	77.3	7.7
1916(F)	8,468	2,874	2,788	229	366	8,417 (60.4)	73.9	7.0
(L)	(3) 8,419	2,009	2,030	294	400	8,290 (60.9)	56.2	8.2
1917(F)	8,290	3,035	2,622	298	452	8,549 (61.6)	77.3	9.0
(L)	8,549	3,937	2,739	515	614	9,652 (63.8)	91.3	13.2
1918(F)	9,652	3,541	3,501	448	157	9,451 (64.2)	79.2	6.3
(L)	9,451	3,056	3,425	909	1,162	8,829 (63.7)	90.5	21.9
1919(F)	8,828	4,379	3,531	502	735	9,443 (62.9)	103.6	14.0
	Male Operatives							
1912(F)	5,249	2,168	1,965	553	223	5,782 (38.4)	93.5	14.8
(L)	5,782	1,701	1,996	394	282	5,599 (36.2)	75.6	11.7
1913(F)	5,599	1,748	1,816	328	181	5,678 (35.0)	72.7	9.1
(L)	5,678	1,792	2,007	463	292	5,634 (26.4)	80.2	13.3
1914(F)	5,634	1,671	1,679	417	207	5,836 (37.1)	70.5	11.6
(L)	5,836	1,365	1,887	390	177	5,527 (37.9)	65.4	9.7
1915(F)	5,592	1,229	1,457	362	234	5,492 (39.8)	58.7	10.7
(L)	5,475	1,410	1,572	299	195	5,417 (39.0)	63.5	9.0
1916(F)	5,417	1,595	1,635	299	167	5,509 (39.6)	68.2	8.6
(L)	5,510	1,200	1,446	280	211	5,333 (39.1)	56.9	8.9
1917(F)	5,333	1,377	1,540	326	176	5,326 (38.4)	64.1	9.4
(L)	5,326	1,809	1,730	359	287	5,477 (36.2)	78.6	12.1
1918(F)	5,477	1,434	1,729	371	276	5,277 (35.8)	69.6	11.8
(L)	5,277	1,525	1,789	405	385	5,033 (36.3)	77.8	15.0
1919(F)	5,030	2,134	1,875	522	239	5,572 (37.1)	94.8	15.1

(F): First half of year
(L): Latter half of year

TABLE 1. (Continued)

	No. of Operatives at the End of the First Half	Recruited During this Period	Retired During this Period	Those Transferred in	Those Transferred out	Presently Employed	Mobility Rate %	Transfer Rate %
	Commuting Female Operatives							
1912(F)	2,817	1,074	954	53	96	2,894	77.3	5.3
(L)	2,894	994	962	58	90	2,894	72.7	5.1
1913(F)	2,894	998	893	48	87	2,960	70.0	4.7
(L)	2,960	1,252	1,154	155	102	3,111	90.0	8.7
1914(F)	3,111	791	777	72	48	3,149	54.5	3.9
(L)	3,149	712	830	107	142	2,996	56.9	7.9
1915(F)	3,106	511	599	239	145	3,112	48.1	12.4
(L)	3,022	763	754	114	157	2,988	59.2	9.0
1916(F)	2,988	652	631	100	114	2,995	50.1	7.2
(L)	2,995	863	760	93	106	3,085	60.8	6.6
1917(F)	3,085	913	745	115	137	3,231	61.9	8.2
(L)	3,231	1,278	1,010	434	482	3,451	99.2	28.4
1918(F)	3,451	944	955	270	281	3,429	71.0	16.0
(L)	3,429	1,159	1,173	292	339	3,368	86.4	18.4
1919(F)	3,368	1,165	944	204	249	3,544	76.1	13.5
	Total of Male and Female Operatives							
1912(F)	16,695	7,545	6,226	1,125	1,192	17,947	96.4	13.9
(L)	17,947	6,664	6,253	840	828	18,370	81.3	9.3
1913(F)	18,370	7,569	6,488	646	933	19,164	85.1	8.6
(L)	19,164	6,435	6,929	949	768	18,851	78.7	9.0
1914(F)	18,851	5,857	5,897	757	684	18,884	70.0	7.6
(L)	18,884	4,977	6,180	940	1,024	17,595	69.5	10.4
1915(F)	18,409	3,890	5,344	909	956	16,908	60.3	10.1
(L)	16,792	5,209	5,059	668	737	16,873	69.5	8.4
1916(F)	16,873	5,121	5,054	628	647	16,921	67.9	7.6
(L)	16,924	4,072	4,236	665	717	16,708	57.3	8.2
1917(F)	16,708	5,325	4,907	739	759	17,106	70.2	9.0
(L)	17,106	7,024	5,479	1,312	1,383	18,580	88.8	15.8
1918(F)	18,580	5,919	6,185	1,109	1,266	18,157	77.9	12.8
(L)	18,157	5,740	6,387	1,606	1,886	17,230	86.0	19.2
1919(F)	17,226	7,678	6,350	1,228	1,223	18,559	95.7	14.2

Source: Data based upon Kanebō's Eigyō-Seiseki Hōkokushō on each term.

Note : 1) The figures 1. 2. 3. do not coincide with the figures of those presently employed for the previous period. 1. is because a new mill was opened in Ōsaka. Although the reason for the inconsistency regarding 2. and 3. are unknown, the figures are presented as they were in the original data.

2) The mobility rate is calculated as follows: (The Number of Newly Recruited + Retired + Transferred In + Transferred Out)÷(The Number of Operatives at the End of the First Half). The transfer rate is calculated as follows: (The Numbers of Transferred In + Transferred Out)÷(The Number of Operatives at the End of the First Half). It is assumed that transfer denotes those who moved from one Kanebō mill to another one in the same concern. Should this be the case, the numbers of those who transferred in and out would be the same, but this is not the case.

TABLE 2. The Number of Recruited, Retired and Presently Employed Workers at Kanebō (the Cotton Textile Mill)

	No. of Operatives at the End of the First Half	Recruited During this Period	Retired During this Period	Those Transferred in	Those Transferred out	Presently Employed	Mobility Rate %	Transfer Rate %
	Boarding Female Operatives							
1912(F)	2,762	1,094	1,028	234	276	2,776 (71.9)	95.3	18.5
(L)	2,776	1,599	1,208	86	163	3,030 (73.6)	110.1	9.0
1913(F)	3,090	1,811	1,225	188	217	3,647 (74.8)	111.4	13.1
(L)	3,647	1,619	1,586	356	609	3,427 (72.3)	114.3	26.5
1914(F)	3,427	1,021	1,258	192	283	3,099 (68.2)	80.4	13.9
(L)	3,099	1,622	1,336	429	508	3,306 (70.7)	125.7	30.2
1915(F)	3,808	1,498	1,543	462	662	3,563 (69.5)	109.4	29.5
(L)	3,563	1,330	1,462	86	154	3,363 (67.9)	85.1	6.7
1916(F)	3,363	802	1,130	47	131	2,951 (63.6)	62.7	5.3
(L)	2,951	1,158	1,119	65	100	2,955 (64.5)	82.8	5.6
1917(F)	2,955	1,126	1,108	54	110	2,917 (63.7)	81.2	5.5
(L)	2,917	1,682	1,122	228	269	3,436 (67.6)	113.2	17.0
1918(F)	3,436	1,589	1,387	198	234	3,602 (66.5)	99.2	12.6
(L)	3,602	2,640	1,850	331	249	4,474 (70.1)	140.8	16.1
1919(F)	4,474	2,789	2,202	275	358	4,978 (70.1)	125.7	14.1
	Male Operatives							
1912(F)	919	439	376	162	61	1,083 (28.1)	112.9	24.3
(L)	1,083	461	496	105	68	1,085 (26.4)	104.3	16.0
1913(F)	1,085	560	488	128	56	1,229 (25.2)	113.5	17.0
(L)	1,229	617	557	140	119	1,310 (27.7)	116.6	21.0
1914(F)	1,310	552	485	139	73	1,443 (31.8)	90.3	16.2
(L)	1,443	430	547	109	63	1,372 (29.3)	79.6	11.9
1915(F)	1,424	747	674	154	88	1,563 (30.5)	116.8	17.0
(L)	1,563	630	647	124	79	1,592 (32.1)	94.7	13.0
1916(F)	1,592	661	631	128	59	1,691 (36.3)	92.9	11.7
(L)	1,691	511	617	103	61	1,627 (35.5)	76.4	9.7
1917(F)	1,627	540	555	97	49	1,660 (36.3)	76.3	9.0
(L)	1,660	655	654	137	50	1,648 (32.4)	90.1	11.3
1918(F)	1,648	696	663	220	90	1,811 (33.5)	101.3	18.8
(L)	1,811	681	690	209	101	1,910 (29.9)	92.8	17.1
1919(F)	1,910	824	711	211	111	2,123 (29.9)	97.2	16.9

(F): First half of year
(L): Latter half of year

TABLE 2. (Continued)

	Commuting Female Operatives							
	No. of Operatives at the End of the First Half	Recruited During this Period	Retired During this Period	Those Transferred in	Those Transferred out	Presently Employed	Mobility Rate %	Transfer Rate %
1912(F)	557	168	168	42	21	578	71.6	11.3
(L)	578	223	210	27	17	601	82.5	7.6
1913(F)	601	215	156	31	34	657	72.0	10.8
(L)	657	292	176	62	56	679	89.2	18.0
1914(F)	679	182	162	23	32	689	58.9	8.1
(L)	689	176	203	48	73	637	72.6	17.6
1915(F)	728	251	189	72	57	805	78.2	17.7
(L)	805	213	255	56	50	769	71.3	13.2
1916(F)	769	197	182	51	43	792	61.5	12.2
(L)	792	229	211	36	37	809	64.8	9.2
1917(F)	809	199	158	47	44	853	55.4	28.2
(L)	853	313	202	109	119	954	98.7	26.7
1918(F)	954	261	208	100	49	1,058	64.8	15.6
(L)	1,008	394	302	139	93	1,146	92.1	23.0
1919(F)	1,146	420	250	111	130	1,297	79.5	21.0
	Total of Male and Female Operatives							
1912(F)	4,238	1,701	1,572	386	358	4,395	94.8	17.6
(L)	4,395	2,283	1,914	218	248	4,734	106.1	10.6
1913(F)	4,734	2,586	1,869	347	307	5,491	107.9	13.8
(L)	5,491	2,428	2,319	558	784	5,374	110.9	24.4
1914(F)	5,374	1,755	1,906	354	388	5,189	81.9	13.8
(L)	5,189	2,228	2,086	586	644	5,273	106.8	23.7
1915(F)	5,273	2,496	2,406	688	807	5,244	121.3	28.4
(L)	5,244	2,173	2,364	267	283	5,037	97.0	10.5
1916(F)	5,037	1,660	1,943	226	233	4,747	80.6	9.1
(L)	4,747	1,898	1,947	204	198	4,704	87.4	8.5
1917(F)	4,704	1,865	1,821	198	203	4,743	86.9	8.5
(L)	4,743	2,650	1,978	474	538	5,351	108.8	21.3
1918(F)	5,351	2,546	2,258	518	423	5,734	107.4	17.6
(L)	5,734	3,715	2,842	679	443	6,843	127.6	19.6
1919(F)	6,843	4,033	3,163	597	599	7,711	122.6	17.5

Source: Data based upon Kanebō's Eigyō-Seiseki Hōkokusho on each term.

Note : 1) The figures 1. 2. 3. do not coincide with the figures of those presently employed for the previous period. 1. is because a new mill was opened in Ōsaka. Although the reason for the inconsistency regarding 2. and 3. are unknown, the figures are presented as they were in the original data.

2) The mobility rate is calculated as follows: (The Number of Newly Recruited + Retired + Transferred In + Transferred Out)÷(The Number of Operatives at the End of the First Half). The transfer rate is calculated as follows: (The Numbers of Transferred In + Transferred Out)÷(The Number of Operatives at the End of the First Half). It is assumed that transfer denotes those who moved from one Kanebō mill to another one in the same concern. Should this be the case, the numbers of those who transferred in and out would be the same, but this is not the case.

(2) Private placement agencies which entered into a special contract with a mill. These were paid on a commission basis whenever they could supply the mills with new operatives. Although reputable local placement agencies entered into these contracts with the mills, the private agencies were after profit. Consequently, they were an evil influence, for in order to receive as large a commission as possible, they enticed not only sickly people but also those who had no desire the work in the mills.

(3) Recruitment agents who were hired on a salary basis and were, in addition, paid a commission whenever operatives were recruited.

(4) Mill employees who were sent out for recruitment whenever there was a shortage of labour. Although this system eliminated the abuses of the recruitment agents and placement offices, it had its demerits because it was very expensive and it failed to gather the necessary number of workers.

(5) While allocating recruitment agents as well as relying on placement offices, the mills sent out their employees whenever needed in order to supervise these people and recruit directly. This method, however, was hampered by all the disadvantages of the above-mentioned methods and was generally used whenever there was a shortage of labour.

Those involved in recruitment ran about trying to secure as many girls as possible and they often relied upon honeyed words and lies. There were even cases of virtual kidnapping simply to secure another recruit. The situation became so bad that various prefectural local authorities had to establish regulations in order to curb some of the abuses. This culminated in a 1924 ordinance issued by the Ministry of Internal Affairs as the "Control of Labour Recruitment Ordinance," which provided the legal basis for nationwide control.[6] The "period of free competition" with regard to the recruitment of female operatives thus came to an end.[7] Consequently, each mill established its own labour affairs branch office in the country and relied upon the previously-stated fifth method for recruitment (Table 3).

The recruitment cost around 1897 when a female operative's daily wage was 8-9 sen was described as follows: "it costs a maximum of 6 yen 60

TABLE 3. The Number of Branch Offices of Labour Affairs

(1939)

Prefecture	No. of Branch Offices	Prefecture	No. of Branch Offices
Kagoshima	20	Kōchi	6
Niigata	18	Fukushima	4
Yamagata	14	Shimane	4
Okinawa	14	19 others	38
Miyazaki	12		
Nagano	10		
		Nationwide Total:	140

Source: Data owned by Tōyōbō, Bōseki Rōmusha ni Kansuru Shiryō, Dainippon Bōseki Rengōkai.

sen and a minimum of 30 sen to recruit one person. It costs a maximum of 8 yen 45 sen and a minimum of 40 sen to bring one operative to the mill."[8] The amount representing the recruitment cost in proportion to the production cost per bale was not at all negligible (Table 4). Moreover, according to the aforementioned survey of 1927, the majority of these female operatives, 67.1 per cent, came from a "farming and fishing background." 6.7 per cent of them had a "merchant" background and those with a "labouring" background accounted for only 6.3 per cent. As for reasons for seeking employment, as many as 17.2 per cent stated that they "wished to become self-supportive or to save money for their trousseaus," which implies that there would be one less mouth to feed at home. However, the first and foremost reason, given by 69.3 per cent, was that they wanted to "help the family finances."[9] Due to the semi-feudal and parasitic large landownership system which existed in Japan prior to World War II, farmers sought to relieve their financially deprived status by sending girls out of the rural village to a city mill to work for a short period, in order to supplement the family finances by borrowing money in advance. Thus it became the pattern to "make payment of the exorbitant tenant rents possible by supplementing wages, while by virtue of the supplement the wage itself is made low."[10]

TABLE 4. Average Expenses per Bale of Cotton Yarn at Kanegafuchi Bōseki Co., Ltd.

(Unit: Yen)

			Employees' Salaries	Operatives' Wages	Expenses on Operatives	Of which the Recruitment Cost	Total Expenses
1915 First Half of the Year	Gassed Yarn	A	4.613	21.399	2.413	0.565	50.415
	Medium Yarn	B	2.103	8.202	0.767	0.087	21.379
	Thick Yarn	C	1.030	4.895	0.450	0.067	12.035
1916 First Half of the Year		A	3.789	20.545	2.979	0.729	48.484
		B	1.670	7.296	0.710	0.089	18.471
		C	1.670	7.296	0.710	0.103	19.239
1917 First Half of the Year		A	4.594	22.453	5.961	1.657	63.329
		B	1.868	7.893	1.316	0.178	23.617
		C	0.988	5.277	0.994	0.151	15.204

Source: Compiled from Gijutsu Kaishō, nos. 2, 4 and 6, owned by Kanebō.

The significance of the system of operative recruitment can be summarized as follows. The tenant farmers and petty farmers who sent out female labour were, in fact, no different from wage-earners themselves. However, even though they tilled the leased land, they could not spontaneously become wage earners so long as they were connected to the land, and thus they were only latent wage earners. It can be said that the system of operative recruitment acted as a medium to transfer such latent wage earners into real wage earners. Female operatives were accomodated at the dormitories of the mills far away from their native homes.[11] The majority of male operatives, along with a handful of female operatives, were recruited at the mill. In such cases the women were usually married and they became commuting operatives.

NOTES

1. Izumi, "Taishō Menbō no ...," pp. 30-41.

2. The labour mobility rate here denotes mobility between mill and home, namely to become wage earners or to stop being wage earners, rather than mobility between one mill and another.

3. Dainippon Bōseki Rengōkai Geppō, No.123, Dainippon Bōseki Rengōkai (25 Dec. 1902), p. 14.

4. Chūō Shokugyō Shōkai Jimukyōkai, Bōseki Rōdō Fujin Chōsa (1929) p. 29.

5. Dainippon Bōseki Rengōkai Geppō, op. cit., pp. 14-15.

6. Takejirō Shindō, Nippon Mengyō Rōdōron, Tokyo Daigaku Shuppankai (1958), pp. 68-70.

7. Wakizō Hosoi, Jokō Aishi, Iwanami Bunko (1954), p. 55.
Riuemon Uno, a believer in labour/capital conciliation (Hiroshi Awai, Nippon ni Okeru Rōshi Kyōchō no Teiryū, Waseda Daigaku Shuppanbu ([1978], "Jo", p. iii) states as follows:

> The employees in charge of personnel at mills are preoccupied with keeping up with the whims of these recruitment agents. It is a fact that they try their utmost to please the recruitment agents. It is not rare that the agents demand unjust payment to the employees, and the extent to which the abuses are in effect is quite great... In view of the difficulties faced by the mill managers in the Osaka area in controlling the recruitment agents, many mill managers desire to recruit operatives without relying upon agents. Some mill managers have sent out

employees to recruit directly and others have relied upon the introductions given by the parents of operatives. They have tried all possible ways. (Uno, Shokkō Mondai Shiryō, Dai-ichi-shū, Kōgyo Kyōikukai Shuppanbu ([1912], p. 256.)

8. Dainippon Menshi Bōseki Dōgyō Rengōkai, Bōseki Shokkō Jijō Chōsa Gaiyōsho (1898, cited in Rōdō Undō Shiryō Iinkai ed., Nippon Rōdō Undō Shiryō, vol. 1, Chūō Kōrōn Jigyō Shuppan (1962), p. 260.

9. Izumi, "Taishō Menbō no...," pp. 44-45.

10. Yamada, op. cit., p. 21.

11. The dormitory was different from the kind that one usually associates with a welfare facility. It was provided for the female operatives as a means to prevent them running away, to secure the necessary labour for the day and night two-shift work hours, and to maintain the low wage standard by cutting down on their living expenses in the city.

On-the-Job Training of Operatives

(i)

The educational level of the workers recruited by the spinning mills is as shown in Table 1. Between 1910 and 1920, more than half the female operatives were either uneducated or elementary school drop-outs. Many of the male operatives were either elementary school graduates or drop-outs, although there were quite a number of male operatives who either finished higher elementary school or dropped out. In the 1920s, however, elementary school graduates became predominant due to the influence of compulsory education. The proportion of the male operatives who finished higher elementary school became greater in the 1930s, and uneducated or elementary school drop-outs became an exception. Table 1 Annex gives a comparison of educational levels in the entire textile industry. Since the survey took place in the 1920s, it reveals the existence of a sizable number of female operatives who finished higher elementary school even though the proportion of regular elementary school graduates was the highest. Consequently, it is probable that the educational level of the spinning-mill workers was the standard existent among the operatives of the entire textile industry. Thus, a certain educational standard had

TABLE 1. An Educational Survey of Operatives in the Spinning Industry

(Unit: persons)

	1918		1925		1925		1927		1934		1935	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Uneducated	3,662	19,885	14	64	5	33			15	545	8	201
	(8.5)	(14.7)	(8.5)	(7.2)	(1.9)	(3.0)			(0.5)	(2.8)	(0.3)	(1.1)
Literate	2,384	10,264										
	(5.5)	(7.6)										
Illiterate	1,278	9,621										
	(3.0)	(7.1)										
							Less than Elementary School Drop-out					
Elementary School	10,008	47,970	14	91	27	153	4,327	(19.8)	101	383	64	243
Drop-out	(23.3)	(35.5)	(8.5)	(10.2)	(10.3)	(13.9)			(3.2)	(1.9)	(2.4)	(1.4)
" Graduate	14,865	56,853	77	718	134	791	14,695	(67.25)	1,485	1,398	1,036	12,335
	(34.6)	(42.0)	(47.0)	(80.9)	(51.0)	(71.6)			(47.5)	(71.1)	(38.6)	(69.7)
Higher Elementary	5,057	5,813	16	3	24	43	1,132	(5.18)	173	1,436	174	1,414
School Drop-out	(11.8)	(4.3)	(9.8)	(0.3)	(9.1)	(3.9)			(5.5)	(7.3)	(6.5)	(8.0)
" Graduate	7,637	4,367	37	11	60	74	1,097	(5.02)	1,210	3,154	1,268	3,365
	(17.8)	(3.2)	(22.6)	(1.2)	(22.8)	(6.7)			(38.7)	(16.0)	(47.3)	(19.0)
Jr. High School	1,232	268			7	6	68	(0.31)	39	65	57	67
Drop-out	(2.9)	(0.2)			(2.7)	(0.5)			(1.2)	(0.3)	(2.1)	(0.4)
" Graduate	503	94	1	1	6	4	49	(0.22)	79	78	63	69
	(1.2)	(0.1)	(0.6)	(0.1)	(2.3)	(0.4)			(2.5)	(0.4)	(2.3)	(0.4)
High School Graduate			More than H.S.Graduate								10	-
			1	-							(0.4)	
University Graduate			(0.6)								1	-
											(0.0)	
Others							484	(2.21)	23	37		2
									(0.7)	(0.2)		(0.0)
Total	42,964	135,250	164	888	263	1,104	21,852		3,125	19,675	2,681	17,696
	(100)	(100)	(100)	(100)	(100)	(100)	(100)		(100)	(100)	(100)	(100)
The Sample of the Survey	247 Mills		Fukui Pref.		Kagawa Pref		34 Mills		Hyōgō Pref. 19 Mills		Hyōgō Pref. 14 Mills	

Source: Shakai-kyoku, Rōdō-bu, Kōjō Kantokukan Nenpō, Nos. 3, 10, 19 and 20 (but data for 1927 from Chuō Shokugyō Shōkai Jimukyoku, op. cit., pp. 16-19).

TABLE 1 - ANNEX An Educational Survey of Operatives in the Textile Industry

(unit: persons)

		1924		1927	
		Male	Female	Male	Female
Uneducated		5,574	38,903	4,937	30,516
		(4.0)	(6.5)	(3.3)	(4.8)
Elementary School	Drop-out	17,013	105,216	12,870	71,397
		(12.3)	(17.6)	(8.6)	(11.3)
"	Graduate	62,600	409,994	68,776	465,659
		(45.3)	(68.6)	(45.7)	(73.4)
Higher Elementary School	Drop-out	9,890	14,351	10,444	22,842
		(7.2)	(2.4)	(6.9)	(3.6)
"	Graduate	35,496	16,138	45,538	33,618
		(25.7)	(2.7)	(30.3)	(5.3)
Practical Training School	Drop-out	774	2,572	691	2,105
		(0.6)	(0.4)	(0.5)	(0.3)
"	Graduate	819	1,123	1,173	4,035
		(0.6)	(0.2)	(0.8)	(0.6)
Jr. High School	Drop-out	2,684	3,320	2,889	2,127
		(1.9)	(0.5)	(1.9)	(0.3)
"	Graduate	1,895	523	2,780	1,528
		(1.4)	(0.1)	(1.8)	(0.2)
More than Technical High School	Graduate	145	13	177	5
		(0.1)	(0.0)	(0.1)	(0.0)
Others & Unknown		1,290	5,380	139	708
		(0.9)	(0.9)	(0.1)	(0.1)
Total		138,180	597,533	150,414	634,540
		(100)	(100)	(100)	(100)
The Sample of the Survey		3,241 Plants		3,379 Plants	

Source: Naikaku Tōkei-kyoku, Rōdō Tōkei Jitchi Chōsa Hōkoku (1924 and 1927 editions), Tōkyō Tōkei Kyōkai (1927, 1930).

been achieved by the workers of the Japanese cotton-spinning industry. Should the educational level coincide with the quality of labour, it is permissible to state that the labour quality for spinning was relatively high.

These workers received a varied education according to the independent system of education provided by each mill. Based upon the general pattern, boarding female operatives could benefit from the following: elementary school education, girls' high school education, courses on domestic affairs, courses on labour, itinerant school, lectures, religious discourses,

a bulletin, a library, a circulating library, a girls' association, a women's association, travelling, farming, sports competitions, choirs and games. Commuting female operatives could benefit from a wives' association, courses on handicraft, lectures and a children's association. As for the male operatives, there were: technical school education, adult lectures, a military branch association, a youth training centre, apprentice school, lectures, library, courses on labour, travel and a heads of household association.[1] Elementary school education was available for those who were either uneducated or elementary school drop-outs. Most of this was established in the form of private elementary schools within a mill or dormitory. These schools mainly provided regular elementary education, but some also provided higher elementary education. They had two consecutive hours of classes per day after work.[2] There were cases such as that of Fuji Gas Spinning, where the boarding female operatives were taught how to read and write and compose essays at night in the dormitory corridors under a so-called corridor itinerant school system.[3] In addition, although this does not appear to have been prevalent, there were cases where girls' high schools were established for the female operatives who had finished elementary school. In spite of the fact that they benefitted from this only for a short while, they were able to achieve a higher educational level (Table 2).

(ii)

Apart from such general education, technical training necessary for new male and female operatives was provided. There was a method of "apprenticeship" whereby a newly recruited operative was put as an apprentice under the care of an experienced operative, from whom he received practical training. There was also a method of training conducted in a special training room to teach necessary skills systematically.[4] Although the former method prevailed at the beginning, once scientific plant management and research on standard motions came to the fore after 1910, major plants began to rely upon the latter.

According to Jokō Aishi [A tragic history of female operatives], the training process of the newly recruited operatives at Tōyōbō Textile

TABLE 2. Cases of Establishing Girls' High Schools at Spinning Mills

	No. of Boarding Female Operatives	Of which the No. of Students		Attendance Rate	Oldest Age	Youngest Age	Average Age	No. of Teachers	No. of Students per Teacher
	persons	persons	%	%	age	age	age	persons	persons
"A" Mill	342	50	14.6	91	23	14	16	8	6
"B" "	2,561	326	12.7	85	21	13	17	9	36
"C" "	2,248	50	2.2	94	26	14	16	2	35
"D" "	794	54	6.8	68	26	14	18	10	5
"E" "	531	171	32.1	87	18	16	17	11	16
"F" "	1,344	102	7.6	95	25	14	17	4	25

Source: Minoru Yadaka, "Kyōiku Nante Dekirumonoka", Shakai Seisaku Jihō (May 1929), pp. 49-57.

Division, which appears to have had the most systematic programme, was as follows. The Training Department was established to train newly hired female operatives and the following staff members were allocated: the chief of the Training Department; a full-time assistant; trainee inspectors who supervised the new female operatives at the mill and the dormitory; teacher operatives who taught skills; and acting supervisors who took care of the newly recruited female operatives on both public and private matters. The term of training was limited to three months which was then divided into three periods. The first period was more than one but less than two weeks. General explanations and readiness with regard to the entire work process were taught in the first period. Courses of action regarding standard motions were taught in the second period. Lastly, necessary skills required by contract labour were taught, and these were concerned with the application of basic and standard motions. When training in the third period was completed, the new operatives were given on-the-job training as juniors so that they could learn the swift operation achieved by experienced operatives. The standard motions were completely mastered during this period.[5] After completing these training periods, the newly hired operatives were classified according to their skill rating (generally the lowest) and were put to work as contract labour.

On the other hand, the training of newly recruited male operatives according to the example of Kanebō, which started a systematic programme in 1916, was as follows. They were given a total of 66 hours of lecture; first on a general description of spinning[6] for 24 hours, second, 24 hours of lecture on regular technical work and, lastly, 18 hours on special technical work.

Training Programme of the Newly Recruited Male Operatives
(Spinning)

(1) A training centre is established at each mill in order to train skilled and dignified male operatives and also to enable them to adjust to factory labour.

(2) All newly recruited male operatives must be trained at the centre as trainee operatives.

(3) The term of training is defined as follows:
An initial period of four weeks and a second of three weeks.

(4) The trainee operatives are divided into the following three groups for practical purposes:
a. those who will be engaged in skilled work,
b. those who will be mainly engaged in labouring work, and
c. those who may later be transferred to group a, although initially put into group b.

(5) Prior to joining the work as regular male operatives, those who belong to group a and group c are trained for a period of seven weeks (the first and second periods), and those who belong to group b are trained for an initial period of four weeks.

(6) The training schedule
First period, first week:
No apprentice work. Practical instructions from 6 o'clock to 12 o'clock. Tour of the mill from noon to 2 o'clock. One-hour lectures on regular technical work and general topics from 2 o'clock to 4 o'clock.
Second week:
Apprentice work until 12 o'clock. Practical instructions from 1 o'clock to 2 o'clock. One-hour lectures on regular technical work and general topics from 2 o'clock to 4 o'clock.
Third and fourth weeks:
As above.
The second period, fifth week:
Apprentice work for eight hours until 3 o'clock. Practical instruction from 3 o'clock to 5 o'clock. Lecture on special technical work from 5 o'clock to 6 o'clock.
Sixth and seventh weeks:
As above.

(7) The daily wage during the training period is the same as before and the increment is two sen per month.

(8) While receiving lectures and on cleaning days, they are to do six to eight hours of apprentice work.

The following reveals the programme for the newly recruited male operatives at their newly established textile plant in 1916.[7] Regulations (1) to (8) are omitted as they are identical to those for spinning operatives. However, each lecture was one and half hours long every day, and altogether there were 36 hours of general lectures, 36 hours of lectures and regular technical work, 27 hours of special technical work and 72 hours of practical instruction.

Training Programme of Male Operatives at a Textile Plant

(1)-(8) omitted.

(9) Staff members specialized in training are in charge of all aspects related to training education and apprenticeship.

(10) The following staff members are in charge of each section:

General lecturers
Chief of technical work
Personnel in charge of operatives
Lecturers on regular technical work
Personnel in charge of apprenticeship
Lecturers on special technical work

(11) Male operatives who need not have skills are those engaged in the transport or distribution of raw cotton, or the transport of beams, cloth or woof yarns and sewing.

As can be noted above, the training of newly hired male and female operatives at major companies from about 1915 became more systematic, which directly corresponds to the two significant factors of that decade, namely the inclination of mill managers to move toward full-scale rationalization, and the monopolistic stage.

(iii)

Besides such training of the newly-hired, there was on-the-job training of female operatives in the daily work process. Thus there was also a programme to nurture those who would become personnel directly in charge of training or chief of operatives. They functioned as foremen at the work place. Those who were carefully chosen from the operatives were

given quite an advanced level of education on specialized knowledge and technology for a relatively long period of one to one and a half years. The most representative of this system were Kanebō Operatives' School and Tōyōbō's Operative Education Centre.

Let us take the case of Kanebō Operatives' School first. The origin of this school was the Junior Operatives' Training School which was established at their Hyōgo Plant.[8] The effect of this school is unknown. However, faced with a shortage of chief operatives and senior operatives, Kanebō opened Kanebō Operatives' School in 1905 under the direct control of the business department.[9] The following is from the content of the school's schedule:

Kanebō Operatives' School Regulations

Article 1. The objective of this school is to train senior male operatives.

Article 2. Those older than age 15 and 16 with a higher elementary school diploma or with equivalent academic ability, having passed a written examination and a physical examination, can be admitted.

Article 3. Each plant manager can admit those operatives and junior operatives working at his plant who desire to be enrolled. New applicants can be admitted, should they fulfil the requirements stated in Article 2.

Article 4. Those who wish to enter this school with previous experience in spinning shall be admitted with slightly less academic ability, as long as they can pass the physical examination.

Article 5. This school does not charge entrance examination fees nor tuition.

Article 6. Those who wish to seek entrance into this school must submit a <u>résumé</u> with the signature of parents or a guardian.

Article 7. Those who have been admitted must submit a letter of reference, with the signatures of two guarantors and a copy

of the family register, within a week.

Article 8. Only those who are adults and the heads of households and who can be solely responsible for the students' behaviour can become guarantors.

Article 9. The guarantors who put their signatures to the letter of reference must either report to the school or reply immediately should they be requested to come to the school or should enquiries be made.

Article 10. The duration of education is one year.

Article 11. The duration of education is divided into the first and the second semesters.

Article 12. Academic work is mainly taught in the first semester and practical training is mainly given in the second semester.

Article 13. Academic work is divided into the following seven subjects: ...(omitted)

Article 14. Examinations are given at the end of each semester.

Article 15. Textbooks, equipment and clothing are provided while attending this school.

Article 16. While attending this school, room and board are provided by the company. Moreover, a monthly allowance of two yen is provided. However, should a student commute from either his parents' or his relative's house, the equivalent amount is paid to the student.

Article 17. Those who complete the school shall, in accordance with their ability, be recruited and given appropriate positions as senior operatives.

Article 18. Those whose grades are poor and cannot be expected to better their technique and skills shall be ordered to leave the school, and shall be recruited as regular operatives. Nevertheless, the clothing and boarding expenses paid by the company need not be compensated.

Article 19. Those who are lazy and dissolute or absent often from the school without valid reason shall be ordered to leave the school. In this case, the clothing and boarding expenses paid by the company must be compensated.

Article 20. Those who are to leave this school due to family reasons must submit a letter explaining the reasons with the signatures of the guarantors. The above clause is applicable in this case.

Article 21. Those who enter this school must pledge that they will not be recruited by another company in the same industry for five years after graduation.

Article 22. Those who enter this school must pledge that they will work for the plant of this company for three years after graduation.

The academic programme of this school consisted of five hours of daily work which included spinning, arithmetic, physics, and drawing in the first semester, and spinning, arithmetic and applied mechanics in the second. Moreover, after World War I, the company no longer accepted general applicants and only those who had worked at their plant for more than six months could qualify for admission.[11] The school sent out graduates twice a year in March and September and from its opening until the early 1920s there were as many as 1038 graduates. Of those, 443 operatives either died or left the company while 595 remained. Of those who remained at the plant, 44 were operatives-in-charge, 124 were given the same treatment as those who were operatives-in-charge, and 179 were either chief operatives or assistant chief operatives.[12] Table 3 shows the years of graduation and the respective plants with regard to those who remained with the company as of the first half of the 1920s.

However, as the spinning industry developed further, the skills taught by operatives' schools were insufficient for students to "become operatives-in-charge, who are the most important middle-ranking plant workers," and thus a training centre for operatives-in-charge was established in July 1915. Trainees were given a three-month education to

TABLE 3. The Distribution of Kanebō Operatives' School Graduates per Plant During the Early 1920s

(Unit: persons)

Parent Plant \ Class	Graduates																										Special Students					Presently Enrolled	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	1	2	3	4	Total	27	28
Business Dept.								1											1												2		1
Tōkyō		3	1	3	1	3	3	3	2	3	1		1	1		2		2	1	2	1	2	2	6	2	3					48	6	7
Hyōgo	4	5	4	1	1	5	1	4	6	2	5	8	7	6	8	3	5	6	3		2	2	4	7	7	10	1	4	3		34	7	8
Sumido	1						2		1					3		1	1	1	1		1				1	1			3		17	1	2
Nakajima	3	1			1					1			1		2				1			1	1	1		3		2	1		19	1	1
Sumoto	1	1					3	1	2	1	1	1	3	2	6		5	4	3		2	3	1	4	3	4	2	3	5	4	65	2	3
Takasago		1			2	2	2			1	1		1	2	2	1	2		1	2	3	5	7	4	2	2					43	4	4
Miike		3	1					1	1	2		1		1	3	1	2	2	1			2	3	5	3	4			1		37	3	1
Kurume					1							1	1	2	1	2	1	4	1				1	1	4	4		1	1	1	23	2	3
Kumamoto		2	1												2	1			1		1			1	1	1	1	2		1	19	1	2
Nakatsu		1					1	2	1	1			1	1	1	2	4		2	1	1		1	1	3	3					27	1	3
Hakata				3		1	1	2			1		1	2			2	1	1	1	6	5	1	1	1	3					28	2	3
Okayama						1						1	1	1			1	1	1		5		3	6		3					29	3	2
Bizen		1				1	1								1	2		1	2	1				2	1	1		2	4	1	21	1	3
Nishidaiji	2	1										1		1							1			1		1	2	1		3	14	1	1
Wakayama				2	2		1		1				1	2		1										1		1	1	1	14		1
Ōsaka		1			2		1			1		1		3	3	1	4		1	1		1		3	1	2	1	3	1	1	32		4
Kyōto	1			4		2	1			2	1		1			2															15		
Kamikyō						1											1														2		
Shimokyō						1			1	1				2	1			1		1											8		
Okayama Kenshi				2					1			1											1	1		1					8		
Total	12	20	8	15	10	17	17	15	16	15	10	15	19	29	30	17	30	23	29	9	23	21	25	44	29	46	8	19	20	12	595	35	49

Source: Data owned by Kanebō, Kakunen Eigyō Hōkokusho.

become operatives-in-charge,[13] who, as stated, were the personnel in charge of operatives primarily involved in the training of the newly-hired The training of operatives-in-charge can be classified as supplementary education.

In 1922, Kanebō established a "Training School for Cotton Textile Plant Operatives" which was one rank lower than operatives' school. This school gave five hours of specialized practical training, five hours of specialized lectures, one to two hours of lecture on general plant knowledge, and one hour per week of lecture on plant ethics, for those who had a higher academic qualification than elementary school graduation and had been working for the plant for more than one year. This was done for a period of one to two months as reinforcement education.[14]

The school which can be regarded as identical to Kanebō Operatives Training School is Tōyōbō's "Operative Education Centre". This school first opened at Shiokijima Plant in Osaka in 1922, then moved to Yamada Plant in 1926. Of the school's establishment in 1933, 520 graduated from the regular course, 174 finished training on cotton textiles and 1280 completed a short-term training course.[15] The content of the school's programme was as follows:

Regulations Regarding the Operative Training Centre,
Tōyō Bōseki Kabushiki Kaisha[16]

Chapter 1. Objective and Duration of Training

Article 1. The object of this centre is to provide the necessary academic knowledge and skills for weaving.

Article 2. The duration of training is one year.

Chapter 2. Curriculum

Article 3. The following departments are established at this centre, and a student is to major in one of them.
1) Spinning Department, 2) Weaving Department.

Article 4. Each department is subdivided into the following sections and practical training in depth in four of the following sections must be pursued.

Spinning Department

Subject	1st Semester		2nd Semester	
	Total No. of Class Hours	No. of Hours per Week	Total No. of Class Hours	No. of Hours per Week
Ethics, Civics	23	1	23	1
P.E.	-	-	-	-
Japanese, Geography, History	23	1	23	1
English	69	3	69	3
Maths	92	4	69	3
Mechanic	46	2	46	2
Spinning	115	5	92	4
Standard Motions	46	2	92	4
Plant Facility	46	2	92	4
Mechanical Drawing	-	-	-	-
Practical	-	-	-	-
Total	457	-	506	-

Weaving Department

Subject	1st Semester		2nd Semester	
	Total No. of Class Hours	No. of Hours per Week	Total No. of Class Hours	No. of Hours per Week
Ethics, Civics	23	1	23	1
P.E.	-	-	-	-
Japanese, Geography, History	23	1	23	1
English	69	3	69	3
Maths	92	4	69	3
Mechanics	46	2	46	2
Weaving	115	5	92	4
Standard Motions	46	2	92	4
Plant Facility	46	2	46	2
Mechanical Drawing	92	4	92	4
Practical	-	-	-	-
Total	552	-	552	-

1) Spinning Department

i. Scutching Section, ii. Carding Section,

iii. Roving Section, iv. Spinning Section,

v. Yarn-Twisting and Reeling Section

2) Weaving Department

i. Preparation Section,

ii. Starching and Warp Arrangement Section,

iii. Weaving Section, iv. Finishing Section.

Article 5. The following shows the subjects and programme for each department.

The number of hours per course is extended or shortened as necessary. If necessary, lectures are given or exercises are assigned to be done after school or during a recess.

Article 6. Academic courses are taught from eight o'clock in the morning to four in the afternoon. Practical work is done during the day, following the schedule of the maintenance staffers. Military drills are entrusted to the Youth Training Centre at Yamada Plant.

Chapter 3. Semesters and Holidays

Article 7. The semester begins in April and September and the programme is completed in one and half years. The programme is divided into three six-month semesters.

Article 8. The following are the holidays of this centre:
Sundays, national holidays, grand festival days, and a winter vacation from 30 December to 5 January. However, the above is subject to change depending upon the plant holidays.

Chapter 4. Admission, the Period of Attendance and Expulsion

Article 9. Those who are to be admitted to this centre must have good conduct and strong aspirations, and must fulfil the following prerequisites. A written and physical examination must be passed.

1) They should have completed two years of higher elementary school or have equivalent academic ability.

2) There are restrictions according to age. 3) They will be selected from candidates who have worked for this company for more than one year.

Article 10. Candidates must prepare the following documents to be submitted to the manager of the plant.
1) Application form, 2) Résumé and 3) Copy of the family register.

Article 11. The entrance examination consists of both a physical examination and a written examination, based upon the academic level of those who finished higher elementary school in:
1) Spelling and 2) Arithmetic.

Articles 12-16 - Omitted (pertaining to guarantors).

Article 17. While attending this centre, those who misbehave, are tardy or who are in poor academic standing shall be expelled.

Article 18. A diploma shall be given to those who have completed the training successfully.

Chapter 5. Remuneration, Duties and Assistance

Article 19. The students of this centre are treated as operatives hired by this company and rules of employment are thus applied.

Article 20. The students of this centre receive during their period of attendance the following remuneration:
1) Textbooks and necessary equipment for practical training are rented to the students. 2) No tuition is required. 3) The students are accommodated at the dormitory free of charge. 4) Based upon the daily wage received by an operative prior to entering this centre, a fixed monthly salary shall be given. However, they shall be charged for their board. 5) 1 yen is given so as to assist in the uniform cost. 6) A dependency allowance and bonus at the end of a semester shall be paid.

Article 21. Those students who are expelled or drop out must, depending upon the reason, pay compensation, either the full amount or a part of the expenses entailed in the training at this centre.

The Content of Each Subject

*Ethics and Civics:	1) Necessary points on worldly wisdom 2) Civic understanding
*Physical Education:	General P. E.
*Japanese, Geography and History:	Regular sentences, reading and composition, geography and history
*English:	1) Elementary 2) English used at the plant
*Mathematics:	1) Arithmetic 2) Elementary Algebra 3) Factorization needed at the plant
*Mechanics:	1) Material 2) Structure 3) Mechanical Operation
*Spinning:	1) Raw Material 2) Spinning Machinery 3) Additional Machinery 4) Calculation
*Weaving:	1) Raw Material 2) Mechanism of Machinery 3) Additional Machinery 4) Calculation
*Standard Motions:	1) Safety Standard 2) Operation Standard
*Plant Facility:	1) Engine 2) Mechanical Equipment 3) Electricity 4) Lighting 5) Power Transmission 6) Fire Prevention Facility 7) Ventilation 8) Temperature and Humidity

*Mechanical Drawing:	1) Instrumental Drawing 2) Simple Mechanical Drawing 3) Sketches of Mechanical Parts
*Practical:	The students study the inspection of all the machinery in general, and receive practical training on the machinery of their specialization. (The rules pertaining to lectures on spinning and special courses are omitted.)

As shown above, the Japanese cotton-spinning industry, having major companies as its nucleus, carried out extensive systematic training of operatives in the company. Moreover, in the case of Kanebō, they established, under the title of the "Training Programme for the First Grade Technical Trainee", a one-year programme for graduates of higher technical high schools and university engineering departments. The outline of the structure and operation of machinery was taught in the first two months and the first half of the remaining ten months was spent on the study of structure, handling, and safety of machinery, from blending and scutching to drawing. The latter half of this ten-month period was spent on the same kind of study covering the areas from initial spinning to bundling.[17]

Furthermore Kanebō began in 1915 to recruit female workers for engagement in office work and it is pertinent to mention that they established a girls' clerical training centre to train female office workers for three months.[18]

NOTES

1. Minoru Yadaka, "Kyōiku Nanka Dekiru Monoka", Shakai Seisaku Jihō (May 1929), pp. 48-49. A full list is shown, although some of them appear to be more recreational associations than educational circles.

2. Hosoi, op. cit., pp. 233-234.

3. Tarōkichi Sōda, "Saikin Rōdōsha no Kyōka ni Kansuru Nisan no Keikō", Shakai Seisaku Jihō (May 1929), pp. 18-19.

4. Hosoi, op. cit., p. 252.

5. Ibid., pp. 252-267.

6. Mutō Sanji Zenshū Kankōkai, Mutō Sanji Zenshū, rev. ed., Shinjusha (1966), pp. 396-398. Revised the passage referring to the training programme of the newly recruited male operatives (weaving plant), as will be discussed later.

7. Property of Kanegafuchi Bōseki Kabushiki Kaisha, Gijutsu Kaishō, no.24; "Teaching Plans" were as follows:

Teaching Plan for Regular Operatives (36 hours)

1. An outline on spinning (three hours): a) a brief explanation on the types, grades and usages of cotton, b) the process of spinning and the names of machinery.

2. Outline on weaving (three hours): a) yarn counts, b) differentiation between warp and woof yarns, c) handling of spool yarns and the regulations on finding defective spool yarns, d) types of cotton fabrics, e) the origin of looms, f) a brief explanation on the inspection and the grading of goods, g) wage and the rating system, h) an outline on the weaving process, i) finished cotton fabrics and the competition from foreign goods, j) the value of Kowloon chits.

3. The names of machines and the attachments and phrases in constant use (nine hours): a) engines, b) transmission, c) spinning-plant equipment and attached parts, d) weaving-plant equipment and attached parts, e) lighting equipment, f) kinds of machine oil, g) cleaning equipment, h) safety equipment, i) units of weights and measures, j) idioms in constant use.

4. Knowledge of injury prevention (three hours): a) general knowledge, b) knowledge of each section, c) first aid.

5. Knowledge on fire prevention (three hours).

6. General caution at work and reviewing (nine hours).

Teaching Plan for Special Operatives (27 hours)

1. An outline of the names and parts of machines used in the department concerned, and their handling (twelve hours).

2. An outline of the names and usage of the materials used in the department concerned (six hours).

3. Knowledge of danger prevention while on operation in the department concerned (three hours).

4. General knowledge and review of the given task (six hours).

8. This is said to have used the method of operative training prevalent in Europe.
Dainippon Bōseki Rengōkai Geppō, no.111 (25 April 1902), p. 36, regulations are as follows:

Rules Regarding the Training of Junior Operatives at Kanegafuchi Spinning Co.

Article 1: This company seeks young male applicants throughout Japan to be trained as good spinning operatives who can set a model example.

Article 2: The applicants must fulfil the following;
1) Young males older than 11 and younger than 16 years old who have completed elementary school.
2) Those who pass a physical examination given by the company doctor. 3) Those who desire to make spinning operations their profession.

Article 3: Those applicants who have been chosen on the basis of the above-mentioned article shall be called junior operatives, who shall receive three years of training.

Article 4: During the period of junior operative training, junior operatives are first of all assigned to work on both spinning and finishing sections together with female operatives. After developing technical skills together with their physical growth, they are taught how to handle various machines and are given training on operational procedures. In addition to these, they are given regular school lessons in a simple form of school, using their leisure time after their daily work.

Article 5: All necessary daily goods such as food, clothing, shoes, etc., are provided by this company during the period of junior operative training. In addition, a fixed salary in accordance with the rating of their ability is paid during the period of junior operative training:
First rate: 80 sen, second rate: 70 sen,
third rate: 60 sen, fourth rate: 50 sen,
sixth rate: 40 sen.

Article 6: During the period of junior operative training, all junior operatives are accommodated at the company

dormitory established for junior operatives, and no commuter is permitted.

Article 7: There are supervisors at the junior operatives' dormitory to supervise their conduct. The supervisors are kind and thorough in taking care of clothing, washing and provision of sundry goods so that the junior operatives shall not be short of anything.

Article 8: During the period of training, those junior operatives who have diligently completed two years of training shall be given a vacation for at most two weeks. Moreover, if desired, travel expenses shall be given in order to allow them to recuperate at home.

Article 9: Should the junior operative be absent from work on days other than company holidays due to unavoidable accidents or illness for less than 14 days per year, they shall be regarded as work absences.

Article 10: Should one fall ill during the junior operative training period, he shall be treated at the company hospital at company expense. However, should he desire to return home for medical treatment, an appropriate allowance in accordance with his skill and length of service and his travel expenses shall be given to make this possible. However, the above is not applicable when the nature of illness requires medical treatment at home.

Article 11: During the period of junior operative training one shall be requested to leave the company should he fall into any one of the following categories: 1) Those who are not diligent at work. 2) Those who commit any wrong. 3) Those who have no possibility of mastering skills. 4) Those who have fallen ill of an incurable disease. However, travel expenses to return home shall be provided by the company when they leave as result of this type of illness.

Article 12: Those who have completed the period of junior operative training shall be granted a certificate of operative competence.

Article 13: Those who have completed the period of junior operative training are obliged to work as regular operatives at this company for a full three years.

Article 14: When a contract to become a regular operative in accordance with the above article is concluded, a single sum of 100 yen shall be paid to either the operative himself, a designated member of his family

or his guarantor.
Furthermore, his salary shall be based upon the following preferential treatment in order to differentiate him from those who have completed the training of average operatives (omitted).

Article 15: This company shall advance travel expenses to those who cannot afford to come to the company to apply for the position of junior operative. The expenses must be returned upon the completion of training.

Article 16: Those who have been permitted to become junior operatives must submit to this company a contract written in accordance with the attached form and a copy of the family register.

Article 17: Items not specified by these regulations shall be treated in accordance with the rules of employment stipulated in the civil law.

Additional Rules

1. Upon the conclusion of a contract to become a regular operative after completing the period of junior operative training, a sum of 30 yen must be paid to the company simultaneously as guarantee money. This guarantee money, however, can be deducted from the sum of 100 yen which is stipulated by Article 14.

2. The guarantee money stipulated in the above article shall be returned upon completion of three years' service to the company plus an annual interest rate of 10 per cent.

3. Those who have completed the obligation of serving the company for a full three years shall receive the benefit of moving to company housing with inexpensive rental (ibid., pp. 36-37)

9. Mutō Sanji Zenshū Kankōkai, op. cit., p. 390. This school was modelled after various practical schools in Germany, particularly after spinning schools (ibid., vol. 2, pp. 140-141).

10. Ibid., Revised ed., pp. 390-392.

11. Mikio Sumiya, author and editor, Nippon Shokugyō Kunren Hatten-shi, part 2, Nippon Rōdō Kyōkai (1971), pp. 110 and 118.

12. Data owned by Kanebō, 1920 Kamiki Eigyō Seiseki Hōkokusho.

13. Mutō Sanji Zenshū Kankōkai, op. cit., vol. 2, pp. 130-131.

14. Data owned by Kanebō, Gijutsu Kaishō No.8.

15. Tōyō Bōseki Kabushiki Kaisha, Sōritsu Nijūnen Kinen Tōyō Bōseki Kabushiki Kaisha Yōran (1934), pp. 77-80.

16. Shakai-kyoku, Rōdō-bu, Dai Jūnana-kai Kōjō Kantoku Nenkan (1932), pp. 46-51.
Moreover, regulations on spinning and weaving courses and special courses are as follows:

Rules Concerning Spinning and Weaving Courses

Short courses are offered at this company as needed to teach necessary knowledge on spinning and weaving.

1. The duration of a course is four weeks.

2. Those workers who have been working for this company for longer than three years and who are chosen by the plant manager can take these courses.

3. An outline of the subjects and the number of hours:

(1) Ethics: two and Civic virtues: two. (2) Mathematics: five (the four fundamental rules of arithmetic and fractions, ratio, percentages, square and cube roots). (3) Mechanics: five (dynamics and mechanics). (4) Plant equipment: four (general plant equipment). (5) Specialized subject: seven (spinning or weaving). (6) Computation related to the specialized subject: seven (spinning or weaving). (7) Drawing: six (sketches of mechanical parts). (8) Special Lectures: three (latest inventions). (9) Observation of the plant: three.

The total number of hours of the above is 43.

4. The treatment of students:

(1) While enrolled for a course the student is to receive his regular salary.
(2) Round-trip travel expenses provided.
(3) School supplies provided.
(4) Free accommodation at a dormitory.
(5) Free board.

Timetable

	1	2	3	4	5	6	7
Mon.	Maths	Ethics	Calculation	Calculation	Special Lecture	Facility	Facility
Tue.	Special Lecture	Spinning	Spinning	Maths	Drawing	Drawing	Drawing
Wed.	Ethics	Calculation	Calculation	Calculation	Mechanics	Mechanics	Maths
Thu.	Special Lecture	Facility	Spinning	Spinning	Drawing	Drawing	Drawing
Fri.	Mechanics	Mechanics	Maths	Maths	Observation	Observation	Observation
Sat.	Facility	Facility	Calculation	Calculation	Spinning	Spinning	Spinning

Rules on Special Courses

1. There are special courses offered by the Operative Education Centre whenever needed. All the rules pertaining to the Operative Training Centre are applicable to the students of special courses.

2. The duration of training of the students is determined case by case and, depending upon a student, he can be transferred to the Operative Education Centre.

17. Data owned by Kanebō, a report sent to those concerned on 4 January and 27 June, 1908.

18. Mutō Sanji Zenshū Kankōkai, op. cit., vol. 2, pp. 132-133.

Timetable

	1	2	3	4	5	6	7
Mon.	Maths	Special Lecture	Spinning	Spinning		Practical	
Tue.	Ethics	Standard Motions	Standard Motions	English		Practical	
Wed.	Facility	Facility	Spinning Calculation	Spinning Calculation		Practical	
Thu.	Spinning Calculation	Drawing	Drawing	Drawing		Practical	
Fri.	Maths	Standard Safety	Standard Safety	English		Practical	
Sat.	Maths	Mechanics	Mechanics	English		Practical	

III. JAPANESE WAYS OF RATIONALIZATION AND INTERNATIONAL COMPETITIVENESS

Characteristics of Rationalization in Japan

(i)

The rationalization of the Japanese cotton spinning industry is insepatable from the Factory Act which was promulgated in 1911. The execution of the Act had a deferment period of five years until 1 September 1916, and the abolition of night work for young operatives who were under the age of 15 was deferred for 15 years after its execution. Despite the fact that the total deferment period was set at 20 years, the Act signified that the Japanese spinning industry which used night work as its greatest weapon to maximize the operation hours of equipment was put in a position where it was forced to set forth some realistic measures against the restriction laid upon night operations. Rationalization was thus taken up as a solution to this predicament. The aforementioned installation of high-draft spinners and automatic looms as well as the training of operatives all comprised a part of this rationalization process. In addition, due to domestic and foreign criticism of night work at international conferences, the Revised Factory Act was realized in 1923, and finally night work for women was prohibited.

Scientific plant management and standard motions based upon the motion study formulated by an American, F. Tiller, after studying cases at iron factories, were therefore systematically pursued by Japanese spinning-mill managers.[1] Prior to this, however, various measures were taken by the Japanese cotton-spinning industry in order to enhance the management ability of the corporation. For example, after 1905 the system of fixed capital refundment was introduced and, additionally, various reserving was made to make capital more abundant. The cumulative amount of fixed

capital refundment in proportion to paid-up capital was 71 per cent in 1919, and the proportion of reserve funds was increased to 110 per cent in the same year. On the other hand, the ratio of corporation bonds as against paid-up capital was decreased from less than 40 per cent in the early 1910s to 11 per cent in 1920.[2] It is probable that the Japanese cotton-spinning industry had made a remarkable accumulation of internal reserves in the 1910s.[3] This was possible because Japanese cotton spinning had amalgamated the weaving industry in order to specialize in the entire cotton industry; the scale of plants was enormous; and a special cotton-blending method was applied in order to minimize the cost of raw cotton, which was 100 per cent imported. Moreover, the three-item Osaka regular exchange designated cotton brands into standard types, passable types, higher types and lower types. This cost differentiation according to types was enforced from 1909 as the system of standard transaction rates, so as to encourage and maximize the yarn qualities produced by each mill.[4]

Furthermore, the Japanese cotton-spinning industry adopted spinning and weaving calculations in order to compare the production costs at each individual mill. A comparative inventory per bale of cotton yarn including the following items was formulated: employees' salaries, electric supplies, power costs, miscellaneous costs, lighting costs, various raw cotton costs, packing costs of finished cotton yarns, transportation costs of finished cotton yarns, transportation costs of waste cotton yarns, costs of dropped cotton, packing costs of waste yarns, repair costs of machinery, various repair costs, fire insurance, various expenses on operatives, labourers' wages, travel expenses, postage expenses, transportation costs, office expenses, sanitation expenses, depreciation costs of electric goods and gas charges. A comparative inventory per 100 tan of cotton textiles or per million shuttling including the following items was also formulated: employees' salaries, operatives' wages, plant expendable supplies, starching, electric supplies, power, miscellaneous expenses, lighting costs, packing costs of cotton textiles, transportation costs of cotton textiles, packing costs of waste textiles, transportation costs of waste textiles, repair costs of machinery, various other costs, fire insurance, various expenses on operatives, labourers'

wages, travel expenses, postage expenses, office expenses, sanitation expenses and depreciation costs of necessary goods. Moreover, there were standard calculations to examine the production efficiency of each mill in the spinning industry. These calculations were made on the basis of per bale costs, the number of operatives required per 10,000 spindles, and the average number of workers present per day according to each process of spinning, namely the motor section, the electricity section, the blending section, the scutching section, the carding section, the drawing section, the roving section, the spinning section, the yarn-twisting section (twining, twisting, cop-winding) the gas fuel section, the gassed yarn section, the finishing section, the winder section, the bundling section, the grading section and the engineering section. Similar calculations were made with regard to cotton weaving on the basis of costs per 100 tan of cotton textiles or per million shuttling, wages for a worker per day, the number of operatives per 100 looms and the average number of workers present per day according to each process of weaving, namely, the motor section, the electric motor section, the electric lighting section, the yarn section, the repeating room, the warp arrangement room, the fermentation room, the starching room, the threading room, the loom chamber, the finishing room and the engineering section.[5] At Kanebō, the company started to send out inspectors to their spinning and weaving plants to conduct systematic investigations from about 1907, so that the machine efficiency and the ratio of labour efficiency could be increased.

(ii)

Scientific management and motion study were objectivized through the establishment of standard motions. Standard motions were set out on the basis of the efficient movements of experienced operatives in each process.[6] For example, the work process in the drawing section at Kanebō used to be mapped out per half a frame independently. In view of the fact that there was no consistency among the operatives at work in the same section, some female operatives had to pay constant attention to the entire process. Consequently, it was said that there was considerable loss because it was very difficult to foretell which half a frame would

be full or which back case would be empty. After conducting "scientific studies," motions for all operatives involved in a section were systematically unified in 1920. By utilizing the time gap among frames, it became possible to increase the number of frames per operative without increasing the amount of work for female operatives[7] (Table 1).

TABLE 1. Comparative Ratio of the Number of Drawing Frames to the Number of Operatives

	No. of Frames According to the Existing Method			No. of Frames According to the Revised Method		
	Thick Yarn	Medium Yarn	Gassed Yarn	Thick Yarn	Medium Yarn	Gassed Yarn
No. of Frames	1.5	2.0	1.5	2.5	3	2
No. of Operatives	3	3	3	3	3	2

Source: Kanebō, Gijutsu Kaishō, no.8.

Once the standard motions for each process were established, the standard of equipment, the number of operatives and efficiency were also determined and, in consequence, comparisons of production costs and productivity among mills and among different yarn counts became easier. At about the same time, Kanebō revised the format of inventory expenditure reports used in its cotton-spinning plants. In view of the fact that the conventional inventory expenditure reports were compiled on the basis of itemized expenditures disregarding the types of finished yarns, the comparative tables indicating per bale production costs which were formulated using the inventory could not show per bale production costs according to types of finished yarns. This was not only inconvenient for making comparisons among mills but it was also nearly impossible to grasp accurate production costs. Kanebō thus revised the format of its inventory expenditure reports in 1921 to reveal expenditures on the following four items in the case of a plant which produced regular yarns, gassed yarns, thick yarns for textiles, spools and cheese winding: 1) from scutching to spinning, 2) from yarn-twisting to winding, 3) from yarn-twisting to gassing and 4) from finishing to bundling.[8] It can be stated that this method made the spinning calculations far more exacting.

At the same time, Tōyōbō aimed at establishing more exact conversion rates than the existing conventional rates, as it became necessary to obtain accurate comparisons of productivity among its mills in view of the depression after World War I. In 1921, Tōyōbō began to use a method similar to the uniform price list which was generally used in Lancashire, UK. Under this method, goods produced in greatest volume were given the standard index of 1. The cost-accounting of goods by each individual mill was converted into standard types by multiplication with a fixed coefficient, and a monthly profit-and-loss account was thus compiled.

It therefore became possible for Tōyōbō to compare the results of each mill by using such standards as one bale of "Rod-32" in the case of cotton yarn and 10,000 yards of "Indian-2", which later changed to "Sheeting Dragon C", in the case of fabric. Consequently, it became easier to improve upon mills with a record of poor performance. The conversion-rate method was applied to the cost-accounting of different counts of yarn, which resulted in the decrease of costs of one bale of No.20 cotton yarn, then 50 to 60 yen, to about 14 yen less within five to six years. These methods are said to have greatly contributed to the promotion of business rationalization of all the mills.[9]

Due to labour reinforcement on the basis of standard motions, the number of operatives was reduced drastically. As shown in Table 2, there were overall cutbacks of operatives from the latter half of 1914 to the end of 1926 in Kanebō, with two or three exceptions. Therefore it can easily be seen that the aforementioned company education was closely linked with the training of operatives who could withstand such exacting labour for many hours. Kurashikibō established the "Standard Regulations for the Operative Physical Examination" in 1920, and in 1923 the company established the "Standard Regulations for the Operative Aptitude Test," so that the recruitment of operatives was made more selective.[10] As can be seen by these regulations, the Japanese cotton-spinning industry began to aim at securing operatives with certain qualifications, again related to the changes pertaining to the methods of operative recruitment.

As is shown in Table 2, rationalization pursued by the cotton industry in Japan was synonymous with increased labour productivity in proportion to the number of frames worked by the operatives. The same holds true for the weaving process. The manufacturer of the Toyota automatic looms aptly recognized the value of automatic looms as follows: "The major objective of automatic looms is drastically to reduce the number of operatives required per loom through the use of automated shuttles."[11] Table 3 reveals that, on the basis of conventional looms, one female operative was in charge of 3.3 looms, while her responsibility soared to 25 looms after the installation of automatic looms, resulting in a drastic reduction of operatives and wages. However, the mechanical efficiency of automatic looms was only slightly higher than that of regular looms (Table 4). It can thus be understood that the process of rationalizing the cotton industry in Japan, which started in the 1910s, was primarily aimed at improving labour productivity based upon the reduction of operatives rather than enhancing mechanical efficiency, except for the transformation from hand looms to power looms.

TABLE 2. A Comparison of the Number of Operatives per 10,000 Spindles

(unit: persons)

	Latter Half of 1914		25 Dec. 1926		Ratio of Increase/ Decrease (%)	
	male	Female	Male	Female	Male	Female
Blending	2.8	4.6	1.9	1.1	Δ 32.1	Δ 76.1
Scutching	6.1		4.7		Δ 23.0	
Carding	14.1		10.1	1.3	Δ 28.4	
Drawing	0.4	17.0	0.6	8.7	Δ 50.0	Δ 48.9
Roving	9.7	63.4	7.6	44.3	Δ 21.6	Δ 30.1
Spinning	19.4	133.2	9.6	79.8	Δ 50.5	Δ 40.1
Sub-Total	52.5	218.2	34.6	135.2	Δ 34.1	Δ 44.2
Yarn-twisting	32.5	308.5	23.3	172.1	Δ 28.3	Δ 44.2
Gassing	2.2	6.4		1.2	Δ100.0	Δ 81.3
Finishing	10.5	120.9	8.5	64.5	Δ 19.4	Δ 46.7
Bundling	11.5	3.7	5.7	2.4	Δ 50.4	Δ 35.1
Classifying	2.8	4.3	1.4	1.7	Δ 50.0	Δ 60.5
Additional Engineering	4.2	2.7	1.8	3.6	Δ 57.1	Δ 33.3

Source: Kanebō, Gijutsu Kaishō, no.10.

TABLE 3. Comparative Number of Workers and Labour Costs per 1,000 Looms (1 October, 1926)

			Regular Looms	Automatic Looms	Ratio of Increase/ Decrease %
			persons	persons	
The Details of Required Operatives	Female Operatives (Single Shift)	In Charge of Looms	300	40	Δ 86.7
		Floorwalkers	45	10	Δ 77.8
		Daily Wages	30	10	Δ 66.7
	Male Operatives (Single Shift)	Repairs and Reserve Looms	20	9	Δ 55
			10	10	0
		Business and Others	8	8	0
	Male Operative (Day Shift)	In Charge of Safety	13	7	Δ 46.2
		Cleaning and Oiling	12	12	0
The Total of Required Operatives	Double Shift	Female Operatives	750	120	Δ 84
		Male Operatives	101	73	Δ 27.8
		Sub-Total	851	193	Δ 77.3
			yen	yen	
Annual Wages	Double Shift	Female Operatives	374	69	Δ 81.6
		Male Operatives	62	52	Δ 16.1
		Total	436	121	Δ 72.2

Source: Toyota Jidō Shokki Seisakusho, op. cit., p. 119.

TABLE 4. A Comparison of Loom Efficiency

		Regular Looms	Automatic Looms	Ratio of Increase/ Decrease
Muslin Broadcloth	Rotational Frequency	180	180	
	Output	38.4(yards)	41.7(yards)	8.6%
Jeans	Rotational Frequency	190	190	
	Output	52.6(yards)	57.8(yards)	9.9%
Shirting Broad-cloth	Rotational Frequency	180	180	
	Output	46.3(yards)	50.5(yards)	9.1%

Source: As Table 3.

While the reinforcement of labour was being undertaken, a policy to involve not only the labour quality but also the spiritual quality of female operatives was adopted. Since 1919, Tōyōbō's Himeji Plant had introduced a policy of "Practise Our Motto" which meant that a monthly motto determined by the executive committee, consisting of employees and operatives, was to be posted in the plants, exhorted and put into practice. For example, the following monthly mottoes were used in 1928: "Harmonious Cooperation" in January, "Curtailment of Expenditure" in February, "Improvement of Efficiency" in March, "Thorough Education" in April, and "Serve for Public Morality" in May. The content of the March campaign of "Improvement of Efficiency" was as follows:
(1) Putting up placards showing the motto at each individual office.
(2) Putting up big posters with "Improvement of Efficiency and quality."
(3) Selecting and posting a "Weekly Motto on Efficiency." (4) Comparing the quantity of extracted inferior yarn per section. (5) A prize competition for workers who sent in items to be improved pertaining to their section. (6) Putting up posters relating the motto, "Improvement of Efficiency," to the commemoration of the Ōshū earthquake. (7) Setting aside a special week for quality improvement [e.g. (a) a week concentrating on the decrease of inferior goods and (b) a week on the cleaning of mechanical equipment] (8) Displaying the attendance record per section

for the month of March in accordance with the ranking list of sumō wrestlers. (9) Putting up posters stating "Happiness Grows Out of Diligence and Economy," issued by the Diligence and Economy Committee of the Ministry of Internal Affairs. (10) Summing up the improvement plans which were actuated by each section. (11) Conducting a survey on fatigue among workers-"When do they become most fatigued on a given day?" and "When do they work best on a given day?" (12) Distributing pamphlets entitled "A Summary of Rationalized Cooking" formulated by Mr. Kunitake. (13) Holding demonstration lectures on rationalized cooking. Finally, (14) Putting up small posters on each bulletin board calling for "Improvement of Efficiency," which were donated by Minakami Town Office.[12] It can thus be seen that the Japanese cotton-spinning industry had pursued rationalization since the 1910s with an extreme emphasis upon spirituality.[13]

While on the one hand spirituality of female operatives was fully incorporated into productive efficiency, on the other hand there were cases whereby boarding female operatives were restricted for the entire day. Tōyōbō started to conduct surveys on boarding female operatives, taking in their entire working day (from the time they arose until they finished work), rest periods and sleeping hours. The results of the surveys revealed that their sleeping hours were restricted to seven (eight hours after 1928) and all other time was spent on washing the face; getting dressed; working; hairdressing; defecation; taking a bath; practice; and lessons; while leisure was restricted.[14]

(iii)

Due to the enactment of the Revised Factory Act on 1 July 1929, night work, which had benefited the Japanese spinning industry, was prohibited. Moreover, the gold standard was actualized as of 11 January 1930 due to the 21 November 1929 ordinance to remove the prohibition of gold export which had been in effect since 1917.[15] At the beginning of 1930, the Japanese economy also plunged into the world depression which started when the US stockmarket fell heavily on 24 October 1929. The spinning industry in Japan, directly affected by these trends, attempted to

rationalize itself systematically during the period from 1929 to 1931. Results of a test operation from 1928 to 1929 for rationalization at Kanebō showed that they were able to reduce the number of workers per 10,000 spindles by 25.8 per cent (Table 5) and the number of workers per day for the production of No.40 yarn by 29.5 per cent (Table 6). As mentioned earlier, it was during this period that high-draft spinners, simplex high-draft spinners and automatic looms were adopted, which made further reduction of the number of workers possible.

The reduced number of workers shown in Table 7 and Table 8 reveal that the number of female operatives involved in the spinning process had been reduced by 30.9 per cent from 142,000 persons in 1926 to 98,000 persons in 1931. The reduction ratio with regard to the weaving process was 52.2 per cent from 48,000 persons in 1926 to 23,000 persons in 1931.[16]

Finally Tables 7 and 8 reveal the characteristics of the Japanese cotton-spinning industry. In the case of spinning, the increased output of cotton yarn was supported by the increased spindleage and by the increased output per female operative who was, therefore, made responsible

TABLE 5. Corresponding Number of Workers per 10,000 Spindles

	October 1928 (persons)	October 1929 (persons)	Increase/ Decrease Rate %
Drawing Workers	3.7	3.2	Δ 13.5%
Slubbing Workers	3.6	1.9	Δ 47.2
Intermediate Workers	6.7	3.5	Δ 47.8
Roving Workers	16.6	9.5	Δ 42.8
Dock Workers	2.2	4.1	86.4
Roller Workers	1.0	0	Δ100
Total up to Initial Spinning	30.1	19.0	Δ 36.9
Spinning Spool Workers	15.1	12.3	Δ 18.5
Spinning Treading Workers	46.2	36.1	Δ 21.9
Total of Spinning	61.3	48.4	Δ 21.0
Total	95.1	70.6	Δ 25.8

Source: Kanebō, Gijutsu Kaishō, no. 10.

TABLE 6. Corresponding Number of Workers for the Production of Yarn Count 40

		July 1928		July 1929		
		Total No. of Workers in a Month(27 days)	No. of Workers on Double Shift per day	Total No. of Workers in a Month(28 days)	No. of Workers on Double Shift per day	Increase/ Decrease Rate
		persons	persons	persons	persons	%
Drawing	Frame Workers	140	5.2	94	3.4	Δ 34.6
	Roller Workers	27	1	28	1	0
	Sub-Total	167	6.2	122	4.4	Δ 29.0
Slubbing	Frame Workers	68	2.5	56	2	Δ 20
	Intermediate Workers	124	4.6	106	3.8	Δ 17.4
	Roving Workers	364	13.5	182	6.5	Δ 51.9
	Spool Workers	104	3.9	168	6	53.8
	Wooden Spool Workers	49	1.8	0	0	Δ100
	Sub-Total	709	26.3	512	18.3	Δ 30.4
Spinning	Spool Workers	486	18.0	448	16	Δ 11.1
	Frame Workers	886	32.8	671	24	Δ 26.8
	Yarn Workers	156	5.8	0	0	Δ100
	Floor Cleaning	54	2.0	56	2	0
	Arranging Wooden Spools	54	2.0	56	2	0
	Sub-Total	1,636	60.6	1,231	44	Δ 27.4
	Grand Total		93.1		66.7	Δ 29.5

Source: As Table 5.

TABLE 7. The Transition of Productivity in Cotton Spinning

	Spindleage		No. of Operatives				No. of Spindles per Converted Female Operative		Output		No. of Operation Days		Output per Converted Female Operative		Output per 10,000 Ring Spindles				
	Average per Day		Male	Female	Conversion into Female Operatives		A Person per Day		Spool Yarn		Annual	Per Day	Operative per Hour		Average per Day	Average per Yarn	Conversion to 20	Per Hour	
	1,000 Spindles	Index	Persons	Persons	1,000 persons	Index	Spindle-age	Index	10,000 kan	Index	No. of Days	No. of Hours	Monme	Index	Monme	S	Monme	Monme	Index
1912	1,984	100	18,421	80,779	108	100	36.6	100	6,668	100	319.8	22.4	85.9	100	100.0	23.2	119.6	5.3	100
1913	2,167	109	19,707	88,038	118	108	36.9	101	7,460	112	328.0	22.4	86.3	100	101.3	22.6	117.4	5.2	98
1914	2,369	119	22,163	92,251	125	116	37.8	103	8,132	122	322.4	22.3	90.1	105	101.3	21.4	110.2	4.9	92
1915	2,463	124	22,674	92,500	127	117	38.9	106	8,464	127	307.8	22.4	97.0	113	110.3	21.9	123.3	5.5	104
1916	2,757	139	23,745	97,279	133	123	41.5	113	9,463	142	328.0	22.3	97.3	113	109.6	21.4	119.2	5.3	100
1917	2,850	144	25,518	97,651	136	125	41.9	114	9,471	142	326.8	22.2	96.0	112	105.1	21.4	114.3	5.1	96
1918	2,936	148	26,790	95,069	135	136	43.4	119	8,864	133	324.1	22.2	91.1	106	97.6	22.3	111.4	5.0	94
1919	3,179	160	30,935	101,399	148	148	43.0	117	9,476	142	328.5	21.9	89.1	104	98.0	21.7	108.4	4.9	92
1920	3,191	161	33,967	109,782	161	146	39.7	108	9,009	135	316.1	20.3	87.3	102	93.2	21.9	104.2	5.1	96
1921	3,162	159	34,904	105,784	158	179	40.0	109	8,946	134	311.8	19.5	93.2	108	99.2	20.5	102.4	5.3	100
1922	3,967	200	41,010	132,442	194	165	40.9	112	10,984	165	315.4	21.1	85.1	99	94.4	20.6	98.0	4.6	87
1923	4,079	206	38,159	121,811	179	158	45.6	125	10,695	160	311.4	19.0	101.0	118	88.0	20.6	91.4	4.8	91
1924	4,115	207	36,015	113,307	171	178	48.0	131	10,174	153	315.3	18.4	102.4	119	76.5	23.0	90.5	4.9	92
1925	4,669	235	39,221	134,383	193	187	48.3	132	11,985	180	320.5	19.8	97.8	114	83.1	23.1	98.8	5.0	94
1926	5,002	252	40,735	141.787	203	175	49.3	135	12,813	192	319.8	19.4	99.5	116	83.8	22.7	97.7	5.0	94
1927	4,831	243	38,763	131,385	190	159	51.0	139	12,430	186	315.3	19.3	107.8	125	84.1	23.2	100.5	5.2	98
1928	4,843	244	36,356	117,698	172	169	56.2	154	12,046	181	311.8	19.3	116.2	135	87.0	24.0	108.1	5.6	101
1929	5,784	292	35,234	124,449	177	164	65.3	178	13,691	205	325.9	17.8	133.1	155	83.9	23.6	102.2	5.7	108
1930	5,897	297	30,202	108,982	154	142	76.4	209	12,399	186	313.8	15.9	161.1	188	74.2	23.5	90.0	5.7	108
1931	5,903	298	23,659	98,008	169	156	79.9	218	12,588	189	311.7	16.2	147.5	172	76.4	24.1	95.4	5.9	111
1932	6,305	318	21,154	105,652	169	156	74.6	204	13,760	206	307.7	16.3	162.2	189	80.5	24.6	103.1	6.3	119
1933	6,737	340	19,295	110,129	168	155	80.2	219	15,473	228	313.6	16.4	175.6	204	80.1	25.0	104.7	6.4	121
1934	7,502	378	18,747	122,661	179	165	83.9	229	17,426	261	318.8	16.4	186.3	217	81.0	25.0	105.9	6.5	123
1935	8,197	413	18,640	133,899	190	175	87.8	240	17,460	262	314.0	16.4	178.6	208	78.3	25.3	103.8	6.3	119
1936	8,392	423	17,950	132,917	187	172	89.9	246	17,672	265	311.3	16.3	186.6	217	-	-	-	-	-
1937	8,972	452	18,739	147,045	203	187	88.3	241	19,416	291	308.7	16.3	189.8	221	-	-	-	-	-
1938	8,305	419	17,330	133,737	186	171	89.4	244	15,920	239	310.7	16.2	170.3	198	71.5	25.9	97.5	6.0	113
1939	8,117	409	16,491	117,598	167	154	97.2	266	14,789	222	313.9	15.3	184.3	215	69.5	25.0	990.8	5.9	111
1940	7,050	355	15,116	98,705	144	133	97.9	267	12,012	180	314.9	14.9	177.7	207	65.0	24.5	83.0	5.6	106

Source: Data from Dainippon Menshi Bōseki Rengōkai, Menshi Bōseki Jijō Sankōsho, each year, and Takejirō Shindō, op. cit., pp. 490-497.

Note : 1) The conversion to 20 was made on the basis of the product-cost conversion ratio shown by Moriya, op. cit., pp. 43-46. For convenience, however, all the calculations are made on the basis of pure cotton yarn.

2) The conversion of male operatives to female operatives is calculated according to the rate of male : female = 1 : 3.

3) The number of spindles per converted female operative was not in existence.

4) The index of 100 is taken from 1912.

TABLE 8. The Transition of Productivity in Weaving

	No. of Looms in Operation		No. of Operatives				No. of Looms per Converted Female Operative		Weaving Output		No. of Operation Days		Output per Converted Female Operative		Average Output per Loom	
	Average per Day		Male	Female	Conversion into Female Operatives		A Person per Day		Weaving Output		Annual	Day	Operative per Hour		Per Hour	
	1,000 Looms	Index	Persons	Persons	1,000 persons	Index	No.	Index	Million Yards	Index	No. of Days	No. of Hours	Yards	Index	Yards	Index
1912	40	100	2,795	18,006	26	100	1.5	100	343	100	318.3	12.1	3.4	100	2.2	100
1913	47	118	3,298	21,961	32	121	1.5	100	417	122	316.1	11.5	3.6	106	2.4	109
1914	50	125	3,569	22,459	33	126	1.5	100	505	147	350.3	11.7	3.7	109	2.5	114
1915	55	138	3,547	22,930	34	127	1.6	107	502	147	306.6	11.4	4.3	126	2.6	118
1916	60	150	3,737	23,245	34	131	1.7	113	560	164	321.9	11.5	4.4	126	2.5	114
1917	63	158	4,333	23,934	35	133	1.8	120	595	174	321.1	11.5	4.7	138	2.6	118
1918	70	175	5,482	29,713	46	175	1.5	100	657	192	297.8	11.4	4.2	124	2.8	127
1919	83	208	7,635	37,040	60	227	1.4	93	739	216	310.6	11.1	3.6	106	2.6	118
1920	89	223	8,005	39,048	63	239	1.4	93	762	222	322.8	10.7	3.5	103	2.5	114
1921	88	220	7,078	32,177	53	202	1.6	107	701	205	300.9	10.4	4.2	124	2.5	114
1922	102	255	7,857	38,102	62	234	1.7	113	869	254	303.2	10.5	4.4	126	2.7	123
1923	106	265	7,962	40,549	64	244	1.6	107	1001	292	297.0	10.7	4.9	144	3.0	136
1924	113	283	8,179	43,056	68	256	1.7	113	1031	301	307.3	10.8	4.6	135	2.7	123
1925	126	315	8,703	47,023	73	277	1.7	113	1180	301	315.3	10.8	4.7	138	2.7	123
1926	131	328	9,216	48,177	76	287	1.7	113	1278	373	317.8	10.4	5.1	150	3.0	136
1927	133	333	8,648	41,879	68	257	2.0	133	1295	378	316.8	10.3	5.9	174	3.0	136
1928	141	353	8,260	35,447	60	228	2.3	153	1382	403	317.1	10.2	7.1	209	3.0	136
1929	137	343	8,485	34,209	59	226	2.3	153	1538	449	324.4	10.2	7.8	229	3.4	155
1930	130	325	7,397	27,957	50	190	2.6	173	1388	405	315.2	9.8	9.0	265	3.5	159
1931	129	323	5,812	23,024	40	153	3.2	213	1405	410	312.8	9.3	11.9	350	3.7	168
1932	136	340	5,380	25,016	41	156	3.3	220	1533	447	316.5	9.3	12.7	374	3.8	173
1933	148	370	5,296	29,013	45	170	3.3	220	1674	489	320.2	9.2	12.7	374	3.8	173
1934	159	398	5,245	30,709	46	176	3.4	227	1794	524	322.8	9.2	13.0	382	3.8	173
1935	165	413	5,025	34,413	49	188	3.3	220	1843	538	319.4	9.3	12.5	368	3.8	173
1936	172	430	4,788	33,671	48	182	3.6	240	1802	526	318.7	9.4	12.5	368	3.5	159
1937	180	450	5,085	38,502	54	204	3.3	220	1891	552	318.7	9.3	11.9	350	3.5	159
1938	176	440	5,094	40,072	55	210	3.2	213	1666	486	318.1	9.3	10.2	300	3.2	145
1939	178	445	5,216	39,196	55	208	3.3	213	1719	502	317.5	9.2	10.7	315	3.3	150
1940	167	418	4,951	35,558	51	191	3.3	220	1428	417	317.0	9.4	9.5	279	2.9	132

Source: As Table 7. However Shindō, op. cit., pp. 500-503.

Note : See Note for Table 7.

for a greater number of spindles in view of the fact that output per ring-spindle was stagnant.[17] The same was true with weaving and the output per female operative was increased as each operative became responsible for an increased number of looms. What supported the increased output of cotton textiles was more the increased number of looms in operation than the increased productivity of each loom. Labour productivity and reinforcement were ultimately the cardinal factors in materializing increased productivity in cotton spinning. Consequently, it must be stated that the nucleus of higher productivity consisted entirely of young female operatives. However, despite the incessant effort to reinforce labour productivity, the net wage index compiled by the Bank of Japan (taking 1926 as 100) showed that their wages were on a constant decline. The decline was as follows:
96.4 in 1927; 86.8 in 1930; 74.5 in 1931; 65.3 in 1932.

NOTES

1. The first company to adopt scientific plant management and standard motion study in the Japanese spinning industry was probably Kanegafuchi Spinning Co. Ltd.
   Sanji Mutō of the same company had ordered a survey to be conducted in 1912 on the basis of scientific management and standard motions (Mutō Sanji Zenshū Kankōkai, op. cit., pp. 365-366).
   It is assumed that these were applied when the wage problem developed in Tōbu Railways in 1910-1911 (Tōyō Bōseki Kabushiki Kaisha, Tōyō Bōseki Nanajūnen-shi (1953), p. 182).
   Moreover, it was in 1917 that Tōyōbō began studies on standard motions. By the end of that year Tōyōbō had established standard motions pertaining to operation and safety according to each work process in both the spinning and weaving departments (ibid., pp. 182-183).

2. Takeo Izumi, "1910 Nendai ni Okeru Nippon Menshi Bōsekigyō no Tenkai-Tokuni sono Dokusen Tenka ni Kanshite", Senshū Keizaigaku Ronshū, vol. 6 (June 1971), pp. 54-55.

3. It is well known that this abundant capital acted as background for the advancement of Japanese cotton spinning into the Chinese market. The capital was systematically exported to so-called "Zaikabō" or China spinning.
   Refer to Takeo Izumi, "Nippon Bōseki Shihon no Chūgoku Shijō Shinshutsu ni Kansuru Ichi Kōsatsu-1920 Nen Zengo no Iwayuru "Zaikabō ni Tsuite", Senshū Keizaigaku Ronshu (Feb. 1972) for further information on the formation of "Zaikabō".

4. The inspection standard to rank 20s yarn in 1921 was as follows (Kanebō, Gijutsu Kaishō, No.8):
(1) A ball of yarn must be dried sufficiently to rid it of moisture and left in a certain place for more than two days. When the weight of a ball of yarn exceeds 1 kan 200 monme after the above treatment, it fulfils the inspection standard. (2) The coefficient of one reelful of yarn is based upon 80 fibres on average and, in the case of a round reel, the length of one reelful of yarn should be 840 yards. (3) The diameter of one reel is 54 inches and thus the reel frame with a diameter of 54 inches becomes the standard. (4) With regard to the stroke dregs and lustre, those which are rated higher than 85 points pass inspection, while the maximum is 100 points. (5) There should not be more than 35 monme of moisture other than the natural moisture, the maximum of which is 5 per cent. (6) The degree of yarn-twisting which passes the standard is more than 15 twistings to the right per inch in the case of 16-count yarn, and less than 19 twistings to the left in the case of 20-count yarn with more than 9 oz. in power. (7) The stretchability should be more than one-tenth of an inch. (8) Any inappropriate yarn counts do not pass inspection. (9) All of the fibre should be cotton.

5. Refer to the following for further information:
Izumi, "Dokusentai-teki Kyodai Menbō Shihon no Seisan Kōzō to Sakushu Kiban-Dai-ichiji Taisenki no Kanebō o Jirei to shite...", Senshū Daigaku Shakai Kagaku Kenkyūjo, Shakai Kagaku Nenpō, vol. 13, Jichō-sha (1979), pp. 322-326 and pp. 337-344.

6. Izumi, "Taishō-ki Menbō no...", p. 18.

7. Kanebō, Gijutsu Kaishō, no.8.

8. Ibid.

9. Tōyōbō, Tōyō Bōseki Nanajūnen-shi, pp. 181-182.

10. Izumi, "Taishō-ki Menbō no...", pp. 19-21.

11. Toyota Jidō Shokki Shashi Henshū Iinkai, op. cit., p. 118.

12. Tarōkichi Sōda, op. cit., Shakai Seisaku Jihō (May 1929), pp. 20-22.

13. Sanji Mutō of Kanebō changed the wording of the method of scientific plant management to the "method of spiritual plant management." He described this to mean "a method to bring about good business results by making all those who are working for this company concentrate on their work spiritually."
Mutō Sanji Zenshū Kankōkai, op. cit., p. 367 and pp. 366-376.

14. Tōyō Bōseki Kabushiki Kaisha, "Tōyō Bōseki Nanajūnen-shi," pp. 243-246. The survey items are as follows:

Entire Work Hours

(1) Time spent on face washing, dressing, eating, hairdressing, defecation, etc. after getting up in the morning(day workers) or at night(night workers), and time spent before starting work at the plant.
(2) Hours of actual work at present.
(3) Time spent on getting to the dormitory or to the cafeteria after finishing work.

Leisure Time

(4) Time spent on school(in the plant, practice, sewing, washing clothes, exercises, training and playing games.
(5) Rest periods during work hours.
(6) Time spent on a meal at the dormitory after work.
(7) Bath time.
(8) Completely free time (what was done during this time?).

Sleeping Hours

(9) Time of going to bed.
(10) Time of getting up.
(11) The conditions of falling asleep.
(12) Have dreams or not.
(13) What sort of dreams?
(14) Wake up during sleeping hours or not.
(15) On which day after starting day work or night work do you find it hardest to fall asleep?
(16) Itemize three reasons which disturb a deep sleep.

Ibid., p. 244.

15. Fusajirō Abe states as follows:

> Due to the fact that the real influence of the lifting of the gold embargo will naturally become more serious, ... it must be presumed that the depression will become more grave. As far as the export trend is concerned, Japan will face more difficulty in competing in the foreign market unless labour costs and commodity prices fall and become inversely proportional to the exchange rate. We industrialists must rationalize the industry as much as possible in order to lower production costs, promote exports and improve international loans.

Dainippon Bōseki Rengōkai Geppō, no.447 (November 1929), 26 December 1929, p. 27.

16. After the prohibition of night work, Dainippon Spinning discharged about half of its workers. Tōyobō also reduced the number of workers drastically. It was said that male operatives with responsibilities were filling the jobs done by male operatives at both mills. Kanebō decided to defer the recruitment of male operatives for the same reason.
Mutō Sanji Zenshū Kankōkai, op. cit., pp. 527-528.

17. The number of frames per female operative and the output in Table 7 and Table 8 are calculated on the basis of the converted female operatives. Thus the figures do not give the true picture. The number of bolsters held responsible per yarn operative in the spinning process, in reality, was 101 in July 1928, increased to 139 bolsters by July 1929. Kanebō, Gijutsu Kaishō, no.10.

18. Tokijirō Minoguchi, Hidezō Inaba, "Saikin ni okeru Wagakuni Sangyō Rōdō no Hensen to Shakai Seisaku no Kōka," 2, Shakai Seisaku Jihō (June 1937), p. 101.

International Competitiveness of the Japanese Cotton Industry

The Japanese cotton industry achieved a self-sufficient domestic cotton market by preventing excessive imports of cotton goods from India and Britain. It in fact began to promote the export of cotton yarns and cotton fabrics. However, the export of cotton yarn hit a peak in the middle of the 1910s and, because there was a drastic decline after that time, it no longer remained an item to be pursued. Instead, the export of cotton fabrics became important.

China was the greatest overseas market for the Japanese cotton-spinning industry as it absorbed 70 to 80 per cent of the exported cotton yarns from Japan. Although cotton yarns from Japan exceeded those from India in the early 1910s, sales quickly came to a dead end due to the growth of the Chinese spinning industry as well as the anti-Japanese movement. Thus the Japanese spinning managers decided to build plants and promote production in China, the so-called zaikabō.[17] However, because there was a gap of 20 yen in production costs between the domestically produced yarn and China products (Table 1), Japan totally lost its basis of international competitiveness. Although the production costs of Japanese yarns could compete against those from India, they were incomparably more expensive than American and British products (Table 2). Consequently, Japanese spinning in China resorted to the supply of raw material for domestic weaving plants.

TABLE 1. A Comparison of Production Costs per Bale of 20 Count in Japan and China (as of August 1929)

	Japan	China
Power Costs	5.50 yen	5.00 yen
Wages	20.00	9.20
Dormitory, Recruitment & Others	3.50	0.60
Supply Costs	1.50	1.20
Packing Costs	2.30	2.00
Transportation Costs	1.00	0.20
Business Expenses	1.00	0.80
Taxes and Others	4.00	0.50
Various Salaries	1.50	1.20
Total	42.00	22.00

Source: Izumi, "Nippon Bōseki Shihon no....," p. 109.

TABLE 2. A Comparison of Production Costs per Pound of Cotton Yarn (up to the Spinning Process)

(unit: sen)

	Japan(1919)	India(1927)	USA (1912)	UK (1912)
Yarn Count	14 3/4	24 1/2	28	28
Wages	5.02	6.64	3.46	2.58
Salaries			0.37	0.23
Insurance & Taxes	1.68	-	0.18	0.15
Repair Costs	0.56	1.56	0.32	0.14
Miscellaneous Supplies	0.40	1.64	0.25	0.3
Power & Fuel Costs	1.65	1.60	0.88	0.35
Others	3.16	2.16	0.15	0.05
Total	12.47	13.6	5.61	3.8

Source: Ryōkichi Watanabe, Nichi-In Mengyō Ron, Nippon Hyōron-sha (1932), p. 35.

Subsequently, the Japanese cotton industry came to compete against Britain, which had the largest market share of cotton fabric exports in the world. Thus it can be restated that the aforementioned rationalization of the spinning process and lower wages were not aimed at gaining advantages in the export market, but at providing the weaving mills with inexpensive raw materials for cotton fabrics. As seen in Table 3, the wages of the workers were so low that they could not even be compared to those of the USA and Britain. The wages in Japan were, in fact, lower than those in India under British rule. In addition, cotton consumption per week was greater than that of Britain and the USA, due to productivity calculated on the basis of work hours (Table 4). However, as far as

TABLE 3. A Comparison of Wages in Spinning (per 1,000 Spindles) (as of February 1932)

	Weekly Wage per Person	No.of Workers	Weekly Wages	Weekly Output	Weekly Wages per Bale
	yen	persons	yen	Bales	yen
USA	35.0(84.0)	3.4	119.0(285.6)	2.4	49.6(119.0)
UK	18.0(29.2)	4.0	72.0(116.8)	2.3	31.4(50.8)
Japan	5.8	6.1	35.3	2.7	13.2
India	5.5(9.07)	15.0	82.5(136.1)	2.4	34.0(56.7)

Source: Takashi Murayama, Sekai Mengyō Hatten-shi, Nippon Bōseki Kyōkai (1961), p. 501.

Note : 1) Surveyed in February 1933.
2) The figures in parentheses calculated according to the exchange rate as of December 1932.
3) The figures include all processes up to the spinning process.

TABLE 4. A Comparison of Spinning Productivity (per 1,000 Spindles) (surveyed in February 1933)

	Weekly Work Hours	No. of Workers	Cumulative Weekly Work Hours	Cotton Consumption per Week	Transaction of Raw Cotton per 1,000 Work Hours
	Hours	Persons	Hours	Bales	Bales
Japan	53.9	6.1	328.8	2.7	8.2
UK	41.2	4.0	164.8	2.3	14.0
USA	42.1	3.4	143.1	2.4	16.8

Source: Murayama, op. cit., p. 502.

the transaction of raw cotton was concerned, productivity in Japan was lower than that of Britain and the USA because the Japanese cotton-spinning industry, as a latecomer, had been relying upon Indian cotton as its primary supply of raw cotton. This was suitable for the production of coarse yarn. This factor correlates to the fact that the rationalization of the spinning process does not enhance inherent mechanical productivity. Nevertheless, due to low wages as well as rationalized management, it became possible for Japan by the end of the 1920s to supply more inexpensive raw yarns than Britain (Table 5).

TABLE 5. A Comparison of Production Cost per Pound of Cotton Yarn between Japan and Britain

Japan (40 Count Weft)		UK (42 Count Weft)	
	pence		pence
Wage	1.27	Wage	2.365
		Interest & Depreciation	2.000
Others	1.65	Others	1.894
Total	2.92	Total	6.259

Source: Dainippon Bōseki Rengōkai Geppō, No.442 (1929), p. 12.

The situation was totally different in the case of the weaving process. Due to the supply of the above-mentioned cheap cotton yarn, automation of looms (Table 6), and wages being less than half those in Britain, it was possible for the cotton industry in Japan to produce cotton fabrics at less than one third of the cost in Britain (Table 7). Furthermore, productivity in Japan was higher, which in itself shows the export competitiveness of Japanese goods. There was an additional factor, other than the conditions of production, which made Japan's position more advantageous in the world market. This factor was the foreign exchange rate. Japan returned to the gold standard by lifting the gold embargo in 1930 and 1931. However, it was more of an exception for Japan to lift the gold embargo since Japan (excepting a two-year period) had maintained

TABLE 6. The Ratio of Automation through the Use of Automatic Looms (as of December 1936)

	Total No. of Looms	Of which Automatic Looms	Ratio of Automation
Japan	332.6	40.0	12.0%
UK	504.8	15.2	3.0
USA	573.5	392.3	68.4
India	201.5	4.2	2.1
China	56.2	17.6	31.3

Source: Murayama, op. cit., p. 503.

TABLE 7. A Comparison of Productivity and Production Costs Between Japan and Britain (Shirting)

		Warp Yarn x Woof Yarn	Width x Length	Weight	Quantity of Warp	Quantity of Woof	Output per 10 Hours	Weaving Cost per 1 tan	Weaving Cost per 100 yards
		S S	inch yard	pounds	per inch		yard	yen	s / d
Japan	No.1	36 x 40	38 x 38	6.50	56	57	57	0.305	1/7 3/4
	No.2	30 x 35	38 x 40	10.25	73	76	39	0.500	2/7
	No.3	28 x 30	38 x 40	11.00	72	75	40	0.470	2/4 1/2
	No.4	42 x 46	40 x 46	9.42	68	72	40	0.500	2/3 3/4
								pence	
Britain	No.1	36 x 42	31 x 125	-	72	72	-	66.250	5/5
	No.2	24 x 22	36 x 40	12	60	64	46.7	24.450	5/1
	No.3	30 x 36	44 x 38.5	10.5	72	68	43.8	28.000	6/1
	No.4	40 x 40	44 x 38.5	8	64	64	46.7	25.500	5/6

Source: Data compiled from Freda Atley, translated by Tadao Nakano and Seiji Ishida, Kyokutō ni Okeru Mengyō, Shōbunkaku (1936), pp. 288-290.

a policy of prohibiting gold exports since 1917. Thus the Yen was cheap not only against the Pound and Dollar but also against the Tael and Rupee (Table 8). This affected Britain particularly, as she was a direct competitor. Due to the multiplied effect of all factors concerned, such as the pursuit of rationalization, low wages and the exchange rate, the Japanese cotton industry was able to outstrip Britain in the world cotton market.

TABLE 8. The Transitional Indexes of Average Foreign Exchange Rates against Yen

(1930 = 100)

	London	Bombay	Shanghai	New York
1920	104	-	37	100
1921	103	-	58	97
1922	101	121	53	97
1923	101	114	56	97
1924	55	95	47	85
1925	54	82	45	83
1926	55	95	58	95
1927	56	96	64	96
1928	55	93	61	94
1929	55	93	66	93
1930	100	100	100	100
1931	108	106	131	99
1932	53	77	74	57
1933	51	58	-	51
1934	51	57	-	60
1935	51	57	-	58
1936	51	57	-	59
1937	51	56	-	58
1938	51	57	-	58
1939	51	57	-	53
1940	51	60	-	47

Source: Data calculated from Nippon Ginkō Tōkei-kyoku, Meiji Ikō Honpō Shuyō Keizai Tōkei (1966), pp. 320-321.

NOTES

1. Izumi, "Nippon Bōseki Shihon no...".

2. Freda Alley, translated by Tadao Nakano and Seiji Ishida, Kyokutō ni Okeru Mengyō, Lancashire and Far East 1931, Sōbunkaku (1936), p. 291.

CONCLUSION: THE POSITION OF THE COTTON INDUSTRY IN THE JAPANESE ECONOMY

Prior to concluding this paper, I will briefly discuss the position of the cotton industry in the Japanese economy in lieu of a summary. Table 1 illustrates the Japanese industrial composition, excluding mining, with the number of workers and the number of private plants with more than five workers. It can be noticed that the textile industry is exceptionally big, and in particular the number of workers involved in the textile industry exceeds the majority of the total number of workers. This number became less than the majority for the first time in the 1930s, which explains why the prewar national economy in Japan was referred to as being at the textile-industry stage.

The breakdown of the textile industry for 1909 is as follows: there were 3720 spinning plants (23.9 per cent) out of a total number of 15574 plants. Those involved in weaving were 8436 (54.2 per cent), including both cotton and silk weaving, and there were 111 (0.7 per cent) cotton-spinning mills. Of a total of 516,000 workers, 198,600 (38.5 per cent) were involved in spinning, 158,900 (30.8 per cent) in weaving and 91,000 workers (17.7 per cent) in cotton spinning.[1] The textile industry was thus dominated by the spinning and weaving industries.

The cotton-spinning industry, on the basis of the number of plants and the number of workers, was not at all big in proportion to the total or to the textile industry as a whole. However, the characteristic of the cotton-spinning industry can be illustrated by the fact that less than 1 per cent of the total number of plants had gathered about 10 per cent of the total number of workers. This epitomizes the fact that, of all the private industries in Japan, it was the cotton-spinning industry which contained a form of large-scale modern mechanized plant system.

TABLE 1. Japanese Industrial Composition (Plants and Workers)

	1909				1919				1929				1933			
	No.of Plants		No.of Workers		No.of Plants		No.of Workers		No.of Plants		No.of Workers		No.of Plants		No.of Workers	
		%	1000 Persons	%		%	1000 Persons	%		%	1000 Persons	%		%	1000 Persons	%
Total Number	32,228	100	842.2	100	43,949	100	1,817.1	100	59,887	100	2,666.6	100	71,940	100	2,122.9	100
Metals	1,044	3.2	19.9	2.4	2,542	5.8	90.4	5.0	3,829	6.4	107.1	5.2	107.1	5.2	143.5	6.8
Machines and Tools	1,580	4.9	52.1	6.2	3,652	8.3	240.5	13.2	5,296	8.8	235.0	11.4	7,850	10.9	291.7	13.7
Chemicals	603	1.9	14.3	1.7	1,616	3.7	76.0	4.2	2,604	4.3	112.8	5.5	3,471	4.8	161.4	7.6
Ceramics	1,902	5.9	40.4	4.8	2,728	6.2	88.0	4.8	3,253	5.4	80.0	3.9	3,355	4.7	80.2	3.8
Gas and Electricity	104	0.3	3.1	0.4	226	0.5	8.7	0.5	457	0.8	11.1	0.5	556	0.8	11.0	0.5
Textiles	15,574	48.3	516.2	61.3	18,800	42.8	990.0	54.5	21,532	36.0	1,121.8	54.3	24,915	34.6	1,016.2	47.9
of which Cotton Spinning	111	0.3	91.6	10.9	288	0.7	200.3	11.0	248	0.4	197.4	9.6	344	0.5	148.8	7.0
Paper, Pulp Manufacturing	921	2.9	18.7	2.2	1,214	2.8	42.7	2.3	1,083	1.8	41.4	2.0	1,346	1.9	44.4	2.1
Foodstuffs	6,203	19.2	95.4	11.3	6,801	15.5	124.9	6.9	11,894	19.9	170.0	8.2	12,868	17.9	167.7	7.9
Others	4,298	13.3	82.1	9.7	6,370	14.5	155.9	8.6	10,817	18.1	187.6	9.1	12,001	16.7	206.9	9.7

Source: Takeo Izumi, "1910 Nendai - 1920 Nendai ni Okeru Nippon Shihonshugi no Jūkagaku Kōgyo ni Kansuru Hitotsuno Sobyō", Senshū Daigaku Shakai Kagaku Kenkyūjo Geppō, no.134 (November 1974), pp. 5-10.

In order for a nation's national economy to be established self-sufficiently and to be modernized, there is a premise that a balanced development should exist between the consumer-goods production sector and the productive-means production sector. In this case, the former, the quantitative development in the production of clothing, supersedes the latter. In the case of prewar Japan, there existed an abnormal imbalance between the two sectors. Due to the extreme backwardness of the productive-means production sector, it had to rely totally upon the leadership of state capital. Under these circumstances, it can be stated that the Japanese cotton industry contributed greatly to the promotion of a self-sufficient economy and capitalistic system, which was guided by the Japanese cotton-spinning industry.

NOTE

1. Takeo Izumi, "1910-20 Nendai ni Okeru Nippon Shihonshugi no Jūkagaku Kōgyōka ni Kansuru Hitotsu no Sobyō...Tokuni Nippon Tekkōgyō no Suiten o Chūshin toshite...", Senshū Daigaku Shakai Kagaku Kenkyūjo Geppō, no.134 (November 1974), pp. 5-10.