

# A History of Japanese Industry (4): Japan's Industrial Revolution (1890-1913)

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Industrial revolution in Japan involved a shift of the main production method from manual to factory production. Factory production, based on motive power such as water and steam power, enabled continual production, or in other words, mass production.

Initially, factories relied on water for their power source, but gradually took to steam, a power source free from limitations according to natural conditions.

When factory production outpaced household production, it became the dominant social production pattern in what was regarded as the start of industrial revolution.

In Japan, factory production began to surpass household production in manufacturing in about 1910-1913. During the years from 1890 to 1913, factory production expanded rapidly and produced industrial capitalists as well as a great number of employed workers, thus accelerating industrial revolution.

With the emergence of new industries and the establishment of companies, industrial production grew fast. Foodstuffs and textiles accounted for 42% and 38%, respectively, or a total 80% of the country's industrial production in 1890, while production of machinery stood at a minuscule 0.4%. In 1913, the ratio of foodstuffs declined sharply to 22%, while that of textiles and machinery rose, to 45% and 8.4%.

## Cotton-spinning industry

The number of large cotton spinning companies in Japan with 10,000 spindles increased to 39 in 1890 from 19 in 1887, with 20 companies established during the three-year period, all in urban districts. Small cotton spinning companies with fewer than 2,000 spindles were mostly located in farming districts, since they used river water as a power source and found it convenient to receive cotton supply from local farmers. Large companies which used steam power saw no need to build plants in such areas. The number of spindles installed at the factories of the

39 large spinning firms accounted for 74% of the total of spindles operating in the country.

Japan's production of cotton yarn grew fast, led by the large companies, and domestic output surpassed imports in 1890. Japan achieved self-sufficiency in cotton yarn as the material for cotton cloth, and Indian cotton yarn, imported from Bombay, was driven out of the Japanese market. Japan began to export cotton yarn the same year, and cotton yarn exports outpaced imports in 1897. Exports of cotton yarn surpassed exports of tea, coal and copper (in terms of value) in 1900 to become the second leading export item, next only to silk. As much as 90% of domestically produced cotton yarn was medium-thick yarn, while high-quality fine yarn was imported from Britain. But as Japan launched production of high-quality fine cotton yarn in 1905, Lancashire cotton yarn disappeared from the Japanese market. In 1907, seven large companies, including Kanegafuchi Cotton Spinning Co., Osaka Cotton Spinning Co. and Mie Cotton Spinning Co., had already formed an oligarchy in the Japanese cotton spinning industry, with the number of their spindles and weaving machines accounting for 60% and 70%, respectively, of the total of such machines in Japan.

Half of Japan's exports were textile goods such as silk, cotton yarn and cotton cloth. Japan became a major exporter of textile goods, domestically producing cocoon and importing raw cotton, but the country still imported most cotton spinning, silk reeling and motive weaving machines from Britain, the United States and France.

## Weaving industry

In 1890, Osaka Cotton Spinning Co. (Osakabo) merged with Osaka Cloth Co. and embarked on producing cotton cloth, thus becoming a spinning-weaving company. Four years later, Osaka installed 1,200 motive weaving

machines imported from the U.S. Both spinning-weaving firms (such as Osaka and Tenma Spinning Co.) and exclusively-weaving companies (Kanakin Weaving Co., for example) boosted output capacity, with the number of their weaving machines increasing from 400 in 1890 to 3,289 in 1901. In those days, most of the 580,000 workers engaging in cotton cloth production were employed at wholesaler-controlled family firms, and factory workers in 1890 numbered fewer than 6,000.

In the spinning industry, cotton yarn was mostly produced at large factories, and hand-spun cotton yarn by farmers and at water-powered throttle spinning factories declined after 1890. However, in the weaving industry, wholesaler-controlled family firms producing cotton cloth and silk cloth still existed.

Factories took over the production of broad rough cotton cloth, and household output of white cotton cloth declined, while production of striped cotton cloth was continued by weaving wholesaler-controlled family firms which introduced motive machines.

Of the 490,000 producers of cloth (silk cloth, cotton cloth, hemp cloth and mixed fiber cloth) in operation in 1907, factories accounted for 3,701, and factory workers accounted for only 90,000 of the 750,000 weavers. Motive weaving machines accounted for only 30,000 of the 780,000 looms in operation at that time.

Most cloth producers were small factories or wholesaler-controlled family firms which employed live-in workers, mostly young girls. Their looms were, for the large part, manually operated. Many farmers also wove cotton and silk cloth to provide some side income.

Production increased sharply with the wide use of motive weaving machines, which were several times more efficient than manually-operated looms. Bearing testimony to the efficiency of motive machines, output by companies with more than five workers accounted for



53% of total production of cotton cloth, 46% of silk cloth and 100% of woolen cloth. Production and exports of cotton cloth rose sharply and overtook exports of coal and tea in 1910, becoming the fourth leading export item after raw silk, cotton yarn and copper. In 1913, just before the outbreak of World War I, cotton cloth moved up to third place in export ranking after silk yarn and cotton yarn.

Imports of raw cotton, mostly from China, started in 1884–85 and rose sharply in the second half of the 1880s, spurred by the successive opening of factories with more than 10,000 spindles. Imports of cloth, the main import item in the closing days of the Tokugawa Shogunate, began to fall from 1900 and imports of raw cotton rose sharply instead. In 1896, the year when import duties on raw cotton were abolished, 99% of the raw cotton used in Japan as the material by cotton weaving companies was imported, mostly from India, the U.S. and China.

In the subsequent years, growing of cotton, indigo and rape seed stopped in Japan in favor of the development of sericulture. Deprived of cotton planting and cotton spinning jobs, farmers sent their young daughters to cotton weaving factories to make ends meet. They also wove cotton cloth in commission to save on the expense of purchasing the cloth.

## Silk industry

Factory production became dominant in the silk industry in the 1894–96 period. Production of machinery-reeled silk

yarn totaled 730,000 kan in 1894, outstripping production of manually-reeled silk yarn, which stood at 560,000 kan. Production at reeling factories with more than 10 reelers accounted for 67% of total silk production in 1896.

In the second half of the 1890s, major silk companies with more than 1,000 cauldrons were founded successively: Katakura-gumi in 1895, Gunze Reeling in 1896, Okaya Reeling in 1897, Tomioka-kan in 1897 and Kaikoku-kan in 1900, among others. Yet wholesaler-controlled small household reeling firms using borrowed cauldrons remained in existence. In 1896, there were 2,900 reeling factories with more than 10 reelers, 1,500 reeling factories with fewer than 10 reelers and 400,000 wholesaler-controlled family firms. Of the 2,900 factories with more than 10 reelers, 994 (34%) were manually operated in cooperative workplaces, 1,077 (37%) water-powered factories, and only 829 (29%) steam-powered.

Japan's silk production grew steadily, to 1,950,000 kan in 1905 and to 3,410,000 kan in 1911, and exports also rose sharply (Table 1). Silk became the export leader, accounting for 30% of the country's total exports. Japan replaced China as the leading silk exporting country in 1909. Silk companies using motive power (steam, electricity and gas) also increased steadily, accounting for 42% of all silk factories in 1911, which increased to 55% of the total in 1915.

## Iron & steel industry

The Meiji government installed imported sophisticated machines at government-run mines and factories, and hired foreign engineers at a large salary as technical advisers to promote the development of the iron and steel, silk-reeling, shipbuilding and mining industries.

The state-run Kamaishi Iron Mill was established at Kamaishi iron mine, to which German and British engineers were assigned. Kamaishi Iron Mill was commissioned in

1880, but ceased operations after only three months due to a shortage of charcoal fuel. It resumed operations in 1882, but suspended them again after six months because the opening of its blast furnace became clogged. The mill was permanently closed and sold to entrepreneur Tanaka Chobei, who rebuilt it as Kamaishi Mine Tanaka Iron Mill Co. The new private company abandoned the blast furnace with a daily production capacity of 25 tons, which was used while the mill was under government control, and installed in its place five water wheel-powered small furnaces with a daily production capacity of 5–6 tons.

The Osaka Army Arsenal, which started mass production of steel in 1890 after installing Japan's first open-hearth furnace, found that Kamaishi produced better iron ore than the Italian iron ore imported for the mill. This prompted other army arsenals, including the one in Tokyo, to use a large amount of Kamaishi iron ore as their material for steel production.

Meanwhile, Tanaka Iron Mill boosted pig iron production in 1894 to 13,000 tons, or 65% of total iron production in the country. Tanaka's pig iron production surpassed iron production by foot bellow furnaces, but still met only a third of the country's iron demand. The remaining two-thirds was covered by imports. Japan's iron production that year totaled only 1,000 tons against 90,000 tons of imports. In order to raise steel production, the government planned to build a state-run steel mill, whereby integral steelmaker Yawata Steel Company was established. In the subsequent years, major steelmakers were established one after the other: Sumitomo Steel Co. (maker of rails and railway coach wheels) in 1901, Kobe Steel Co. in 1905, the steel division of Kawasaki Shipbuilding Co. and Nippon Steel Pipe Co. in 1912. The establishment of the steel companies resulted in the expansion of steel production by open-hearth furnaces, with the result that domestically produced rolled steel and pig iron in 1914 accounted for 44% and 64%, respectively, of the country's demand for these products. Yawata Steel

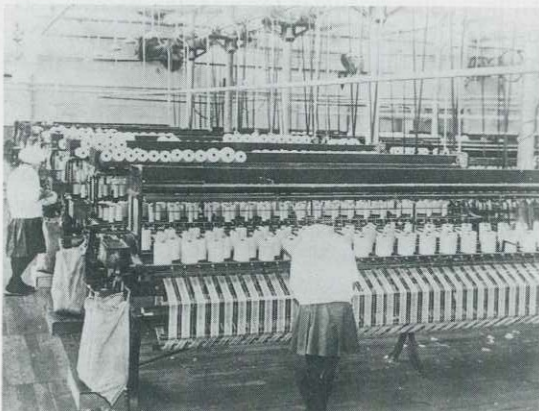


Photo: Kyodo News Service

Mechanized production was becoming mainstream in silk industry by the mid-1890s.





was the largest steelmaker, holding 70% of the domestic pig iron market and controlling a 80% share of the steel market.

### Machinery industry

In the closing days of Shogunate rule, the central government as well as various clan-based governments, such as Fukuoka, Kurume, Satsuma and Saga, built musket and canon arsenals. The Fukuoka clan's musket arsenal installed a steam engine and the Kurume clan owned a steam engine and a lathe.

With the coming of the Meiji Restoration, all musket arsenals of clans were abolished, while the Nagasaki and Yokosuka iron mills run by the Shogunate government were taken over by the Meiji government. Artisans at clan musket arsenals were reemployed by state-run factories and learned ship-building and machinery-making know-how under the guidance of foreign engineers. These artisans, who had been experienced in metal-making, were already skillful enough to make copies of Western mechanical products just by looking at them. The existence of a large number of such artisans enabled production of machines based on Western products.

A watch mechanic named Tanaka Hisashige, who was hired by the Saga clan in the late years of Shogunate rule, had already made a steam engine for ships, built a steam boat and prototyped a telegraphic instrument. He later worked for the Kurume clan, where he manufactured rifled canons and invented machine tools for making muskets. He came to Tokyo in 1873 and founded a machinery manufacturing company, which was commissioned by the Engineering Ministry to manufacture telegraphic instruments. He founded a separate machinery company to produce boring machines, knitting machines and cotton pickers, all of which were copies of imported machine tools.

Many machinery makers were established in the late 1890s.

Tanaka Works, founded by Tanaka Hisashige Jr. and based on the companies founded by his father, developed into the largest private-sector machine tool company in Japan in 1887, employ-

Table 1: Value of main export items (¥1,000, %)

	Raw silk	Tea	Copper	Coal	Cotton cloth	Cotton yarn	Total
1880	8,607 30.3	7,497 26.4	474 1.7	460 1.6	33 0.1	0 0	28,395 100.0
1890	13,859 24.5	6,327 11.2	5,377 9.5	3,100 5.5	174 0.3	2 0.0	56,604 100.0
1900	44,657 21.8	9,036 4.4	12,922 6.3	12,486 6.1	5,724 2.8	20,589 10.1	204,430 100.0
1910	130,182 28.4	14,542 3.2	21,176 4.6	14,938 3.3	20,463 4.5	45,347 9.9	458,429 100.0
1913	188,476 29.8	10,076 7.6	28,605 4.5	20,996 3.3	33,611 5.3	70,998 11.2	632,460 100.0

Table 2: Value of main import items (¥1,000, %)

	Textiles	Yarn	Iron-steel	Metal products	Machinery	Grains Starch and seeds	Total
1880	12,337 33.7	8,089 22.1	1,698 4.6	428 1.2	722 2.0	786 2.1	36,627 100.0
1890	12,832 15.7	16,644 20.4	2,215 2.7	3,397 4.2	3,857 4.7	14,543 17.8	81,729 100.0
1900	40,281 14.0	76,057 26.5	21,743 7.6	12,687 4.4	9,749 3.4	20,065 7.0	287,262 100.0
1910	31,700 6.8	186,092 40.1	32,480 7.0	11,102 2.4	15,546 3.3	27,173 5.9	464,234 100.0
1913	26,164 3.6	271,416 37.2	56,764 7.9	15,346 2.1	36,762 5.0	79,226 10.9	729,432 100.0

Textiles: cotton textiles, woolen textiles

Machinery: steam engines, railway locomotives, spinning machines, weaving machines, paper-making machines, printing machines, sewing machines, cranes, pumps, turbines, etc.

ing 465 workers. The company later evolved into the present-day Toshiba Corp.

Kanegafuchi Spinning Co., founded in 1890, imported spinning machines for its factory from Platt Co. of Britain, but ordered steam engines from Tanaka Works.

Miyata Eisuke, a musket artisan for the Kasama clan, who was running a rifle manufacturing factory, started making the fashionable bicycles of the day in 1890.

Oki Electric Co. was established the same year to manufacture telephones and telegraph instruments upon the inauguration of telephone services between Tokyo and Yokohama. Then came watch maker Seikosha in 1892, followed by electric bulb maker Tokyo Electric Co. Seikosha totally eclipsed foreign-made alarm clocks in the Japanese market by 1910.

Most of the broad weaving machines

installed at large weaving-spinning firms were imports. But Kyoto Weaving Co. started in-house production of weaving machines, based on imported machines, in 1906.

Of the 20,000 motive weaving machines used in Japan in 1906, 50% were for weaving broad cotton cloth and the remainder for weaving narrow cotton cloth. Of the 120,000 weaving machines in operation in 1914, 20,000 were for weaving broad cotton cloth, 20,000 of those for weaving silk cloth, and 80,000 low-priced motive machines for weaving narrow cotton cloth, all of which were supplied by small local machine manufacturers.

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