Tomioka Silk Mill and its role in modernization of Japan

Case study – First Draft

SOC 920b - Seminář k disertační práci II

Pavel Sindlar

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Introduction

In this paper I want to demonstrate how sericulture influenced the development of so-called Japan’s modernization. As an example, on which I will illustrate the development process, I chose a case study of Tomioka Silk Mill, in Gunma Prefecture, Japan. Tomioka Silk Mill is the first silk-reeling factory which Japanese government established in 1872.

At the end of the Edo period\(^1\) of Japanese history, Japan opened its doors to the world and in 1859 began to trade with Western countries. At that time, the most important Japanese export to the West was raw silk. Silk has always been traditional Japanese business article. However only thanks to the opening of Japan to the West in 1854 (the end of a long period of isolation by the conclusion of a treaty of amity and commerce with Western countries)\(^2\), historical circumstances and import of modern technology it was possible to achieve the mass expansion of silk production. Right after the opening of Japanese ports, silk became a prominent export article and silk-reeling industry developed remarkably. Especially silkworm eggs and raw silk started to be sold significantly as global products.

Fundamental changes happened a decade later with the beginning of the Meiji period\(^3\). The new national leadership systematically ended feudalism and transformed an isolated, underdeveloped island country into modern world power. Reforms during this period crucially affected social structure, internal politics, economy and foreign relations. Thanks to new technologies and business Japan achieved a leading position in the global market and the performance of the silk-reeling industry contributed greatly to the modernization of Japan.

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1. Edo period (1603 – 1868)
2. During the Edo period Japan cut off almost all contact with the outside world for more than two centuries. In 1854 Commodore Matthew Perry forced the opening of Japanese ports to Western trade.
3. Meiji period (1868 – 1912)
History of silk production

Sericulture or silk production has a long and colorful history. Silk, one of the oldest fibers known originated in China. Silk used to be one of the main goods traded between the West and East, and the secrets of its cultivation had been closely guarded for generations. Around 200 BC was opened the famous trade routes known as the Silk Road (Gladis 2007). Although many types of goods were traded, silk became a precious commodity highly sought by many countries.

Later, as a result of the spread of sericulture, silk production was brought to Western Europe, which saw an economic potential in silk export. During the Middle Ages began changes in manufacturing techniques with devices such as the spinning wheel. During 16th century, especially Italy and France contributed to the development of silk production. Finally, Industrial Revolution brought a huge expansion of technological advances and expansion of sericulture and the textile industry (Federico 1997).

New spinning technologies and increase in production efficiency have helped further development of sericulture in Europe, but soon was stopped by widespread silkworm epidemic called “Pebrine”. Pebrine generally upset the whole process of trade expectations. The disease was similarly serious everywhere in Europe and some countries, such as France, never recovered from this epidemic. Meanwhile Pebrine

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4 Among many articles, silk was the most attractive to the Romans. “An example might also be given of the extravagance of the Romance in third century, in the fact of a pound of silk being estimated literally by its weight in gold”(Gilroy 1845: 9). It is believed that great civilizations of China, India, Egypt, Persia, Arabia and Rome developed knowledge and trade through the transmission of merchandise on the Silk Road (Thorley 1971).

5 Technological advances have occurred in various stages of production of textiles and for example, thanks to the invention of the Jacquard loom (1801), the production has become highly mechanized (Fascinating facts about the invention of the Jacquard Loom by Joseph-Marie Jacquard in 1801 available online at http://www.ideafinder.com/history/inventions/jacquard.htm)

6 In 1845 started the first signs of disease caused by infection silkworms mulberry leaves. Pébrine epidemic spread throughout Europe and gradually began to even more viruses attacking the mulberry trees. French scientist Luis Pasteur introduced measures to prevent the spread of the disease (Federico 1997:39).
crisis in Europe was at its worst, Chinese sericulture was hit by the Taiping war\(^7\) (Federico 1997: 39). This situation has become a great opportunity for Japan which was so far backwards.

Japan therefore began to trade with the West at best possible time. They started to export the silkworm eggs and “at the end of 1860s and Japan became the sole supplier of the whole Mediterranean sericulture” (Federico 1997: 38). Western countries prompted an increase in the demand of silk and were willing to pay an extraordinary price for this commodity. As a result of above mentioned circumstances (Pebrine epidemic and Taping War), the Japanese silk industry received hardly any competition and flourished and even spread to new areas. According to McCallion (in Chin and Mommaneni 2000), from the time that trade with the West began in 1859, the value of raw silk which was exported through Yokohama, had consistently dwarfed that of all other commodities\(^8\).

By the end of the 1860s and the beginning of the 1870s, the silk industry in China and Europe began to recover while the quality of Japan's silk dropped resulting in the decline of the whole industry. There were two main reasons. One of the reasons was that producers were only exporting as much as possible to get the highest profit, disregarding the quality of their silk and its production methods. The other reason was the fact that Japan did not have good machinery and the necessary skills required to produce the highest quality of silk (Chin and Mommaneni 2000).

The Meiji’s regime response to the situation was simply to acquire the Western technology. This marked the beginning of the mechanization of the silk industry in Japan\(^9\). The Japanese managed the complex process of silkworm rearing. Due to

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\(^7\) Taiping War (1850-1864) in China did great damage to the sericulture districts as well as the urban silk weaving industry. The extent and nature of this damage was believed to have been disastrous for silk exports (Chin and Mommaneni 2000).

\(^8\) "During the year of the Meiji Restoration, in 1868, the export of raw silk accounted for almost 40 percent of the value of all exports and 45 percent of all tax revenues from exports" (McCallion in Chin and Mommaneni 2000).

\(^9\) "This mechanization was technically simple. The process consisted merely of turning the reel by steam or water-power instead of by hand or foot, thus producing a silk filament of brighter luster, of more uniform size and of greater strength, with greater speed. The Western-style mechanization also
their diligence and skill they have developed many important devices to improve the process of farming - especially multiplication cycle production of cocoons per year and thereby greatly raised the production (Watson 2010).

Silk-reeling industry spread throughout the country thanks to a sophisticated system of teaching specialists, and in the first half of the 20th century became one of the world's largest producers of silk (Federico 1997). Sericulture in Japan started the development of other sectors of industry and transport and thus significantly contributed to the overall transition of Japanese society to its modern form.

Main roles of Japanese silk production:

1. During the silkworm epidemic Pebrine and Taiping rebellion in China, Japan filled the overall demand for eggs and raw silk.

2. The development of sericulture helped to modernize the country and Japan has become one of the world's major producers of silk.

Tomioka Silk Mill

As mentioned above, around 1860 Japan begins to trade with Western countries. Japanese silk industry began to develop and started spreading cultivation of mulberry trees. This development had several stages and introduction of new silk-reeling techniques was necessary. Originally Japanese women after throwing cocoons in hot water unfolded and twisted fiber with right hand while the left hand spiraled coil winding. This was followed by a phase where the axle with coil by turning the handle (Watson 2010). This traditional method of production of raw silk is called “Zaguri” (see Appendix 2 Methods of Unwinding Silk).

did not cause a cut down on the labor force as the skills of the handicraft veterans were still required as the cocoons still had to be prepared, the filaments started on the reel and splices made when breaks occurred by hand. Women comprised the majority of the employees in the silk factories, thus continuing the tradition. Thanks to introduction of more advanced methods of production and numerous factories throughout Japan sericulture progressed greatly under the Meiji rule” (Chin and Mommaneni 2000).
Nonetheless raw silk produced in Japan still failed to satisfy the growing demand of Western countries. It was necessary to increase the quantity of cocoons. This problem was solved by introducing natural cooling equipment for storage of silkworm eggs. A device that uses natural cold winds were installed in the mountains\(^{10}\) and allowed the multiplication cycle of hatching silkworm per year (see Watson 2010). Since that time it was possible to increase the quantity of cocoons, however there were still problems with the quality of raw silk for export.

Since 1868 a new Meiji’s regime introduced a policy of support for modern industry. The aim was to support the modernization of Japan and to catch up with Western countries (Federico 1997, Hazama 2007, Slabý & Thoma 1994). Therefore, the government came up with a solution – to build a mill for mechanical production of silk and thus experts from Western countries were invited to help Japan with the progress.

The main person, Paul Brunat from French trading company in Yokohama, was chosen by the government to find a place to build a new silk mill. After studying the landscape he chose Tomioka for the following reasons (All about Tomioka 2013):

1. The area around Tomioka could produce sufficient quantities of cocoons for producing raw silk.
2. There was land available on which to build the mill complex.
3. There was a ready supply of fresh water from a nearby river, which is necessary for producing raw silk.
4. Coal to power steam engines was available in the nearby towns.
5. Local residents agreed with the construction of a factory which would be directed by foreigners.

\(^{10}\) E.g. Arafune Fuketsu. It was a cold storage facility for silkworm eggs using cold air from gaps between rocks. By using such Fu-ketsu, multiple rearing cycles of silkworm was enabled (The Tomioka Silk Mill and Related Industrial Heritage available online at http://worldheritage.pref.gunma.jp/en/ks003-003.html).
Construction was completed in July 1872 and in October was launched as state enterprise. Winding machines were imported from France and adapted for smaller Japanese woman. A number of the first employees were French such as technicians, doctors and instructors of production techniques (Watson 2010). Initially it was difficult to get Japanese workers because they passed on a number of superstitions. For this reason, to support and emphasize the importance of Silk Mill, prominent officials began to send their daughters to Tomioka. Moreover at that time unusual importance was attached to the welfare of employees. This situation helped and soon female workers started migrating from across Japan for work (All about Tomioka 2013).

Women workers were employed in large numbers to work on the silk-reeling machines. By 1876 all French experts and instructors left and Tomioka Silk Mill was operated only by Japanese workers. Within 2-3 years, Japanese women have undergone training and then returned to their home prefectures and then spread their knowledge in order to teach the technique of reeling machines. Sericulture expanded throughout Gunma Prefecture, as well as across the country and many facilities was established for the promotion and teaching of production techniques (All about Tomioka 2013).

The concept for innovation of the factory was laid on several criteria:

1. The introduction of imported modern machinery.
2. Employment of technical advisors from Western countries.
3. Employment of Japanese women as spinners and to train them silk-reeling technology in order to gain expertise for future branches in their home areas.

11 E.g. French drink the blood of young Japanese girls (red wine).

12 In the spinning area accommodation for workers was ensured. Tomioka was the first Japanese factory with this kind of service. Innovative was also working time. Although it was usual to work 12 hours a day, there was limited time to 8 hours per day with one day off work per week. Within the complex, there was a clinic for employees and workers also received financial support for food and medical expenses.

13 Sometimes whole villages were established for the production of silk.
Sericulture also contributed to the development of the railway network of Japan. To overcome the steep mountain slopes the government used Swiss ABT system with cogwheels and chains. From this period there are preserved many countless brick buildings, tunnels and bridges\textsuperscript{14}. Since raw silk was the most important export item, to transport it rapidly and inexpensively in large volume, many railroads connecting each area in Gunma Prefecture with Yokohama was developed (The Tomioka Silk Mill and Related Industrial Heritage 2013).

Running the Tomioka Silk Mill was not always profitable and at the end the government decided to privatize the Mill in 1893 (All about Tomioka 2013). However the main goal from the very beginning was the successful implementation of complex production and spread of the know-how across the country. High-quality raw silk has been produced and its products gained international reputation. Silk has become popular and affordable goods, affecting the global fashion in 20\textsuperscript{th} century.

The factory was closed a century after in March 1987 (see Appendix 1 – Timeline of Tomioka Silk Mill), due to the growing silk industry in other Asian countries with who could not compete with the price anymore. Today it is preserved as symbol of Japan's modernization which the Mill significantly contributed to the development of silk production industry, transportation and trade. The Tomioka Silk Mill occupies a strong social, economic, industrial and architectural importance in the scale of world industrial heritage. In 2012 Japanese government recommended Tomioka Silk Mill and related industrial heritage to be put on the UNESCO World Heritage list with the aim of getting the status granted in 2014.

\textsuperscript{14} E.g. Spectacle Bridge from 1893, which is the largest brick bridge in Japan
Conclusion

When Japan started to modernize after the Meiji Restoration in 1868, its development lagged far behind the Western countries. In fact, Japan relied on the export of only one product as a major source of its income – silk. But during that time even the silk industry was in decline, as the consequence of lack of quality of their silk products. So the Meiji government introduced a policy of support for modern industry in order to support the modernization of Japan and to catch up with Western countries.

Japan's oldest modern silk factory - the Tomioka Silk Mill was completed in 1872, based on decision to set up a state enterprise. This silk mill provides an example of the improvement of the ability to produce high-quality goods. Innovation began with the introduction of imported modern machinery and employment of technical advisors from Western countries. Another important role played the employment of Japanese women as spinners and the aim to teach them silk-reeling technology in order to gain expertise for future branches in their home areas.

This concept of innovation later spread to factories across the country. The rise of silk as a major economic factor in Japan also helped to promote associated trades, such as cocoon farming, silk textile production and even the railroads and other infrastructures that were required for the transportation of goods. Eventually, Japan became one of the world's largest exporters of silk.

Tomioka was one of the primary locations which signaled the beginning of factory life in Japan, resulting in transition to become an industrial power in the 20th century. Increased importance of factories went hand in hand with many important social changes. As a result of industrialization, for example, women workers’ rights emerged (as later did forming of unions and the rise of a working middle class). These changes become vital to the modernization of Japan on both technological and societal level.
References:


Online sources:


- Fascinating facts about the invention of the Jacquard Loom by Joseph-Marie Jacquard in 1801 available online: <http://www.ideafinder.com/history/inventions/jacquard.htm>.


Photographs:

Appendix 1:

**Timeline of Tomioka Silk Mill**

1872-1893: government organized administration

1893-1902: a period of MITSUI

1902-1939: a period of HARA - improvements of winding machines, high production of high quality silk, silkworm breeding research to improve the quality

1939-1987: the period KATAKURA; TSM associated with the largest silk production company in Japan, machinery reconfigured for fully automatic

from 1950: TSM leading producer of raw silk in Japan

1987: Production stops as a result of international competition and cheaper silk from other Asian countries, but also because of the historical value of the TSM

2005: TSM designated as a historical monument

2007: proposal for a TSM to write on tentative list of UNESCO

2012: Japanese government recommended Tomioka Silk Mill and related industrial heritage to be put on the UNESCO World Heritage list with the aim of getting the status granted in 2014.
Appendix 2:

Methods of Unwinding Silk

1. Zaguri method

Women insert cocoons in a bowl of hot water, wined and twisted fiber with right hand while the left hand spiraled coil winding. Followed by a phase where the axle with coil was turned by the handle. Gradually mechanism was improved perfected until reached a rapid and continuous winding.

2. Machine winding

Cocoons are inserted into the hot water, where the machine finds several threads and the ends of fibers winds into threads. Over time, the machines were converted to fully automatic.

Source: http://www.flickr.com/photos/24443965@N08/4245207889/