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Analysis on the Development of China's Modern Silk Industry

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Abstract

As the old idiom "men's farming and women's weaving" lays out an original picture of a traditional Chinese family organization, the silk weaving industry in China has experienced a long history and formed a well-rounded, stabilized technical system. Since the modern times, with the introduction and application of new looms, raw materials and advanced techniques, Chinese silk industry has gradually completed modernization. This article, based on historical materials and comparative analysis, aims to explore the co-evolution of science, technology and social structure by analyzing the technological and social changes in the modern silk industry. It has been found that essentially stakeholders in either the upstream or downstream value chain of the industry will all influence how such business is shaped, and at the same time, be affected by the result of product and process innovation. This might result in the business prospect where small family based farmers tend to be reluctant to the technological changes in order to protect their own business interests locally.

Keywords: Chinese silk weaving industry, technological development, technical import, silk export, comparative analysis

1. Modernization of Chinese Silk Industry

After Shanghai opened the port in 1843, a large amount of raw silk was exported from the Shanghai. Both the production scale and technology of hand processing natural silk in the renowned Eastern Zhejiang product area have been greatly improved compared to before the Opium War. With the export of raw silk booming, in order to meet the technical requirements in the foreign silk industry, silk merchants in Nanxun (in Huzhou) and Zhenze distribute native silk bought in to local farmers and workshops to reel into wrap yarn, which later was known for foreign wrap for that it was exclusively for export. For the sake of such production, manual silk reeling in Zhejian Area was fairly busy, with production in Nanxun, Huzhou area especially famous. While the influx of foreign machinery to some extent forced the traditional handcraft industry to decline or reform, there were still traditional craft industries which experienced gratifying growth because of the lack of domestic competition and the stimulation by export requirements. Instead of a recession, such industries showed a boom in production and sales. According to statistics in 1912, "Silk is mainly made by hand by farmer weavers in silk-producing areas and each weaver uses a unique silk from different types of natural silk. Jiangsu province and Zhejiang province are known for top-quality silk. Suzhou, Wuxi, Nanjing in Jiangsu and Shaoxing and Hangzhou in Zhejiang are known as major production centers, for a wide range of silk output covering 200 to 300 different categories.

At the same time, the sericulture industry in Yunnan province as the foundation of Chinese silk weaving industry, has also been greatly improved through vigorous promotion. The improvement can be demonstrated in different aspects. First, the increased output of silk, has provided sufficient raw materials for the silk industry, and more opportunities for border areas development. During the reign of Guangxu, opium smoking and poppy cultivation have been strictly banned in Yunnan, forcing local people to turn to other industries to make a living. Sericulture in this way, was greatly promoted to help with the economy. The silk produced in Yunnan was mostly exported to Myanmar, making it an important export commodity. In addition, silk produced in the province was also distributed within Yunnan, facilitating the establishment of local silk market. Second, using scientific methods to improve the sericulture industry has introduced high quality mulberries and silkworm eggs, as well as advanced breeding technology to improve the capability of the sericulture technology. Before, the sericulture industry in

Yunnan was mostly a family-based, extensive handicraft industry. With the government-led development and promotion, scientific methods were adopted to continuously improve sericulture technology. In the twenty-eighth year of Guangxu (1902), Yunnan provincial government established a sericulture school, bringing in faculties appointed by Zhejiang province, and quality mulberries and silkworms from Zhejiang. Apart from importing from Sichuan and Zhejiang, Silkworm eggs nurtured in Yunnan were also imported from overseas. In 1921, Su Rongli brought two boxes of French silkworm eggs to the provincial agricultural school for testing. Such French silkworm eggs were bred for about 30 days. The color of the cocoons was yellow and white, producing a volume silk with high-quality strength and elongation, which is especially graceful compared to Sichuan and Zhejiang originated silkworm species.

After the 1920s, in the efforts of technical personnel, Yunnan silkworm industry achieved a major breakthrough of being able to cultivate local silkworm eggs locally. Third, promoting the popularization of sericulture education became the beginning of modern agricultural education in Yunnan. In the twenty-eighth year of Guangxu (1902), counties in Yunnan began to establish sericulture schools, facilitating development of Yunnan sericulture industry and turning the underdeveloped situation around. One effective means has been found, which was to establish county-level sericulture schools, run on the apprenticeship system. After the apprentices graduated, he/she would return home and use new techniques to cultivate silkworms, while at the same time, impart the newly adopted technology within the neighborhood, so as to raise the overall production capacity for the sericulture industry.

The main reason for the promotion of sericulture in Yunnan in modern times is that as an alternative to planting crops after the ban on opium smoking, Yunnan’s climate considered suitable for the development of sericulture, making the area an important national sericulture base at the time, especially after the Anti-Japanese War. At the same time, the promotion of sericulture in Yunnan was also a strong means to facilitate industrial restructuring, as well as improve the overall economic income.

The prosperity of China's silk industry in modern times can also be reflected in foreign trade exports. According to statistics, the total value of China's silk and satin exports in 1880 was 5.42 million customs tael (a currency unit mainly used in foreign trade in Qing Dynasty). The number was increased to 7.98 million in 1894 and to 10.87 million in 1914, showing a trend of increasing year by year. Apart from the European and American markets, there is also a substantial demand emerged in various markets of Southeast Asia.

2. The Technological Innovation of Modern Silk Weaving Industry

The rapid development of the silk weaving industry and silk fabrics in the Republic of China is directly related to the introduction, digestion and application of modern textile technology, as well as the modern evolution of the industrial base of new techniques of silk reeling, silk weaving, dyeing and finishing. Technological advancement has been one of the main supporting conditions for silk fabric development. The introduction and widespread use of new looms, changes in production relations, production materials and consumption structure are all key underlying factors.

2.1 Application of Technology Development

China's silk weaving industry has a long history. By the end of the 13th century, the silk loom had been shaped. Before the end of the Qing Dynasty, machinery was stagnant in the wood materials for a long time. The only improvement to the wood machine in the Qing Dynasty was to install a wooden frame on the bamboo reed to increase the force when beating up the weft. The weaving of broch é had been using the "flower machine", that is, the Hualou bundled jacquard machine described in *Heavenly Creations of Things (“Tiangong Kaiwu”)* by Song Yingxing in Ming Dynasty. The long-term rigidity and lack of improvement of the machinery construction and production technology would inevitably impose restrictions on the improvement and innovation of silk fabrics. At the beginning of the 19th century, the hand drawn machine invented by the French came out and was introduced to China. Hangzhou Weicheng Co., Ltd. took the lead in introducing such France originated hand-pulling knitting machines. Thanks to the advanced machinery, the well-known "Weicheng satin" and other products were not only flat and even with better quality than wood knitting machines, but also able to yield remarkable production efficiency of more than double.

In the early 1920s, about 10 major silk mills were using the French hand drawn machine, together with the Japanese input of jacquard devices and texturing technology, becoming fully capable of producing relatively more complex jacquard fabrics. This to some extent, has widened the category of light and thin products, and raw materials.

2.2 Update of Industrial Characteristics

By 1937, taking Suzhou as an example, the number of silk mills had increased to 93, having nearly 2,100 electric looms, 500 hand-pulling machines, and 700 wood machines. Within the 15 years of time, Chinese silk weaving industry had completed the modernization process of which the same level progress was made by Europe and the United States in 100 years, and by Japan in almost 30 years. In some silk and satin mills, decentralized manual production had gradually phased out and been replaced by the modern factory production and management. This has successfully set a solid industrial foundation for Suzhou silk weaving industry later. It is worth mentioning that after 1912, the business model of traditional satin firms also changed. Managers in charge of the finance were not necessarily responsible for production planning at the same time. Instead, they chose to hire well-managed and proficient personnel as production managers. There emerged a trend of approaching the manager system commonly found in a modern capitalist enterprise.

2.3 Iteration of Consumer Demand

After the Revolution of 1911, due to the abolition of the clothing system in the Qing Dynasty, the promulgation of the "Clothing Code" and the "Clothing System Policy" of the Republic of China, silk fabrics have also undergone major changes in consumption structure, social needs, and popular culture. On the one hand, many traditional varieties were eliminated, such as: xianchun (a silk fabric with a geometric pattern), shuluo (a refined silk), official silk gauze (a fabric as a tribute to the imperial), and mitong fabrics. After the power loom was put in use, new varieties that adapted to the market and consumption trends accounted for more than half of the products on the market including: single crepe, double crepe and georgette. On the other hand, the use and sales channels of some traditional varieties also went through major changes. For example, plain satin had been widely used in clothing and hats, but with the market continuously shrunk starting the early years of the Republic of China, it started to be mainly applied as a base material for embroider. In addition, due to the large demand for worsted or woolen fabrics in modern clothing, a variety of fabrics similar to wool started to take over the silk weaving industry in Suzhou. In order to understand how different trends might influence products on the market, business owners in Suzhou conducted thorough research on fashion, silk quality, patterns and color preferences in different silk markets around the globe, so as to "introduce hot-selling fabrics according to the sales locations and consumer preferences".

3. Comparative Analysis on Chinese and Japanese Silk Reeling Techniques

Taking the silk reeling industry in Southern China as an example, the first person contributing in improving the hand-reeling technology is known to be Chen Qiyuan. He targeted the flaws in the traditional cocoon cooking technology and adopted steam ovens in production. He proposed the use of a steam oven in Ji Chang Long Reeling Mill. Although Ji Chang Long Reeling Mill has been considered by the academia as a representative of Chinese national industrialization, in fact, the steam oven was never used as a power plant. Instead, its main functions are, 1) to start the water absorber in order to drain outside water into the plant; 2) to boil water, and convey the boiled water to each reeling station through the steam pipe. At the time, the steam oven had not been used to push the silk to rotate automatically. Therefore, major differences between the Ji Chang Long method and traditional reeling skills are the more flexible devices, and the add-on of small iron pillars to the machinery in order to bear weight and rotate faster. Such improvement cannot be considered as the accomplishment of mechanical reeling. Chen Qiyuan’s steam cocoon cooking technology had a tremendous impact in Southern China silk reeling, enabling reeling factories in Shunde to shift from charcoal boiled water to steamed water, making such production plants comparable to a steam engine silk reeling factory. Thereafter, a large number of hand reeling factories in Nanhai, Shunde and Xinhui started to use steamed water. In order to be shape the technique applicable to family-based silkworm raisers, Chen Qiyuan and his son invented the "motor-steam bicycle." The equipment is a straight reeling wooden car made by local carpenters, with a simple structure and method of use easy to learn. Such small-scale machinery basically carried the same functionality with large reeling facilities, only powered by foot pedals. In this way, the workers' hands would be freed for thread reeling. This not only reduced workload, but also improved work efficiency. The production pattern of one person operating one machine makes family based silk reeling feasible. "One person carrying one cart and producing at home, large or small volume of outputs would be bought in by silk trade firms, making home reeling a profitable and popular business." This production pattern was rapidly spread out: "Namshun's local communities together followed the trend. Only Tongfu county has no fewer than 20,000 people using this method."

Although the original steam reeling machine did not fully achieved steaming production, it still greatly improved the production efficiency. The quality of the silk produced was also significantly higher than that of the handmade silk. Moreover, the silk reeled by this new method had uniform thickness and was clean in color.

Guangzhou's foreign trade firms at the time bought Ji Chang Long silk at a price that was 50% higher than the average market price of ordinary raw silk, mainly to export to France.

In the Great Depression in France in 1882, Japanese silk producers suffered a recession in the French market. Japan businessmen tried to change its export target to the U.S. silk market. At the time, Lyon hand-woven goods market was still at a dominant position, with low volume outputs and high product variety. The demand for different types of raw silk last till the beginning of the 20th century; on the other hand, in the United States, machinery for silk reeling was under rapid development since late 1870s, especially in the production of low- and medium-grade fabrics for mass consumption. Most importantly, with the introduction of electric looms, the work of weaving was transformed from the delicate operation of a manual loom to the management of a logarithmic loom. Many Japanese manufacturers selling 10-12 or 11-13 denier raw silk in France started to produce13-15 denier raw silk according to the American standard. In the 1880s, due to capital constraints, Japanese factories were only equipped with dozens of reeling pots, and the output at the beginning of production did not reach the average level of demand in the US market. Therefore, the Suwa Silk Manufacturers Association introduced the double reeling system, and in 1884 established the cooperative completion system in 1884. The cooperative completion procedure consists of cooperative reeling and cooperative inspection. Cooperative double reeling was a innovative practice of Gunma production in the 1870s for the attempt to enter the US market, which by definition, refers to the production procedure that each cocoon is reeled and re-reeled to dry the raw silk. After double reeling, the raw silk from each factory and company would be in dispatch together. Through cooperative re-reeling and shipment, it was ensured that the volume of shipments in a batch was expanded and the raw silk is more uniform.

4. Conclusion

Professional differentiation required by social technological evolution involves significant changes in the social structure, and will inevitably touch the main aspects in social development. For instance, in the application of modern technology in mechanical reeling, no matter in the domestic or foreign silk weaving industry, in addition to silkworm farmers, all the stakeholders including local gentries, traditional traders, sericulturists, weaving workers and the government, will all influence the new social structure by protecting their own business interests. The research philosophy of combining the individual microscopic analysis with macro-structural observation will possibly be used in further sociological analysis of technology innovation. Therefore, it is not plausible to fully understand technological innovation without bringing in the impact from social environment, users of technology, and subjects directly and indirectly affected by technology. Therefore, it is necessary for future researchers to focus on the analysis of individuals, groups, and organizations related to technological development, to analyze the relationship between their own interests and the potential influence the on development process of technology.

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