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The First Technological Paradigm: Textile Industry

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Abstract

The first technological paradigm (of textile industry) was formed during the final phase of the Industrial revolution and finally took shape around the 1820s – the 1830s and reached maturity in the 1840s. Thus, it developed within the framework of the first long Kondratieff wave (the 1780s – the end of the 1840s). Breakthrough innovations in the textile industry which led to its almost complete mechanization became the basis of the first technological paradigm. At that period there was created a number of highly productive machines which became much more complex than in earlier periods and more advanced, replacing human labor and skills. It is very important that a system of mechanized production was formed in a sector that was growing almost continuously. This growth led to major social changes in society. For a long time a large number of artisans coexisted with machine production by creating a kind of symbiosis of old and new technologies. But the new paradigm gradually became more distinct. Thus, by the mid-1840s there were already only 60,000 hand weavers and 150,000 machine weavers, and 15 years later hand weaving in England almost completely disappeared. This period was marked by the introduction of the universal engine. However, contrary to popular belief, steam power, which was actively introduced into the British economy, was not an absolutely necessary element for the completion of the Industrial Revolution and the formation of the first technological paradigm. For a long time, these processes were based on water power, which by the end of the Industrial Revolution, even in Britain, provided half the textile capacity.

Keywords: *Kondratieff waves, technological paradigm, textile industry, the Spinning Jenny, steam engine, industrial revolution, industrial production principle.*

Kondratieff Waves: Processes, Cycles, Triggers, and Technological Paradigms 2022 186–189 DOI: 10.30884/978-5-7057-6191-3_13

The first technological paradigm (of textile industry) was formed during the final phase of the Industrial revolution and finally took shape around the 1820s – the 1830s and reached maturity in the 1840s. Thus, it developed within the framework of the first long Kondratieff wave (the 1780s – the end of the 1840s). Breakthrough innovations in the textile industry became the basis of the first technological paradigm. In 1730 (according to other data, in 1733) John Kay invented the flying shuttle. As a result, weaving started to significantly outpace spinning in terms of volume. The most rapid process of mechanization of spinning (and later other operations) began in the 1760s and 1770s. At this time James Hargreaves invented the Spinning Jenny, and Richard Arkwright the water-powered spinning machine used at his own manufactures. But behind this success there was the work of many inventors of previous decades (see Tseitlin 1940; Grinin and Korotayev 2015), since cooperative efforts of numerous people are required for the beginning of a technological breakthrough.

The Spinning Jenny was a domestic machine, capable of spinning without human assistance. On such a machine (which already had almost all the characteristics of a simple human-powered machine) one person could spin eight threads at first, and later 80 or more. But this spinning machine did not destroy the domestic spinning system. On the contrary, due to the absence of a mechanical engine, it was widely used in small handicraft production, at first even strengthening it. As a result, during the first stages of the Industrial Revolution the number of artisans significantly increased, especially at the expense of weavers. It was only as a result of the rapid development of manufacture production that the number of artisans began to decline sharply.

Almost simultaneously with the development of this partly mechanized domestic production, there began the development of a new industrial production principle through the creation of manufactures with hired workers. The aim of these manufactures was to form a full cycle of mechanization and production of finished goods.

The first cotton spinning mill was built by Richard Arkwright. His machine was improved and was called a water frame. It was adapted to use water power. Due to its size it was impossible to move the mechanism by muscular force. Thus, Arkwright succeeded in combining a source of energy (water), new machines, hired labour, a specific type of raw material (cotton) and initiated a new system of mass production. In the 1770s he was already able to create a system of machine production of cotton fabrics, capable of performing almost all the successive operations of this industry. In 1801 the first mechanical spinning mill equipped with almost 200 machines was already in operation in Great Britain.

Thus, for the first time, not only was a single industry mechanized, but there began a process of mechanization, which led to the continuous and systematic expansion of the application of machinery in one related industry after another.

The creation and development of the steam engine occupied a period of 150 years until it became universal. In the 18th century, Newcomen's steam engine was used for pumping water out of mines, for blasting in hearths and forging iron, and later for replacing the water wheel in propulsion systems (Allen 2014). In the 1770s Watt's already quite productive steam engine started to be used in industry and continued to improve for a long time. In 1826 in England there were 15,000 such machines with an average power of 25 hp. However, contrary to popular belief, steam power, which was actively introduced into the British economy, was not an absolutely necessary element for the completion of the Industrial Revolution and the formation of the first technological paradigm. For a long time, these processes were based on water power. And in the United States the Industrial revolution and the emergence of the textile industry took place mainly due to water power, which was in abundance in America (see Grinin and Grinin 2015; Grinin and Korotayev 2015).

At the final phase of the Industrial Revolution, machines became much more complex and the universal engine emerged. It is important to note not just the increasing complexity of machines, but also the fact that they became more advanced, replacing human labor and skills. According to A. Bogolyubov (1988: 33ff), it was the development of these machines that led to the Industrial Revolution.

The Industrial Revolution in England was largely completed in the 1830s. In these years the number of steam stationary plants here equaled the number of water plants which was 160,000 (Allen 2014: 252). One can mention other events which took place at that time, for example, the creation of the self-acting spinning mule machine by engineer Richard Roberts between 1825 and 1830 due to which the remaining manual operations in spinning were eliminated; James Smith's invention (in 1834) of the self-acting mule in which all operations, except for some minor ones, were already fully automatic. No further fundamental improvements were made to these machines.

The end of the final phase of the Industrial Revolution meant that by this time the industries that emerged as a result of the Industrial Revolution had already taken a firm place by creating the primary model of the Industrial (machine) production principle which spread into new industries. At the same time, at the maturity phase of the new production principle, the economy is in fact a hybrid, organically incorporating the new and old production principles (Grinin 2019). Thus, as early as in 1831 in England, the hand weavers accounted for more than 80 % and factory weavers – less than 20 % (225,000 and 50,000 people respectively [Tseitlin 1940]). Thus, for a long time a large number of artisans coexisted with machine production by creating a kind of symbiosis of old and new technologies. But the new paradigm gradually became more distinct. Thus, by the mid-1840s there were already only 60,000 hand weavers and 150,000 machine weavers, and 15 years later hand weaving in England almost completely disappeared (*Ibid.*).

The spread of the first technological paradigm was associated with the ruin and displacement of numerous cohorts of artisans as well as with the active involvement of children and women in labor. This is why the first decades of industrialization in England, especially the period of 1840–1850, when the first technological paradigm reached its peak, are associated with the worsening situation of workers.

The development of the textile industry was extremely rapid. In particular, there was a 33-fold increase of cotton processing volumes in the period of 1780–1825, and in 1780–1800 total cotton consumption in England increased more than tenfold (Mendelson 1959–1964, vol. 1: 124–125). The replacement of machinery producing textile products was rapid. For example, in 1834 self-acting mules were invented, and the same year they were installed in 60 spinning mills in England with 200,000 spindles (*Ibid.*)

Already in the 1810s the cotton industry became the leading and most mechanized industry in England, contributing about half the value of exports. But soon it faced the narrowness of the English market. Increased productivity did not fully solve the problem of sales, so English industrialists sought to conquer foreign markets. Throughout the first half of the 19th century, the question of export and foreign market expansion was one of the most important.

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