# Exploration on the Application and Practice of Marx's classic theory of Residual Value Based on The Perspective of Modern "Unmanned Factory"

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**Abstract.** The high production efficiency and low number of workers of the unmanned factory production model have increased some scholars' misunderstanding of Marx's theory of surplus value. The main body of this essay is the unmanned factory. The full text takes Marx's theory of surplus value as the theoretical basis. It conducts a historical exploration of the unmanned factory in different eras, and discusses the production relationship of the unmanned factory and staffing information. When discussing the source of surplus value in unmanned factories, it is considered that there are two labor methods, "human labor" and "intellectual labor", but the labor methods are different, and both labor methods can generate value. In fact, the surplus value of unmanned factories comes from three aspects: one is to squeeze the unnecessary labor of workers in human labor; the other is to squeeze the intellectual labor of scientific researchers that condensed into commodities; From the perspective of surplus value, unmanned factories seek high profits from the difference between the social average product value and the value of individual products produced efficiently. Therefore, Marx's theory of surplus value is applicable to unmanned factories, and the production machines of unmanned factories cannot create value. And it can be seen that the degree of exploitation of workers by capitalists under the unmanned factory mode has not weakened. At the same time, the impact of the unmanned factory model on workers is drawn, that is, the labor value of workers is degraded.

**Keywords:** Surplus value theory, Manned factory, excess surplus value, Intellectual labor, Necessary labor time, concealment.

## 1. Introduction

With the advent of the digital age, today's world is undergoing a large-scale technological innovation, including the typical "unmanned factory". A production model similar to the "unmanned factory" can produce considerable profits at a high-efficiency production scale with a small amount of human manual labor which can consume less labor costs. In the Capital, Marx believed that capital cannot generate value, and only labor can generate value. Nowadays, people have doubts about the source of value-added (surplus value) of "unmanned factories" that can reap the same or even higher benefits while consuming a smaller amount of labor costs. Some people even think that Marx's surplus value theory is no longer applicable to the high-tech production mode in the new era. Using the method of literature analysis and theoretical analysis, this paper briefly describes the history and actual operation of the unmanned factory, and perspective the main content and research status of the surplus value theory. Analyzes the authenticity of the contradictions between the two on the surface, so as to illustrate the generality and universality of the theory of surplus value, and at the same time, it can enhance the confidence of the theory and promote the function of linking theory with practice and guiding practice.

## 2. Brief description of the status quo of unmanned factories and comparison of industrial production modes

### 2.1 History and current situation of unmanned factories

In 1952, the Ford Motor Company of the United States built the world's first fully automatic factory to produce engines in Cleveland, Ohio. 500 different operations and processes are carried out by 42

automatic machines, and it is also possible to check out unqualified products. At this time, it has only been six years since the first generation of computers was put into use, and the UNIX operating system had not been invented yet, and the unmanned degree of the fully automatic factory was still relatively low. On April 9, 1984, the world's first experimental "unmanned factory" was built in Tsukuba Science City, Japan. The project was completed by 20 companies and cost a total of 13.7 billion yen. The proportion of workers was significantly reduced, and the production efficiency was increased by 325 times according to preliminary calculations. Its high efficiency has been proved in the follow-up operation of the whole experiment. Since this period, intelligent machines have been welcomed by enterprises, and the output and installed number of Japanese robots have jumped to the top in the world. China's first unmanned factory was built in Dongguan, Guangdong Province in 2018. The factory is completely automated. Because of concerns about product quality, there are two or three inspectors, and the number of people required by the factory has been reduced by 10 times.

Unmanned factories will further accelerate the "factory automation" process of the entire manufacturing industry. At present, China's production models such as unmanned factories and intelligent factories are accelerating their deployment. In the actual construction of China's unmanned factories, Hubei Oris Group Co., Ltd. invested 500 million yuan to build a Gelema intelligent manufacturing industrial park, including 5G unmanned black light manufacturing center, mobile phone metal mold processing center, aerospace precision machining center, There are four areas in the product display center; in terms of the regional planning of unmanned factories, it was proposed in the Shanghai Intelligent Manufacturing Industrial Park Promotion Conference that by 2022, Shanghai will build a "100+" benchmark unmanned factory. It is precisely because of the characteristics of high efficiency, low cost and low consumption of human resources that unmanned factories can be widely built in the country. Its main features can be summarized as the following two points:

First, it has high efficiency and low cost, but it will inevitably impact the traditional enterprise field. Facts have proved that the efficiency of unmanned factories is hundreds of times or even higher than that of pure human factories, and high profit margins can be obtained in a short period of time based on low raw material costs. On the one hand, it has a certain positive impact on social capital enterprises and government economic planning agencies, but to a certain extent, it can also be seen as the impact of the arrival of the digital age on the original production model and social life.

Second, it reduces employment opportunities while reducing labor dependence. The emergence of unmanned factories has undoubtedly reduced the part of its production structure that relies on human labor, especially for monotonous and highly repetitive assembly line production. The machines in unmanned factories are more accurate and efficient than human labor. However, as large machinery groups replace human specific labor, the corresponding simple labor positions are replaced with complex abstract labor that requires high intelligence, which undoubtedly reduces the number of employment positions, raises the threshold for employment, and increases social pressure.

### 2.2 Modern industrial production model and modern unmanned factory production model

Because of the highly leap in the material means production activities and the scale of productivity between eras, and the rich and diverse production activities of contemporary non-material means and the increasing scale, it is essential to reasonably review the relevant production factors such as the industrial model and social labor relations between Marx's era and the current digital age when exploring the explanation and connection of Marx's surplus value theory to the unmanned factory model. Marx's labor theory of value was founded in the steam era at the beginning of industrialization. Marx began to investigate the phenomena of private capital and labor relations, commodities and money circulation in the 1830s, and studied the relationship between “labor” and “labor force and commodities”, as well the production, circulation, and distribution of surplus value over several decades, and first publicly elaborated the theory of surplus value in 1865 in Wages, Prices and Profits. In the 19th century, there was a clear relationship of employment and oppression between capitalists and the working class, i.e., capitalists earned profits by forcing workers to work longer hours and

appropriating the value created by hired labor beyond their own without compensation. Most of them were handicrafts industry, manual manufacture of goods, because large-scale machines and assembly line factories had not been widely popularized, the money and commodity factor was easy to analyze in the social circulation of the 19th century.

In contrast, the production structure of the unmanned factory has changed, and the unmanned factory is fundamentally sourced from the human "scientific value base" [1], and there is very little human labor in the production chain of the unmanned factory. Unmanned factories, some people think that on the surface seems that capital enterprises can weaken the oppression of workers, and Marx's theory of surplus value is no longer suitable for unmanned factory, this view is incorrect. Theoretical presupposition should develop with the progress of the times and production methods. Unlike the steam age, the most distinctive feature of the current digital age is the increase in intellectual labor and the unprecedented unification of the surplus value created by the advanced and complex labor of all generations of scientists engaged in fundamental research in the scientific value base. As Roosevelt points out, "The unmanned factory of the future is not about eliminating workers altogether, but about liberating them completely from manual and simple mental labor to play a more creative and challenging role." And that role remains that of the laborer.

It can be seen that knowledge theory and knowledge creation played an important role between the two eras. In Marx's time, except for physical basic theories such as steam theory, there was no similar Internet system and open source system of knowledge theory that can lead the world's industry and civilization to large-scale changes in the century. For a certain unmanned factory, advanced scientific knowledge became a key factor for capital to gain profit, while capital itself does not create surplus value, it is the intellectual laborers who master the relevant knowledge that creates surplus value. The present intellectual property rights and R&D patents were not available in Marx's time, and Marx's time lacked a strict intellectual property protection system. [2] On the one hand, both factories in the era of Marx and unmanned factories turn surplus value into profits. The laborer remains the role of value creation. However, the minimal human labor in the unmanned factory causes some people to misread the surplus value theory in their production relations. In addition to the surplus value generated by the operators and managers in the direct production process, a large part of the high profits of the unmanned factory comes from the surplus value created by the hidden scientific researchers and coordination managers.

## 3. The Continuation and Misinterpretation of Surplus Value Theory in the Present Form

### 3.1 Current Research Situation and Basic Academic Views

Marx's theory of surplus value has existed for 157 years, and its generality and accuracy constantly explain the nature of capitalist exploitation and oppression, and it has served as a guide for the primary stage of socialism that China is in. As history advances and social conditions change, the exploration of the theory of surplus value is multifaceted. At present, China is in the primary stage of socialism, and exploring Marx's theory of surplus value is of great significance to China in reducing the gap between the rich and the poor, achieving common prosperity, and building a strong modern socialist country. In addition to public production, there are also a large number of private enterprises in the country, which built a wide range of labor and capital system, in which surplus labor under Marx's vision still exists. Employment labor relations and surplus value still exist in China at the primary stage of socialism and will exist for a long time.

The discussion on the surplus value theory of the unmanned factory production mode is mainly considered to be a challenge to Marx's theory of surplus value in the digital age due to technological change and the improvement of labor efficiency. As a part of human specific materialized labor materials, the unmanned factory machine is only the material condition for the creation of labor value, and it cannot create value itself. On the contrary, continuous exploration has confirmed the scientificity and correctness of Marx's theoretical system. The theoretical study of surplus value in

the context of the current digital age emphasizes the impact of technology on production relations and production patterns. In the digital age, surplus value is more concentrated by capital enterprises. It is worth noting that the powerful attendance and worker monitoring algorithms in today's era can effectively control the labor time and labor intensity of workers, which have a good auxiliary role for capital enterprises to further extend the remaining labor time of workers. Large-scale network digital capital accumulation and the replication and expansion of the digital economy, the labor results and generated value of more digital laborers are not the same as the traditional labor value on the surface, but the essence is the same. These more created values are not more effectively distributed to more corporate stakeholders, but are further gathered in the hands of the capital side or the actual controller of the company. [3]The contemporary unmanned factory with high digitization and technological innovation is in line with this situation.

### 3.2 Value generated by intellectual labor

The examination of labor objects in the unmanned factory model can be divided into concrete physical labor and human abstract labor (intellectual labor). A large number of production machines in unmanned factories represent abstract labor, which is the combination of human scientific and technological achievements, and is produced by the intellectual labor consumed by scientific researchers, programmers, and mechanical designers. Marx said, "Productivity is the result of man's practical ability." Obviously, the practical ability of people does not simply refer to the material factors such as people, money and materials, but also include people's ability to dispatch people, money and materials, that is, the degree of organization of people in production, and the way people, money and materials and other factors of production are allocated. [4] The emergence of unmanned factories is that people use technology to explore non-human labor, and then develop a reasonable way to distribute production factors in this regard. The production machines that replace workers inevitably create value when they transfer and consume their own value, and the value of the machines comes from intellectual labor value of intellectual workers such as scientific researchers. Scientific and technological knowledge relies on the inheritance and accumulation of historical human scientific knowledge and experience to add value to intellectual value. In an unmanned factory, machine parts need to be purchased from the market when they are damaged, but the technology of the machine can be used repeatedly, so most of the surplus value and wealth accumulated repeatedly in an unmanned factory comes from intellectual labor.

Strengthen the re-recognition of Marx's theory of surplus value, despite the continuous emergence of new or transformed economic production models in the current era, the practical application of surplus value theory is still not out of date. Discuss the changes in production relations brought about by the emergence of new technologies. Even if traditional products are not replaced by new products, with the use of new technologies, the production efficiency of these old products will also change. Therefore, measuring the absolute value of the social total production at different times and the relative value of various commodities and services has always been a concern of people. [5] The surplus value of commodities is brought about by the prolongation of labor time. Technology upgrades have improved production efficiency and can produce more value. The emergence of unmanned factories has broken the distribution of labor in social production, and produced a very large amount of value in a short period of time. It has caused huge differences in the amount of surplus value of different production enterprises of the same product or similar products, affecting the distribution of the commodity economy at the level of the whole society. We can also see that the incomplete popularization of technology in production enterprises has caused the special existence of unmanned factories in economic relations.

# 4. Surplus value in unmanned factories

## 4.1 Source of surplus value

In Parts II to IV of Volume I of Capital, Marx specifically explained the two modes of production of surplus value—absolute surplus value production and relative surplus value production. The production of absolute surplus value described by Marx is to prolong the labor time of workers and increase the rate of surplus value, which is the degree of exploitation of labor force. The production of relative surplus value is to shorten the necessary labor time, reduce the production cost, increase the surplus labor time, and increase the surplus labor quantity. It is worth noting that in Chapter 13 of Volume 1, Marx specially wrote about the generation of surplus value in machinery and large industry. The mode of machine production line replacing labor described by him is similar to the mode of unmanned factory.

In Marx's discussion of absolute surplus value, it is more difficult to produce surplus value by absolutely extending the time of surplus labor because technological advances lead to increased efficiency, for example, the unmanned factory model reduces the time of the worker's workday. Marx, on the other hand, paid keen attention to the factor of technological progress when studying relative surplus value, and the high production efficiency of unmanned factories can greatly shorten the necessary labor time of workers and extend the surplus labor time for surplus value production. At the same time, the innovation, development and application of science and technology in the unmanned factory model provide realistic possibilities for the shortening of the production workers' working day and the reduction of labor intensity. [6]

The generation of absolute surplus value is achieved through the absolute extension of the production workers' working days and the substantial increase of labor intensity, the absolute surplus value depends to a great extent on the labor hours of the workers. Due to the innovation, development and application of science and technology, the labor productivity of production enterprises that have invested a lot of modern science and technology factors constantly improving. At present, when capitalists or business owners obtain a large amount of surplus value, the average working hours of hired workers is showing a decreasing trend. According to the data, full-time workers in the UK work an average of 43.7 hours per week, while the average in Western Europe is 40.4 hours. In 1998, in the United States, “most full-time workers work 5 days a week and 8 hours a day, which is 40 hours a week. system”, “The legal maximum working week is now 48 hours in Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands and the United Kingdom; 48 hours in Austria, Finland, Norway, Portugal, Slovakia, Spain, Sweden; Belgium It is 30 hours.”[7] Since China’s reform and opening up, with the continuous improvement of technological innovation and development level, the labor hours of workers have also shown a trend of decreasing. “Before 1995, Chinese enterprises implemented an 8-hour work system six days a week, but since 1995, a five-day work system has been implemented, and since 1999, the Spring Festival, May 1st, and 11th long holidays have been implemented. It took 100-200 years to reach the situation. At present, China has 114 statutory holidays, and some groups have more leisure time.”[8] Both countries that implement capitalist market economy and countries that implement socialist market economy apply laws to limit the absolute extension of working days and the improvement of labor intensity by enterprises to varying degrees. Therefore, under the social background of the continuous improvement of the development level of scientific and technological innovation and the continuous reduction of the working days of laborers, the production method of absolute surplus value can no longer be the choice for capitalists or business owners to increase the rate of surplus value and obtain high profits. The essence of capitalists is oppression and greed, and they will never take the initiative to reduce the labor time of workers. They will seek other more suitable methods, which increase productivity to lower the value of labor force and reduce the average value of social necessary working hours. A conclusion can be drawn here that state policy intervention and moral and ethical pressure, the progress of science and technology in the information age, and the greed of capitalists have brought about unmanned factories to a certain extent.

Therefore, while the production of absolute surplus value in factories decreases, these enterprises begin to tend to the production of relative surplus value. Under the background of the development of science and technology, the production mode of unmanned factory that mainly seeks relative surplus value comes into being. In discussing the generation of relative surplus value in unmanned factories, there are two main aspects.

One is to improve labor productivity and reduce the necessary labor time of operators and managers in the direct production process of unmanned factories, thereby extending their surplus relatively working time. Change the scientific and technological conditions of the labor process and the combination of production factors, improve labor productivity through technological innovation and management innovation, shorten the necessary labor time, and achieve an increase in the relative surplus value of production. In the process of social and economic operation, the improvement of labor productivity caused by the improvement of science and technology always starts from individual enterprises. In order to obtain more surplus value, individual enterprises can only increase the investment of capital in scientific and technological factors, and improve labor productivity by adopting new scientific and technological achievements without extending the working days of production workers and strengthening their labor intensity. The necessary labor time can be shortened, the surplus labor time can be extended accordingly, and more surplus value can be obtained than other capitalists or business owners. It is worth noting that the essence of machines in unmanned factories is the labor materials embedded in human materialized labor, which cannot have the status of workers at all and cannot be called new workers. As the carrier of scientific transformation and technological succession, machines are no different from production tools such as steam machines, except that they have a higher level of technological intelligence and are still essentially labor materials invested by capitalists. And Marx also believed that production tools cannot generate value spontaneously, so it cannot be understood that enterprises have obtained the relative surplus value generated by the "labor role" of unmanned factory machines, and the labor objects that generate relative surplus value can only be human beings. It is certain to say that human beings have continuously evolved the means of production, but the relations of production will not change.

The second is the surplus value created by the scientific research personnel and scientific research management personnel inside the unmanned factory, who create surplus value through intellectual labor. The intellectual labor performed by the huge scientific research team behind the unmanned factory and the scientific research managers with high cultural knowledge and scientific research skills is high-level labor with high value. Scientific researchers have done a lot of high-intensity intellectual labor for the development of programs, the improvement of production machines, and scientific and technological innovation, which have produced great value. The value they create is much higher than the value created by the same number of laborers who engage in low-level labor . And the surplus value generated by these researchers is reflected in the highly efficient production of goods and is shown in the exchange process.

### 4.2 The concealment of surplus value produced by unmanned factories

The exploitation of surplus value by unmanned factories is concealed, and its superficial economic relationship is reflected in the reduction of the number of workers and the increase in the production scale of machines. Machines are not workers, and it seems that they exploit the surplus value produced by workers to a great extent. However, the concealed intellectual labor of numerous researchers and the difficult labor of managerial workers behind the unmanned factory are not easily manifested. The progress of science and technology and the change of production mode have caused labor distribution mode different from the traditional production industry, and also changed the personnel distribution of labor workers at the same time. For example, in the "Shanghai GM Jinqiao Factory", there are only 10 workers in a large workshop, and they manage 386 robots and work with the robots to produce 80 Cadillacs every day. There is also "Jingdong Asia No. 1 unmanned warehouse", where the loading and unloading of goods is entirely by computer and robot cooperation, replacing the once large number of manpower to transport goods, and this unmanned warehouse of Jingdong only needs five

managers. Both news reports and enterprise promotion only overemphasize the degree of its unmanned machine technology and production efficiency, while the complex and difficult labor of the researchers behind it is downplayed, and in the current unmanned factories, the number of researchers is the vast majority, and the few laborers are shown as the aforementioned managers and skilled workers. Unmanned factory enterprises firmly control the scientific research results and strengthen the control of intellectual property rights, in order to prevent other enterprises in the same industry from having the possibility to use similar technology. In this way, the average socially necessary labor time will not be reduced too much, while the enterprises with advanced unmanned machines can shorten the necessary labor time of their own workers, and the difference with the socially necessary labor time forms the excess surplus value, so the unmanned factories obtain the surplus value in society in a hidden way.

## 5. The impact of the existence of the unmanned factory model

### 5.1 Exploitation of unmanned factories

After some factories left the traditional factory production model and entered the unmanned factory mode of operation, the acceleration of their own technological level and production efficiency led to the reduction of the necessary labor time of the unmanned factory workers. However, the unmanned factory model is not prevalent in most industries, the emergence of a few unmanned factories does not have a significant impact on the social average necessary labor time in the industry, and the social average necessary labor time is not reduced too much. The unmanned factory still requires workers to work in accordance with the social average necessary labor time, so that they can obtain more surplus value from workers, which is created by the difference between the social average necessary labor time and the unmanned factory necessary labor time. However, the number of workers involved in the production line in the unmanned factory is after all in the minority, and the capitalist cannot rely only on this small number of people to meet the needs of interests. The control of intellectual property rights by unmanned factory enterprises hinders the proliferation of advanced science and technology and the fairness of economic market. Enterprises with advanced science and technology can obtain super high profit rate in the same industry to make unequal exchange for a long time, which is the real form of exploitation by unmanned factory, and it indirectly exploits the surplus value of workers from other enterprises in society. Marx emphasized the formation of the average rate of profit in the labor theory of value and argued that equal exchange is a prerequisite for the formation of a fair social and economic market, and individual capitalists can indeed make use of the difference between the average profit and their own profit to earn benefits, as well as through unequal exchange. At present, under the trend of economic globalization, the absolute monopoly of developed countries' multinational enterprises on science and technology enables them to obtain a large amount of excess surplus value in the international market. Enterprises with developed science and technology and mastering the unmanned factory model expand their own unmanned factories into developing countries, squeeze the development space of local related industries, earn the difference of necessary labor time between local and developed countries, and try to monopolize industries. While destroying the development of local industries, the local workers are exploited covertly, and the driving force of the exploitation is the difference in technological development. This is why large international technology companies support the development and application of technology with huge capital and constantly engage in legal disputes over intellectual property issues. Thus, it can be seen that the exploitation in the unmanned factory is not only the direct exploitation of individual workers, but also the hidden exploitation of the social level.

### 5.2 The impact of the unmanned factory on workers

Marx explores the impact of the machine mode of production of large industries on workers in Chapter 13 of Volume I of Capital. Marx argues that the material mode of existence of machines will necessarily require natural forces to replace human forces, the application of natural sciences to

replace the stereotypes in workers' experience. And the relative surplus value generated by the machine mode of production would devalue labor and increase the degree of exploitation. If unmanned factories become widespread, it will inevitably cause the shrinkage of jobs, but the number of workers is much larger than the number of jobs, which will cause the devaluation of labor. So the impact of the unmanned factory model on workers - fewer jobs, devaluation of the social value of labor, and higher than average social labor output per unit of labor time.

## 6. Conclusion

The model of the unmanned factory has both positive and negative aspects, i.e., productive and exploitative. On the one hand, the unmanned factory significantly raises the productivity level and enhances the efficiency and intensity of the economic system; on the other hand, the exploitative nature of its capital enterprise remains unchanged. Even if the number of workers in the unmanned factory decreases, the capitalists will not ignore the surplus value generated by this small number of workers as long as they exist. This high-quality and complex labor has a greater amount of value, which is of course reflected after the exchange of products. The current trend of construction of unmanned factories is increasing, which comes from the fact that they can harvest excess surplus value, which is the excess profit that individual monopolies or enterprises with much higher productivity than their counterparts can harvest from the overall surplus value of society beyond their average profit. If the number of unmanned factories increases greatly in the future and the difference between the average social surplus value and the average surplus value of unmanned factories decreases until most firms in the industry start unmanned factories, resulting in the near disappearance of excess surplus value, a situation may arise in which productivity is huge but earnings are lost. As things stand now, companies are trying to maintain ultra-high profit margins and excess surplus value for a long time. This will lead to intellectual property issues, and some companies hinder the spread of unmanned factory technology exchange to prevent the emergence of competitors and accelerate monopolization at the unmanned factory level. For the common wealth advocated by China today, it is necessary to solve the problem of monopoly and sharing of science and technology that may arise in unmanned factories in the future, as well as to explore how to maximize the protection of the legitimate rights and interests of workers who perform human labor and intellectual labor in unmanned factories.

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