

## Original Paper

# Marx Scientific and Technological Innovation Thought and Its Contemporary Enlightenment

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### **Abstract**

*China's economic and social development is inseparable from the development of science and technology, people are enjoying the convenience brought by science and technology, but also facing the problem between the application of science and technology and social development. Marx's works contain a wealth of thought on scientific and technological innovation and are still of important value in the contemporary era, and provide an action guide for contemporary scientific and technological innovation, and maintain to guide our country's science and technology development under the Marx thought of scientific and technological innovation, and provide the important practical significance to solve the problems facing our country's science and technology development. It plays an important role in building a powerful nation of science and technology, and is conducive to promoting the sound development of science and technology undertakings. The current social development needs to increase the investment in science and technology. Based on the analysis from the perspective of development, advanced science and technology leads our country to constantly explore new fields, and mastering the core science and technology that has an important impact on the destiny of the country still has certain practical significance for the current construction of an innovation-oriented country.*

### **Keywords**

*Scientific and technological innovation, Revelation, The present age, Marxism*

## **1. The Formation Background of Marx's Scientific and Technological Innovation Thought**

The formation of Marx's scientific and technological innovation thought is inseparable from the specific historical background at that time, it is the product of The Times, in the contemporary research on scientific and technological innovation theory, from the ideological source of Marx's theory and view of scientific and technological innovation in-depth excavation, "the accelerated development of science and

technology in the 19th century, the impact on economic and social life is more and more prominent; At the same time, these questions also entered Marx's theoretical field of vision" (Liu, 2017). The emergence of Marx's scientific and technological innovation ideas has profound social, historical and realistic roots, and is the result of a variety of factors. Science, technology, politics, economy and culture have all had an impact on it. Its systematization has experienced a long process and gradually developed and improved with The Times.

### *1.1 Natural Preconditions: The Development of Natural Sciences*

The formation of Marx's scientific and technological innovation thought is inseparable from the rapid development of modern natural science. Natural science is the thought that in the process of human development, the religious theocracy in the middle ages ruled mankind for a long time. Since the Renaissance, science has gradually liberated itself from the bondage of theology. The Copernican revolution in astronomy set off the first wave of scientific and technological revolution, in which natural science was liberated. Marx lived in the era of natural science is developing to the climax stage, people's ideas began to develop and change, a series of famous theories in natural science gradually emerged, under the influence of materialism, metaphysical thinking mode gradually disappeared, people began to use a comprehensive, dialectical perspective on the development of science. In the 19th century, natural science made more outstanding achievements, and mankind made major breakthroughs in the fields of biology, geology and physics, especially the cell theory, the law of conservation of energy and the law of transformation, and the three scientific discoveries of biological evolution laid a solid natural foundation for the formation of Marx's scientific and technological innovation ideas. At the same time, the development of natural science has played a role in promoting the production of the industrial revolution, and people have paid more and more attention to the application of science and technology.

### *1.2 Methodology Support: The Development of Humanities and Social Sciences*

In the 18th and 19th centuries, the humanities and social sciences developed rapidly, and the British classical political economists Adam Smith and David Ricardo deeply analyzed the capitalist economic relations and the contradictions between capitalists and workers, and put forward the theory of labor value, which provided a theoretical basis for the development of the labor theory of value. During the French Restoration period, some historians made a preliminary exploration of the influence of class society on social development, and through research and development, the role of people's power and economic interests in the class struggle is very necessary. In this period, the rapid development of humanities and social sciences, the formation of new ways to understand the world and transform the world, to human thought concepts and ways of thinking brought a new form. Because of the influence of the humanities and social sciences at that time, Marx's thinking mode of understanding scientific and technological innovation can be more comprehensive, and his understanding of scientific and technological innovation ideas is more in-depth.

### *1.3 Realistic Background: The Development of the Two Industrial Revolutions*

Marx lived from the prosperity of the first Industrial Revolution to the beginning of the second Industrial Revolution. Based on the completion of the industrial Revolution, Marx began to study scientific and technological innovation and gradually formed the idea of scientific and technological innovation. The first Industrial revolution was a huge revolution in the history of technological development. It created an era in which manual labor was replaced by machines, and large-scale machine production began to replace factory handicraft. With the rapid development of productive forces, the industrial society at that time underwent tremendous changes. The second Industrial revolution came into being in the 19th century, with the rise of a large number of technology industries related to power, which caused profound changes in the industrial structure and further promoted the rapid development of productivity. The development and application of science and technology in the two industrial revolutions produced a large number of production tools and means, which had an impact on all aspects of human life. Marx saw the role of scientific and technological innovation in promoting social production under the realistic background of the development of the industrial Revolution, and formed Marx's scientific and technological innovation thought. The prosperous development and application of science and technology in the two industrial revolutions, and the emergence of a large number of production tools, greatly promoted the development of social productive forces, and had an impact on the way of production and life.

## **2. The Main Content of Marx's Scientific and Technological Innovation Thought**

"Scientific and technological innovation" has a wide range of applications in today's society. At present, many scholars attribute the concept of "scientific and technological innovation" to Schumpeter's "innovation theory". From the history of the development of science and technology, science and technology have their own development histories, and the three revolutions experienced by science and the three revolutions experienced by technology are inconsistent in time. Engels pointed out in his speech at Marx's tomb: "If there is a new scientific achievement anywhere, no matter whether it is practical application, Marx feels the greatest joy than anyone else" (The Complete Works of Marx and Engels: Vol Volume 25, 2011). Although Marx did not leave a monograph on the issue of scientific and technological innovation, nor did he have a clear explanation of the theory of scientific and technological innovation, in his works, the development of productive forces, the improvement of the organic composition of capital, the use of machines and other concepts are related to scientific and technological innovation, and contain rich ideas of scientific and technological innovation.

### *2.1 Social Demand Provides the Impetus for Scientific and Technological Innovation*

Both scientific and technological innovation are derived from the needs of society, Marx once said: "with machine spinning, there must be machine weaving, and these two in turn make bleaching, printing and dyeing industry must undergo a mechanical and chemical revolution" (The Complete Works of Marx and Engels: Vol Volume 46, 1979). The development of scientific and technological innovation is

inseparable from the needs of society. In the process of industrial production, every part is interlinked and inseparable, and the driving force of scientific invention and technological innovation comes from the needs of society.” Once society has the technical needs, it will be able to push science forward more than 10 universities” (The Complete Works of Marx and Engels: Vol Volume 39, 1980). Scientific discoveries are inextricably linked to social needs. The intrinsic motivation of the development of science and technology is related to the need of capitalists to pursue surplus value. The pursuit of interests is the essential feature of capital production. In order to obtain higher interests and gain advantages in the fierce market competition, it is essential to improve labor productivity and reduce production costs. The application and improvement of machines can greatly reduce labor time and improve the competitiveness of goods. When there is a contradiction between people’s needs and reality, the imbalance between production and demand can be solved through scientific and technological innovation. In addition, in terms of transportation technology, the original means of transportation can no longer meet the needs of industrial production due to the further development of industry, so the innovation of new means of transportation such as railway and ocean shipping has emerged. It is these needs of production and social development that promote the development of scientific and technological innovation and provide impetus for scientific and technological innovation.

## *2.2 The Dialectical Relationship between Scientific Innovation and Technological Innovation*

The term scientific and technological innovation includes scientific innovation and technological innovation. This concept is produced in the Chinese context. From the western perspective, Schumpeter did not put forward the concept of scientific and technological innovation, but the Western academic circle believes that technological innovation and institutional innovation are included in his innovation concept. Marx lived in a time when science and technology were not closely related terms. Marx did not explicitly put forward the concept of scientific and technological innovation in his works, but there are many aspects of scientific and technological innovation in his works. The concept of innovation is the product of modern society. Scientific innovation includes scientific understanding, scientific discovery and scientific application. Major scientific discoveries and major theories usually promote the occurrence of scientific revolution. Technological innovation is the creative application of existing scientific and technological achievements, which is usually manifested as the birth of new things and new products. Technological invention is the core of technological creation.

### *2.2.1 Social Demand Provides the Impetus for Scientific and Technological Innovation*

On the one hand, in Marx’s view, the progress of machine invention and technology cannot be separated from scientific and technological innovation, and the invention and application of technology are based on natural science. The invention and creation of new machines and methods are inseparable from each new development and theoretical progress, and the development of scientific innovation promotes the innovation and transformation of technology.

On the other hand, science and technology is the primary productive forces, and the development of productive forces is bound to be inseparable from the progress of science and technology. Science and

technology penetrate into various elements of productive forces, greatly change people's production and life style, and have a far-reaching impact on the development of society.

### 2.2.2 Technological Innovation Provides Motivation for Scientific Innovation

Science is the production of potential knowledge forms, and technology is indispensable to play the role of science. Technological innovation connects scientific innovation and production, and provides scientific innovation with the research means it needs. In order to play the role of science, the intermediary role of technology is also very necessary. The development of science cannot be separated from the innovation of technology, and under the effective technological innovation, science and technology can be developed to a certain extent. On the contrary, without the guidance of technology, the development of scientific innovation will lose the right direction. Science serves for production, and technological innovation provides scientific innovation with the material means of research it needs.

### 2.3 *Scientific Innovation is Closely Linked to Technological Innovation*

In contemporary society, science and technology are closely related, and scientific discovery is closely related to technological invention. Marx used the machine system as an example to illustrate the relationship between science and technology. In capitalist society, scientific innovation and technological innovation tend to be integrated. In the machine system, scientific discovery is the source of mechanical and chemical laws, the internal relationship between scientific innovation and technological innovation makes the productive forces of capitalist society develop greatly, and science and technology are closely linked. On the basis of inheriting the predecessors' inventions, technological inventors make technological breakthroughs through innovation and promote the development and progress of technology. Although Marx did not put forward the concept of scientific and technological innovation, scientific and technological innovation is included in his works. In this sense, scientific and technological innovation is the generation of new scientific achievements and scientific principles. Transform scientific principles into new technological inventions, production methods, etc., to promote the development of productive forces and social progress. As one of the important means to promote social development, science and technology can promote the continuous change of production tools and better input into social transformation. Science and technology are the first step in the progress of human society and the development of civilization, and provide a means of observation and experiment for natural science research to a certain extent. People's grasp of scientific knowledge not only involves in theory, but also applies scientific knowledge to specific production practice, and combines technology with science and technology to play a greater role.

### 2.4 *The Double Effect of Scientific and Technological Innovation*

Marx emphasized, "The hand mill produced a feudal society, and the steam mill produced a society of industrial capitalists" (Selected Works of Marx and Engels: Vol Volume 1, 1995). Different times have different scientific and technological achievements, which promote the development of productive forces, and scientific and technological innovation is also the driving force for the change of production relations. With the great development of science and technology, human beings' ability to understand and

transform nature is also constantly improving, and the scope of labor objects is expanding day by day. Scientific and technological innovation is combined with laborers, labor materials and labor objects and transformed into actual productive forces. But at the same time, we should also see that scientific and technological innovation is a double-edged sword, while promoting social development, scientific and technological innovation has also brought some problems that can not be ignored. In terms of environment, the wide application of machines has caused environmental pollution, environmental deterioration, abnormal climate, food safety, etc., affecting people's normal production and life. The irrational use of science and technology eventually leads to a series of ecological problems that nature cannot bear. The main body of scientific and technological innovation includes capitalists, who, driven by capital, use invention and creation to pursue interests and maximize the interests of capitalists. These problems caused by the development of science and technology have a certain universality. Science and technology has played a powerful role in promoting the capitalist society, but it will also have negative effects when it is improperly used by people. Science and technology should play its due role and be used by people.

### **3. The Enlightenment of Marx's Thought of Scientific and Technological Innovation to Contemporary Scientific and Technological Innovation**

Marx's scientific and technological innovation thought, as an important part of Marxist theoretical system, has a very important guiding significance for the development of science and technology and the progress of society. At present, China is building a world power in science and technology. To ensure the steady and long-term development of China's science and technology, it is necessary to take scientific theories as guidance, and take Marx's scientific and technological innovation thought as guidance for socialist scientific and technological innovation with Chinese characteristics, building an innovative country, and realizing the "two Centenary goals".

#### *3.1 Adhere to the People-oriented Approach and Comprehensively Enhance Innovation Capabilities*

In today's world, scientific and technological innovation is an important factor affecting the comprehensive national strength, scientific and technological innovation is a practical activity, affected by a variety of factors, the results of scientific and technological innovation should be truly applied to real life, and bring certain value to the development of human society. Scientific and technological innovation exists in various fields of economic development and social production. At present, China has entered a new era of socialism with Chinese characteristics, and China's scientific and technological innovation has also started a new journey. It is necessary to continue to encourage innovation and increase investment in capital and talent. Since the new era, the main contradiction in our society has changed. Scientific and technological innovation should take people's happy life as the starting point and landing point. In real life, scientific and technological innovation affects people's life from time to time, has an impact on the production and life of the whole society, and makes life more convenient and rich. It is necessary to apply the achievements of scientific and technological innovation into practice, invest the

research results into the fields that the people need, take the needs and calls of the people as the direction of scientific and technological innovation, accelerate the establishment and improvement of scientific and technological achievements sharing mechanism, meet the actual needs of the people, adhere to the people-oriented, and let more scientific and technological achievements into the people's lives.

People nature is the "soul" of scientific and technological innovation in the new era, science and technology is created by human beings and serves human beings, therefore, China's science and technology should adhere to the principle of human text, so that science and technology can truly serve the people, while carrying out scientific and technological innovation and development activities, we should clarify the value of scientific and technological activities, and reflect the role of science and technology in promoting human development. With the development of The Times and the progress of society, people's needs will also change, and the development of science and technology should focus on the real needs of the people, so as to better benefit all mankind. Proceeding from a highly responsible attitude towards the people, we should vigorously develop science and technology, make science and technology benefit mankind, unswervingly adhere to the fundamental position of the people's nature of Marxism, and constantly meet the people's ever-growing needs for a better life. We should adhere to a people-centered approach to development, closely integrate scientific and technological innovation with people's wellbeing, and foster green development and lifestyles.

### *3.2 Adhere to Science and Technology to Benefit the People, and Attach Importance to the Training and Introduction of Scientific and Technological Talents*

Human resource is the first resource in scientific and technological innovation, and the most active factor in the development of productivity and science and technology is people. The key to China's innovation-driven development is to effectively stimulate the enthusiasm of scientific and technological personnel for innovation and entrepreneurship. To build an innovation-oriented country, it is necessary to cultivate innovative talents, pay attention to the shaping of talents' thoughts, train talents suitable for the needs of national development, and vigorously promote and cultivate the spirit of scientific and technological innovation. At present, a new round of scientific and technological revolution is booming, and the strength of human resources determines the rise and fall of a country and a nation. In order to realize the transformation into a scientific and technological power, building a large scale and reasonable resources of innovative talents is the key. Therefore, we should pay attention to personnel training and talent introduction. Specifically, in terms of scientific research returns, the performance and results of scientific researchers can be more reasonable income, so that the scientific research project fund management system can be improved, and a more reasonable scientific research project fund management system can be established. In the evaluation system, the evaluation system of scientific research performance should be improved so that the contribution of scientific research personnel can be demonstrated. In terms of scientific research environment, to create a good social atmosphere, create a good environment conducive to the work of scientific researchers, with a stable environment, the enthusiasm of scientific researchers to improve. Improve the mechanism of talent mobility and service

guarantee, realize that people make full use of their talents, mobilize the enthusiasm of various types of talents, and point out the way forward for the training of scientific and technological innovation talents in our country. The development of talent resources should be the top priority of scientific and technological innovation. The development of science and technology needs innovative young talents, who have a global vision in the selection of talents, and create a good social atmosphere for the training and growth of scientific and technological innovation talents.

Scientific and technological talents should be guided by correct values and carry out scientific and technological innovation with correct values and responsibilities, so that scientific and technological achievements can better benefit mankind. High-quality scientific and technological workers can play a role in promoting the development of society and help scientific and technological achievements better benefit mankind. Under the guidance of correct values, Guide scientific and technological workers to establish a correct sense of responsibility and humanistic care spirit, so that science and technology in a more reasonable and healthy direction of continuous development, adhere to the correct values, establish a service to the people, the motherland of the great ideal, in the process of scientific and technological innovation, adhere to the correct values. The development of scientific and technological innovation is closely related to high-quality scientific and technological talents, enhance the self-discipline of scientific and technological workers, adhere to professional ethics, consciously abide by scientific and technological norms, keep in mind the purpose of serving the people, fully mobilize the enthusiasm of scientific and technological innovation personnel, and build a good scientific and technological innovation environment for scientific and technological talents.

### *3.3 Deepen Scientific and Technological Innovation to Promote Economic Development*

In Marx's time, the development of science and technology was still in an immature stage, and the development of science and technology in today's society has gradually become perfect. Scientific and technological innovation has played a role in promoting the progress of The Times. The accumulation of modern scientific knowledge has played a role in promoting the development of scientific and technological innovation, and the updating time of scientific and technological products has been gradually shortened. Scientific and technological innovation provides the impetus for economic development, and the improvement of social and economic benefits of science and technology is closely related to technological innovation. With the deepening of scientific and technological innovation, the development of emerging industries will promote the updating of product structure and promote economic growth. Our country should improve the ability of independent innovation, make full use of scientific and technological innovation, make the industrial structure develop in a more reasonable direction, change the economic development mode, and make new analysis of new situations and problems. We will combine economic benefits with social benefits, pay attention to the development of science and technology in the international community, and widely learn from and absorb existing scientific and technological achievements. With the acceleration of the social development process, China should promote the institutional innovation of our country while constantly improving the basic

social system, so as to provide vitality for the economic development. China's development should be based on its own fundamentals, constantly improve the construction of institutions, coordinate the interests and relations of all aspects of society, and help achieve sustainable economic and social development.

The implementation of innovation-driven development strategy is the focus of scientific and technological innovation in the new era. Centering on scientific and technological innovation, we should grasp the core of innovation, implement the innovation-driven development strategy, and adjust the original system that is not suitable for the new economic development mode in view of the problems faced in the practice of scientific and technological innovation in China. We should choose the direction of scientific and technological innovation according to the market demand, give play to the decisive role of the market in the allocation of resources, accelerate the transformation of innovation achievements, actively promote the development of industrialization, optimize the innovation environment in the whole society, form a good social atmosphere, improve the system and mechanism of scientific and technological innovation, and promote the healthy development of national science and technology undertakings. Science and technology are inseparable from economic and social development, and every major change in productive forces has a direct relationship with scientific and technological progress. In the new era of socialism, scientific and technological innovation has increasingly become the decisive force for economic and social development. A new round of scientific and technological innovation represented by electronic information technology and artificial intelligence has entered a new stage, promoting profound changes in social and economic organization and management. In the period of strategic opportunities for high-tech development, China continues to open new bureaus and educate new machines, and has walked in the forefront of the world in many high-tech aspects, promoting economic development and social progress through scientific and technological innovation.

#### *3.4 Pay Attention to the Possible Negative Effects of Technological Innovation*

While promoting the development of social civilization, scientific and technological innovation may also have a negative impact on the progress of human society. The development of scientific and technological innovation not only brings about economic growth, but also has a certain impact on the natural environment. Some achievements of scientific and technological innovation will bring some negative effects when they are improperly applied. With the development of high and new science and technology and the progress of industrialization, environmental pollution, resource shortage and other problems have also followed. Scientific and technological innovation has brought economic growth but also brought a series of ecological problems, such as soil erosion, global warming and other natural problems, which have become a disharmonious factor in the relationship between man and nature. The traditional mode of industrial production has caused pollution to the natural environment and consumed a lot of natural resources. The development of science and technology has enhanced people's ability to transform nature, but it has also caused the destruction of ecological environment. In the era of intelligence, the development of Internet technology provides people with a platform for communication

and communication, and at the same time, the information security problems brought by it also affect People's Daily life. Therefore, it is necessary to correctly view science and technology issues, rationally apply the achievements of scientific and technological innovation, adhere to the development of green science and technology, and respect the laws of nature while using science and technology to understand and transform nature. The current achievements of economic development and social progress are inseparable from science and technology, and the solution of contemporary scientific problems is inseparable from the development of science and technology. To develop green science and technology and improve the level of ecological civilization construction, we should not over-use resources in order to pursue development, but protect resources, manage while developing, apply existing science and technology to optimize the industrial structure, realize the coordination of environmental protection and natural environment in production, gradually establish ecological civilization, use scientific and technological innovation means to manage the environment and create new energy. In the construction of ecological civilization, focus on the construction of ecological civilization for all mankind, promote the good transformation of ecological environmental scientific and technological achievements, let science and technology become a progressive force for human development, and promote the harmonious coexistence of man and nature. In the process of scientific and technological innovation, to protect the environment as the premise, not only to achieve economic development, but also to do a good job of environmental protection, in the face of climate change and other ecological and environmental problems, respect the laws of nature, advocate the concept of active and responsible scientific and technological innovation, promote scientific and technological innovation activities in line with the requirements of sustainable development, and promote the harmonious coexistence of man and nature.

Through science and technology to better realize the harmonious development of man and nature, the world comes from nature, human development needs to rely on nature, promote social development through science and technology, rely on science and technology to improve the natural environment. When people use science and technology to obtain what they need from nature, they should not only see economic benefits, but also respect nature and use modern science and technology to improve nature. The Times are developing, science and technology are advancing, through the power of science and technology to improve the natural environment, save natural resources, and strive for the goal of building a modern socialist country.

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