

# The Impact Mechanism and Structural Effect of Artificial Intelligence on the Labor Market

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**Abstract:** With the rapid development of artificial intelligence (AI) technology, its impact on the labor market has become an important research direction in the field of labor economics. Starting from the two dimensions of action mechanism and structural effect, this paper systematically discusses the dual impact of artificial intelligence on the job market, and combines traditional theories and emerging research paradigms to deeply analyze the process of technological change reshaping the employment pattern. The results show that artificial intelligence significantly reduces the demand for standardized and repetitive jobs (such as data entry clerks and administrative assistants) through the "substitution effect". The employment structure shows an obvious differentiation trend: the agricultural labor force continues to shift to the secondary and tertiary industries, the number of low-skilled jobs in the manufacturing industry continues to shrink, while the demand for high-skilled and versatile talents increases significantly, promoting the transformation of labor force ability structure to the direction of "digital skills + professional knowledge". At the policy level, the current labor protection system is insufficient in terms of technical adaptability and timeliness of supervision. It is urgent to strengthen vocational skills training (such as supporting the skills transformation of manufacturing workers), improve the labor security mechanism (coping with the risks brought by new working modes such as remote working), and optimize the orientation of industrial technology policy (focusing on technological innovation rather than simple scale expansion). To achieve a dynamic balance between human-machine collaboration and the job market. This study not only provides theoretical support for understanding the evolution of the labor market in the era of artificial intelligence, but also provides a practical basis for the

formulation and improvement of relevant policies.

**Keywords:** Artificial Intelligence; Labor Market; Labor Economics

## 1. Introduction

With the development and application of artificial intelligence and other new technologies, "de-worker" has become an important means for enterprises to enhance their competitiveness [1]. According to IDC, the total investment scale of global artificial intelligence (AI) Information Technology was US \$315.8 billion in 2024, and is expected to surge to US \$815.9 billion by 2028, with a five-year compound growth rate (CAGR) of 32.9%. Among them, the emergent AI markets around the world have more rapid development, compound growth rate for five years, or 63.8%, to 2028 the size of the market will reach \$284.2 billion, accounting for 35% of the total size of the AI market investment [2]. In the context of increasingly fierce global competition, scientific and technological innovation and industrial upgrading are accelerating. Artificial intelligence, as one of the most transformative technologies, has become the core field of scientific and technological competition among countries. In 2023, the Central Economic Work Conference proposed to take scientific and technological innovation to lead the construction of a modern industrial system as the primary task of promoting high-quality development, emphasizing the acceleration of the development of artificial intelligence and strengthening the dominant position of enterprises in scientific and technological innovation [3]. This strategic deployment encourages and promotes the wide application of intelligent and advanced technologies by enterprises, injecting new momentum into steady economic growth [3]. At present, China has become the world's largest user of industrial robots, and industrial robots have been widely penetrated into 60 industry

categories and 168 industry categories of the national economy. Facing the dual pressure of gradually tightening labor supply and limited capital flow, China is taking the initiative to seize the opportunity of automation technology innovation with the popularization of industrial robots as the core. as a key measure to cope with labor shortage, promote sustained economic growth and achieve high-quality development.

The development of artificial intelligence has a broad and far-reaching impact, profoundly reshaping the economic model, social form and international pattern. It drives the rapid development of machine learning and other related technologies, which has a significant impact on the employment structure and labor market [4]. On the one hand, the development of artificial intelligence has promoted the birth of many emerging industries and jobs, such as artificial intelligence engineer, data analyst, AI algorithm optimizer and AI data annotation analyst. However, the talent gap in the field of AI in China is expected to reach about 4 million people in the next few years. On the other hand, many repetitive and regular jobs, such as data entry, document processing and administrative affairs, are at risk of being replaced by AI. Research in 2024 shows that 90% of workers will be affected and 9% of the workforce may be completely replaced in the next 10 years [5].

With the rapid expansion of artificial intelligence technology in all walks of life, its transformative impact on the labor market has become an important focus of labor economics research. As a review of relevant research, this paper will focus on three main aspects: firstly, it will sort out the theoretical basis of the interaction between artificial intelligence and the labor market. It will not only integrate the traditional skin-biased and skin-biased task progress theories, but also discuss the development of emerging theories such as human-machine collaboration driven by AI characteristics and their discussions and disagreements in the academic world. Secondly, this paper deeply analyzes the internal mechanism of artificial intelligence's impact on the labor market, focusing on its impact on standardized jobs through substitution effect, new career opportunities through creation effect, and the differentiation trend caused by the overall employment structure. Finally, it summarizes the policy measures adopted by various countries in promoting the coordinated development of

artificial intelligence and the labor market, including the practical exploration of vocational training and employment security, and summarizes the main debate points at the current policy level, in order to provide clear ideas for subsequent research and provide useful reference for policy making.

## **2. Theoretical Basis of the Interaction between Artificial Intelligence and Labor Market**

### **2.1 Classical Theories of Traditional Technological Change and Labor Market**

Technological progress plays an important role in improving people's living standards and enhancing the comprehensive strength of a country. Neoclassical growth theory holds that technological progress is neutral, and technological progress makes the marginal output of production factors increase year on year, and its representative production function is Cobb-Douglas function [6]. However, in the actual production process, this assumption is often difficult to hold. Technological progress usually creates a preference for a particular factor of production, resulting in that factor gaining a comparative advantage in the production process. Therefore, the direction of technological progress has a key impact on the distribution pattern of primary income. It is of great practical value to deeply understand the biased characteristics and evolution rules of technological progress for grasping the trend of income distribution and promoting the optimization of economic structure.

Bias technology progress (biased technical change) theory origin can be traced back to the early induced innovation (induced innovation). Hicks(1932) first proposed the theoretical hypothesis of induced innovation, believing that the driving force of technological innovation lies in the economical use of a relatively expensive means of production [7]. Kennedy(1964) proposed the theory of "innovation possibilities frontier" from the perspective of technology supply, arguing that it is the form of "innovation possibilities frontier" rather than a given neoclassical production function that determines the distribution of factor income [8]. The induced innovation theory can be summarized as the following economic logic: when the labor supply is insufficient, the wage level will rise, which will prompt enterprises to seek

technological innovation that can save labor. However, there is a common problem in the early research on induced innovation, that is, the lack of solid microeconomic foundation as support.

Hicks induced innovation theory holds that the change of factor relative price is the direct cause of invention and innovation, which will induce technological innovation activities that save expensive input factors. Kennedy induced innovation theory is carried out under the assumption that the relative price of factors is unchanged, and enterprises choose the appropriate technological progress on the innovation possibility curve to minimize the production cost. Hicks theory focuses more on explaining the bias of technological innovation from the macro perspective of factor price changes, and has strong persuasion in explaining the wide application of artificial intelligence due to the rising labor cost. Kennedy theory pays more attention to the micro decision-making process of enterprises based on the innovation possibility curve under the given factor prices, which has more direct guiding significance for analyzing how enterprises make specific strategic choices in the innovation and application of artificial intelligence technology, such as what kind of artificial intelligence technology solution to choose and how to allocate resources.

## **2.2 Expansion and Revision of the Theory in the Era of Artificial Intelligence**

The "non-competitive" and "data-driven" nature of artificial intelligence is profoundly changing the traditional theoretical framework of labor economics, posing a fundamental challenge to the theory of skimp-biased technological progress (SBTC). From the perspective of the evolution logic of technological progress, the data-driven feature reconstructs its endogenous development mechanism. Different from the traditional theory that regards technological progress as the result of external factors, the development of artificial intelligence relies on the accumulation and efficient processing of data resources, forming a dynamic feedback path of "data input-model optimization-efficiency improvement". This endogeneity mechanism makes the speed of technological progress no longer mainly depend on the growth of skill supply, but more affected by the scale and quality of data. This shift has formed an

important supplement and revision to the core idea of SBTC theory: SBTC emphasizes the adaptation between highly skilled labor and technology, while in the context of artificial intelligence, the "data skill premium" focuses more on the individual's ability to process and analyze data, thus giving birth to new occupations such as data labeling analyst. These jobs do not take traditional academic qualifications as the main threshold, but they can provide high salary returns, which shakes the traditional cognitive system that "education level determines the value of skills".

In recent years, the human-machine collaboration theory has broken the traditional binary opposition concept of "technology replaces human", and put forward four collaborative modes, such as "human excellence + machine excellence" and "human disadvantage + machine excellence", emphasizing the realization of human-machine complementary advantages through flexible task allocation and improving the overall efficiency. Taking the medical field as an example, doctors rely on their rich clinical experience to cope with complex diagnosis, while artificial intelligence systems quickly process medical image data, forming an efficient collaboration mode in which "humans are responsible for non-standardized decision-making and machines undertake data processing tasks". The development of this theory has promoted the transformation of skill demand, and promoted the development of the labor force in the direction of "technical understanding ability + professional domain knowledge".

## **3. The Mechanism of Artificial Intelligence Affecting the Labor Market**

### **3.1 Influencing Mechanism of Total Employment**

The influence mechanism of total employment refers to the influence path of artificial intelligence on the overall employment scale (total number of jobs) in the labor market, focusing on the dynamic balance between "job substitution effect" and "job creation effect" caused by AI technology.

In terms of the employment substitution effect, the employment substitution effect of artificial intelligence refers to the economic and social phenomenon that under the background of the wide application of artificial intelligence

technology, the software and hardware developed based on artificial intelligence technology gradually replace human workers in the field of production and service, resulting in the reduction or even disappearance of the labor demand for the original specific jobs and occupations. To understand the employment substitution effect of artificial intelligence, we must start from its technical mechanism, deconstruction of labor itself and reshaping of the job market, and reveal the internal logic of its replacement of human labor [9]. From the historical perspective, every large-scale scientific and technological revolution will affect employment, and its essence is the reflection of the strong substitution of technology and capital factors for labor factors [10]. With the emergence of advanced technologies and tools, production departments tend to increase capital investment in new technologies for the consideration of improving efficiency and cutting costs, and correspondingly reduce the dependence on inefficient human labor. In addition, the shortened product life cycle also shortens the investment return cycle of enterprises, and the income of enterprises becomes lower, which inhibits the entry of new enterprises and reduces part of the employment [11]. For example, the application of artificial intelligence robots in fire fighting, disaster relief and other industries with high risk can reduce work risks and the possibility of accidents. The advancement of artificial intelligence technology has replaced some jobs and improved the dignity of workers. For example, through machine substitution, workers can devote more time and energy to other more meaningful and challenging tasks [11].

Job creation effect refers to the dynamic development process in which artificial intelligence (AI) and automation technologies replace original jobs and drive the demand for new occupations and jobs to emerge by means of technology diffusion, industrial optimization and economic structural transformation. On the one hand, the advancement of artificial intelligence technology enables enterprises to widely adopt automation equipment, thus improving labor productivity and reducing production costs. With the decrease in production costs, enterprises become more competitive in the market, which in turn may expand the production scale and increase the demand for labor. In addition, in the short term, by automating the operation process

and improving production efficiency with the help of artificial intelligence technology, enterprises can effectively increase the added value of products, reduce product prices, and drive the growth of overall domestic consumer demand, thus promoting economic expansion and employment opportunities. On the other hand, as the cost of capital is relatively lower than the improvement of labor productivity, enterprises are more inclined to increase the investment in labor, thus promoting the demand for human resources. For example, the development of the new generation of artificial intelligence represented by ChatGPT has greatly reduced the information cost and transaction cost of enterprises, reduced the market entry threshold and various restrictions of small and medium-sized enterprises, and promoted all kinds of innovation and investment of small and medium-sized enterprises [9].

### **3.2 Influence Mechanism of Employment Structure**

The development of artificial intelligence drives the continuous optimization and upgrading of the industrial structure, and then has a profound impact on the employment structure and employment opportunities of the labor force.

From the perspective of industrial structure, labor in the market economy often migrate to industries with higher returns, which is particularly obvious in the change of employment structure under the influence of artificial intelligence. The intelligentization of the primary industry (agriculture) is accelerating, and unmanned aerial vehicles, intelligent irrigation, automated picking and other equipment are widely used. Taking UAVs for plant protection as an example, some agricultural developed areas use them for efficient spraying, precise quantity control and pollution reduction. The comprehensive management mode of a modern smart orchard constructed in Xiying Village, Yukou Town, Pinggu District, has reduced labor costs for the orchard by more than 50% [12]. A large number of agricultural labor force find another way to flow to the secondary and tertiary industries. In the adjustment of industrial structure, artificial intelligence has a significant impact on the employment structure of various industries [13].

From the perspective of the skill structure of employed personnel, the optimization of industrial structure is often accompanied by the

synchronous upgrading of employment structure [14]. As a key force of industrial transformation, artificial intelligence not only creates new jobs, but also leads to the disappearance of many traditional jobs, especially low-skilled repetitive jobs are the first to be replaced. Artificial intelligence deeply reconstructs the labor process through automation and intelligent technology, and promotes the development of production in the direction of high automation and intelligence, thus changing the traditional operation process and production organization mode. This change has put forward new and higher requirements for the skills and quality of workers: workers not only need to master solid digital skills, but also need to have strong ability to analyze and solve problems, as well as the innovation quality of working with intelligent systems.

Under the background of continuous optimization of economic structure and continuous upgrading of industries, the flow of labor among industries has become more frequent, and the skill structure has also shown a significant adjustment trend. This transformation not only reflects the improvement of social production efficiency and the optimization of employment pattern, but also brings new driving forces for economic growth. Taking manufacturing as an example, with the wide application of automation technology, many traditional labor-intensive jobs have been gradually replaced by intelligent equipment, which has prompted part of the labor force to shift from the secondary industry to the tertiary industry, especially in the service industry and high-tech fields to find new employment opportunities. At the same time, the rapid development of the digital economy, artificial intelligence, clean energy and other emerging fields has opened up a broader space for career development for talents with cutting-edge technologies and compound abilities.

However, this transformation has also put forward higher requirements for workers to adapt. On the one hand, technology iteration accelerates the renewal cycle of vocational skills, and workers must continue to learn and improve their ability to match the changing job needs; On the other hand, employees in some traditional industries face great pressure of re-employment due to their single skills or lack of transformation conditions. Therefore, strengthening the vocational training system, building a lifelong learning mechanism, and

improving the overall human quality have become important strategies to cope with the challenges of transformation.

At the same time, government agencies, enterprise organizations and all sectors of society are also actively seeking diversified support paths, such as setting up special funds for skills training, promoting the deep integration of education and industry, encouraging self-employment and flexible employment, aiming to provide workers with a more smooth career transition channel. These measures not only help to alleviate the structural contradiction of employment caused by industrial restructuring, but also provide strong talent guarantee and human resources support for long-term stable economic development.

#### **4. Policy Responses to the Coordinated Development of Artificial Intelligence and the Labor Market**

##### **4.1 Skills Training Policy**

As the core technology of the fourth industrial Revolution, artificial intelligence has an uncertain impact on the demand for skills in the process of integration and development with the industry, and the labor market has begun to show two characteristics of "job polarization" and "human-machine symbiosis" [15]. Employment training policies can accurately meet the labor market demand and future technological trends, promote the update of knowledge and skills, improve workers' skills and production efficiency, enhance social innovation, and promote high-quality economic development [16]. In 2021, the 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Outline of the Long-term Goals for 2035 also clearly stated that "enterprises should be encouraged to carry out job skills upgrading training".

However, increasing the number of robots per 10,000 employees will mean a significant reduction in the number of jobs performing repetitive manual labor. If the skill mix of front-line workers in production workshops cannot be updated and enriched in time, the manufacturing industry, which accounts for about 20% of the national employment, may become the hardest hit area for unemployment, which will have a non-negligible negative impact on the entire economic and social development [15].

In short, the deep integration of artificial intelligence and traditional industries has triggered structural changes in the labor market, which is manifested as the trend of "job polarization" and "human-machine collaboration", which puts forward new requirements for employment training policies, and it is urgent to keep up with the development direction of the market and technology. Although our country has put the construction of the vocational education and training system up to the national strategic level, the robot used in the manufacturing of rapid promotion could cause the loss of a line position, thus low-skilled workers constitute the employment pressure. Therefore, it is necessary to adjust the content of skills training in time and strengthen the career transition support for the affected groups, so as to realize the optimization and upgrading of the labor force structure.

#### 4.2 Labor Security Policies

First, pay attention to labor protection policy to protect the laborer labor process. In the face of intelligent manufacturing, telecommuting and flexible work schedules and other new technology application and work mode change, labor protection policies through the establishment of prevention beforehand risk control mechanism, safeguard the rights and interests of worker safety and health, can help prevent new occupational diseases, improve the health level of workers [17]. Second, the labor protection policy to promote inclusive growth and promote the overall social welfare is very important. Labor protection policy focus on specific groups such as young, migrant workers, the disabled and elderly remote worker health and safety requirements, pay attention to building a multivariate inclusive work environment, thus stimulating the innovative potential of different bodies of society, promote social cohesion [18].

However, labor protection policies have the problem of lack of adaptability and flexibility, and the regulatory coverage is still insufficient. First, the development of labor protection policies to meet the requirements of new technologies is insufficient. Artificial intelligence, robotics, biotechnology and other fields have generated new health and safety risks, but the existing policies for high-tech environment risk assessment are insufficient, the rapid change of technology policy lag is

prominent, failed to timely adjust to actively adapt to the new quality productivity of the working environment [18]. The second is the lack of labor protection policy flexibility and cross-border perspectives. Labor protection policies are usually aimed at the risk of a specific industry. This industry specificity of policies designed to ignore the new mass productivity in interdisciplinary application of the complex and diverse risk [19]. Third, the new work mode for the labor protection supervision put forward new challenges, the current regulatory system in response to emerging issues obviously deficiencies. With the continuous development of new mass productivity, emerging technologies and innovative business models emerge endlessly, flexible work schedules, and the application of a fixed office space is becoming more and more widespread. However, the current labor protection laws and regulations are relatively lagging behind in updating speed, which makes it difficult to effectively cover the new occupational health risks caused by this. At the same time, the rapid evolution of new quality productivity also puts forward higher requirements for the flexibility and foresight of labor protection policies, and regulatory agencies generally lack the corresponding professional ability in identifying and evaluating the risks brought by cutting-edge technologies. The lack of professional ability not only weakened the laborer's trust in the labor security system, but also to a certain extent, inhibit its participation in the high technology content, high risk industry and innovation vitality. Therefore, it is urgent for the labor protection supervision system to break through the limitations of traditional management mode and inherent thinking framework, and promote the systematic improvement of supervision mechanism and enforcement ability.

To sum up, in the context of new technologies and continuous changes in work patterns, labor protection policies not only play an important role in protecting workers' rights and interests, but also face many practical challenges. On the one hand, the policy relies on preventive mechanisms to effectively safeguard the safety and health of workers in the new working environment, and promotes more inclusive social development by focusing on specific groups such as younger and older people. On the other hand, the current policy system still lacks

adaptability and flexibility, and the regulatory coverage fails to keep up with the development of emerging businesses in a timely manner. Specifically, the assessment of potential occupational risks in emerging fields such as artificial intelligence is not sufficient, and the industrial special design fails to fully consider the compound risks brought by cross-industry technology integration, which makes it difficult for policies to timely respond to the occupational health risks brought by new working modes such as flexible employment and remote working. At the same time, the professional ability of regulatory agencies to deal with the complex risks brought by high and new technologies still needs to be strengthened. Therefore, it is urgent to break through the traditional regulatory thinking pattern and build a more systematic and forward-looking labor protection supervision system.

#### 4.3 Industrial Technology Policy

Judging from the experience of the development of China's strategic emerging industries of the last generation, industrial policy plays an important role in the development of emerging industries and future industries [20]. Industrial policy can greatly shorten the time lag from the budding period to the rapid development period of future industries: on the one hand, through the guidance of positive policies, the expectation of rapid development of future industries can be established in all sectors of society, and more patient capital can be guided to enter the future industry field, accelerating its technological and industrial development; On the other hand, through tax relief, 09 Zeng Xiankui: Based on the dynamic convergence of artificial intelligence industry development paradigm and industrial policy to explore the fifth phase of financial incentives, supporting facilities construction and even micro market demand policies, break the constraints of various supporting conditions that limit the future industrial development, so as to promote the future industry to enter the stage of rapid development in a short period of time [20].

At the same time, the artificial intelligence industry shows stronger dynamic convergence characteristics, which makes the challenges faced by industrial policy in this field more complex and severe, and its policy effect (especially in promoting the expansion of industrial scale) is relatively limited. The rapid

iteration of artificial intelligence technology requires industrial policy to pay more attention to scientific and technological innovation, rather than industrial scale expansion. However, the effect of industrial policy, especially traditional industrial policy, in promoting industrial scale expansion is significantly better than that of promoting industrial technology innovation. Industrial policy must be transformed to a certain extent to be more applicable to the artificial intelligence industry [20].

In general, the core of artificial intelligence industrial policy lies in the complex balance between properly coordinating and promoting the moderately advanced development of the industry and effectively controlling its potential negative effects. This dual goal constitutes the main problem in policy design.

### 5. Conclusions and Prospects

#### 5.1 Research Conclusions

5.1.1 Dual characteristics of influence path: the effect of artificial intelligence on the job market is reflected in the coexistence of "substitution effect" and "creation effect". On the one hand, automation technology gradually replaces low-skilled and repetitive jobs; On the other hand, the wide application of technology has led to the emergence of new occupations, thus forming a dynamic balance and structural differentiation of the number of employment.

5.1.2 Deep adjustment of employment structure: the process of industrial intelligence accelerates the transfer of labor from agriculture to industry and service industry, and the manufacturing jobs show a trend of concentration at both ends of high-skill and low-skill, and the skills required by labor are gradually changing to data processing, cross-field collaboration and other complex abilities.

5.1.3 Practical urgency of policy coordination: The current relevant policies are still insufficient in the accuracy of skills training, the predictability of labor security and the guidance of technological development. It is urgent to establish an integrated policy framework covering "skill upgrading, rights protection and industrial regulation", focusing on strengthening the support for the career transformation of low-skilled workers, and promoting the innovation of the supervision of new employment forms.

## 5.2 Future Prospects

5.2.1 In-depth discussion on the characteristics of technology evolution: the continuous and rapid update of emerging technologies represented by generative AI may accelerate the replacement and creation of employment structure. Future research should further focus on the internal logic of the "data skill premium" and its impact mechanism on emerging career development path.

5.2.2 Detailed analysis of regional and group differences: The existing research on the impact of artificial intelligence on the labor market is mostly at the macro level or overall level. It pays insufficient attention to the differential impact of technology impact on regions at different stages of economic development and vulnerable groups (such as migrant workers and people with disabilities), and pays relatively little attention to regional differences. It is necessary to carry out more targeted comparative research based on regional micro data. It is necessary to carry out more targeted comparative research combined with regional micro data. It can not only fill the theoretical gap, enrich and improve the theoretical system of the relationship between artificial intelligence and the labor market, but also help the precise formulation of regional policies, optimize the allocation of labor resources, and promote social equity and stability.

5.2.3 Adaptive innovation of policy tools: in the face of the contradiction between cross-industry risks brought by artificial intelligence and the relatively lagging current regulatory capacity, new governance means such as "agile supervision" and "technical ethics assessment" should be actively explored to enhance the predictability and flexibility of the labor security system.

5.2.4 Interdisciplinary integration of theories: the research perspective of behavioral economics and sociology is introduced to deeply explore the psychological adjustment process of workers and the reconstruction law of social relationship network under the background of technological substitution, so as to provide a more comprehensive and three-dimensional theoretical basis for policy making.

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