

CHALLENGES IN TECHNOLOGY INNOVATION-DRIVEN ECONOMIC DEVELOPMENT: VALUE CONFLICTS AND GOVERNANCE COUNTERMEASURES IN THE APPLICATION OF ARTIFICIAL INTELLIGENCE

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Abstract: In the process of global economic transformation and upgrading, Artificial Intelligence (AI), as a core field of technological innovation, has become a key force driving economic growth due to its significant role in improving production efficiency and optimizing industrial structures. However, the characteristics of AI technology, such as data dependence, algorithmic black boxes, and autonomous decision-making, while empowering economic development, have also triggered three core challenges: data application (issues of privacy protection and fairness), algorithm application (insufficient interpretability and short-term interest orientation), and labor market (structural unemployment and unfair competition). Behind these challenges, the in-depth value conflicts between efficiency and equity, innovation and sustainable development, as well as individual rights and collective interests are further highlighted. If not effectively addressed, these conflicts will restrict the sustainable application of AI technology and affect the stability of economic development. Taking AI applications as the research object, this paper systematically analyzes the specific challenges faced by AI in the process of technological innovation-driven economic development and deconstructs the logic of value conflicts behind these challenges. On this basis, targeted governance countermeasures are proposed from four dimensions: improving laws, regulations and supervision, promoting algorithm transparency, strengthening talent cultivation and employment transformation, and building a multi-stakeholder collaborative governance mechanism. The purpose is to provide theoretical support and practical reference for realizing the coordinated development of AI technology, economy and society, and promoting high-quality economic development driven by technological innovation.

Keywords: Technological innovation; Artificial Intelligence; Economic development; Value conflicts; Governance countermeasures; Employment transformation

1 INTRODUCTION

At the critical stage of global economic transformation and upgrading, technological innovation has become the core engine driving economic development. As a frontier field of technological innovation, Artificial Intelligence (AI), with its powerful data analysis, autonomous learning, and efficient decision-making capabilities, is profoundly reshaping production methods, business models, and industrial structures. From process optimization in intelligent manufacturing, intelligent risk control in the financial industry, to auxiliary disease diagnosis in the healthcare sector, the wide application of AI technology has injected strong impetus into economic growth. According to a well-known 2018 report by the McKinsey Global Institute, by 2030, AI is expected to contribute an additional approximately \$13 trillion to the global economy [1]. Meanwhile, PwC claims that by 2035, AI will drive a 15% growth in the global economic scale and reshape the global economic pattern [2].

However, while promoting high-speed economic development, AI technology has also triggered a series of practical application challenges due to its characteristics such as data dependence, algorithmic black boxes, and autonomous decision-making. If these challenges cannot be effectively controlled, they will not only restrict the continuous innovation and application of AI technology but also may trigger social problems, exerting a negative impact on the sustainability of economic development. Therefore, in-depth analysis of the specific challenges faced by AI applications in the process of technology innovation-driven economic development, clarifying the value conflicts involved, and proposing scientific and effective governance countermeasures have become important issues urgently to be solved by the current academic community, industry, and policymakers.

2 CORE CHALLENGES OF AI APPLICATIONS IN TECHNOLOGY INNOVATION-DRIVEN ECONOMIC DEVELOPMENT

2.1 Data Application Challenges

Data serves as the core foundation for the development and application of AI technology. The training and optimization of AI algorithms require substantial high-quality data support. In the process of technology innovation-driven economic development, enterprises often face multiple challenges in data application while pursuing higher economic efficiency

and commercial interests.

On one hand, there are difficulties in user privacy protection during data collection. When many enterprises collect user data, they fail to fully inform users of the scope, purpose, and duration of data collection, or implicitly force authorization through complex user agreements. This exposes users' personal information (such as identity information, consumption habits, and location information) to the risk of leakage. For instance, some Internet platforms construct user profiles based on users' browsing records and search history to achieve precise marketing, but they do not effectively protect the data, increasing the probability of privacy leakage.

On the other hand, there are fairness issues in data usage. Most training data for AI algorithms is derived from real society. If the data itself contains historical biases or discriminatory information and is not effectively cleaned and screened, such problems will be amplified in algorithm applications, affecting the fairness of resource allocation. For example, AI systems in the recruitment field may produce unfair screening results for job seekers from specific groups due to gender and regional biases in the training data, disrupting the normal order of the job market.

2.2 Algorithm Application Challenges

Algorithms are the core of AI technology, and their rationality, fairness, and transparency directly affect the effect of AI applications. Against the backdrop of technology innovation-driven economic development, enterprises often focus on complexity and efficiency to improve algorithm performance and competitiveness, while ignoring potential problems in applications, thus triggering algorithm application challenges. Firstly, algorithmic black boxes lead to insufficient interpretability of decisions. Due to the complexity and non-linear characteristics of AI algorithms, the decision-making process is difficult for humans to understand and trace, forming an "algorithmic black box".

In fields involving major interest decisions such as financial credit and judicial assistance, algorithmic black boxes result in a lack of transparency in decision-making results. Once errors or unfairness occur, users find it difficult to safeguard their legitimate rights and interests. For example, some banks use AI algorithms to assess borrowers' credit risks and determine loan amounts, but borrowers cannot know the specific reasons for loan rejection nor make effective appeals. Secondly, algorithm optimization is oriented towards short-term interests. Under the pressure of economic development, enterprises often take economic interests as the primary goal of AI algorithm optimization, ignoring the impact on public interests. For example, the AI recommendation algorithms of some social media platforms excessively recommend vulgar and homogeneous content to increase user activity and stay time. Although this improves platform traffic and revenue in the short term, it has a negative impact on the quality of information obtained by users and the social information environment.

2.3 Labor Market Challenges

The innovation and application of AI technology play a role in promoting economic structure upgrading and production efficiency improvement. Joseph Briggs and Devesh Kodnani, economists at Goldman Sachs Research, point out that the business process changes triggered by these technological advancements may affect 300 million full-time jobs due to AI automation[3]. At the same time, it also exerts a profound impact on the labor market, bringing about a series of employment challenges. On one hand, AI technology leads to the replacement of some traditional jobs, causing structural unemployment. With the penetration of AI technology in fields such as manufacturing and services, repetitive and low-skilled jobs (such as assembly line workers, basic customer service representatives, and traditional bank tellers) are gradually replaced by AI robots and intelligent systems, putting a large number of workers at risk of unemployment. Research by PwC shows that by 2030, AI and automation technologies will replace 20%-25% of low-skilled manufacturing jobs worldwide[2]. Although AI technology also creates new job opportunities (such as AI algorithm engineers and data analysts), these new jobs have high skill requirements and cannot absorb a large number of displaced low-skilled workers in the short term, resulting in an imbalance between supply and demand in the labor market and exacerbating the problem of structural unemployment. On the other hand, AI technology intensifies unfair competition in the job market. The research and application of AI technology require substantial capital and technology investment. Large enterprises and technology giants, relying on their capital strength and technological advantages, can take the lead in realizing the industrial application of AI technology, occupy a dominant position in market competition, and further squeeze the living space of small and medium-sized enterprises. However, small and medium-sized enterprises are an important force in absorbing employment. The shrinking of their living space will inevitably lead to a reduction in job opportunities, intensifying the unfairness of competition in the job market.

3 VALUE CONFLICTS BEHIND THE APPLICATION OF AI TECHNOLOGY

3.1 Value Conflict Between Efficiency and Fairness

In the process of technology innovation-driven economic development, the application of AI technology takes improving economic efficiency as its core goal and promotes economic growth by optimizing production processes, reducing costs, and enhancing resource allocation efficiency. However, while improving efficiency, the application of AI technology also exacerbates the imbalance of social fairness[4].

On one hand, AI technology leads to a more concentrated distribution of wealth. Due to the high investment threshold for the research and application of AI technology, large enterprises and technology giants can take the lead in mastering

and applying AI technology, obtaining more economic benefits, concentrating wealth in the hands of a few groups, and widening the gap between the rich and the poor.

On the other hand, AI technology leads to unfair opportunity distribution. As mentioned earlier, in the structural unemployment caused by AI technology, low-skilled workers find it difficult to obtain new employment opportunities due to the lack of skills adapted to the AI era, further exacerbating the inequality of opportunities in the job market. This value conflict between efficiency and fairness reflects the neglect of social fairness in the process of AI technology promoting economic development. If not properly resolved, it will affect social stability and sustainable economic development.

3.2 Value Conflict Between Innovation and Sustainable Development

Technological innovation is the core driving force for the development and application of AI technology, and also an important source driving economic development. However, in the pursuit of technological innovation, enterprises and research institutions often take technological breakthroughs and commercial success as their primary goals, ignoring considerations for social sustainable development, thus triggering a value conflict between innovation and sustainable development. For example, some research institutions are eager to carry out research projects with potential social impacts to gain an advantage in the field of AI technology, but fail to fully evaluate the impact of these projects on long-term social development; some enterprises, in order to launch new AI products and seize market share, ignore the protection of user rights and public interests during the R&D and promotion process, resulting in obvious defects in products and affecting social sustainable development. This value conflict exposes AI technology to the risk of unsustainable application while developing rapidly, restricting the long-term driving effect of technological innovation on economic development.

3.3 Value Conflict Between Individual Rights and Collective Interests

There is also an obvious value conflict between individual rights and collective interests in the application of AI. On one hand, the application of AI technology requires the collection and use of a large amount of personal data to realize algorithm training and optimization, which may infringe on individuals' legitimate rights such as the right to privacy and data control to a certain extent. On the other hand, the application of AI technology can bring significant collective interests to society, such as improving the efficiency of public services, enhancing the level of social governance, and promoting sustainable economic development. For example, in the prevention and control of public health emergencies, AI technology provides support for prevention and control work by analyzing epidemic data, ensuring public health and safety and the stable operation of society. However, this process also involves the collection and use of personal privacy information. This value conflict between individual rights and collective interests makes it difficult to balance individual rights and public interests in the application of AI. If not handled properly, it will not only damage the legitimate rights and interests of individuals but also may affect the realization of collective interests, restricting the positive role of AI technology in promoting economic and social development.

4 GOVERNANCE COUNTERMEASURES FOR AI APPLICATION CHALLENGES

4.1 Improve the Legal and Regulatory System and Strengthen Supervision

Laws and regulations are important guarantees for regulating AI application behaviors. A sound legal system can define a reasonable boundary for AI applications and address various challenges[5].

Firstly, accelerate the formulation of special laws and regulations for AI applications, clarify the standardized requirements for the collection, use, and storage of AI data, define the transparency standards for algorithmic decision-making, and prohibit the unfair application of AI technology in fields such as employment and finance. For example, formulate the Regulations on the Management of Artificial Intelligence Applications to clearly stipulate the protection of user data, algorithm transparency, and the protection of employment fairness[6].

Secondly, establish and improve the supervision mechanism for AI applications, set up a special AI supervision agency to conduct full-process supervision over the R&D, application, and promotion of AI technology, increase the penalties for illegal and non-compliant AI applications, and ensure that the application of AI technology complies with legal requirements and public interests.

Finally, promote the construction of industry self-regulation norms, encourage industry associations to formulate AI industry application guidelines, guide enterprises to strengthen self-restraint, establish an internal AI application review mechanism, and conduct compliance assessments on AI products and services to ensure that the application process is legal and compliant.

4.2 Promote the Development of Algorithm Transparency and Interpretability

Algorithm transparency and interpretability are the keys to solving the problem of algorithmic black boxes and addressing algorithm application challenges[7].

Firstly, increase investment in AI algorithm R&D and promote technological innovation in algorithm transparency. Research institutions and enterprises should increase investment in the R&D of Explainable Artificial Intelligence (XAI)

technology, develop AI algorithms with high transparency and interpretability, enable the algorithm decision-making process to be understood and traced by humans, and reduce the risks brought by algorithmic black boxes. Secondly, establish an algorithm filing and review system, requiring enterprises to file AI algorithms involved in key fields such as finance, employment, and justice and accept reviews by supervision agencies. Supervision agencies organize experts to evaluate the rationality and fairness of the filed algorithms, and require enterprises to rectify problematic algorithms within a time limit to ensure that algorithm applications conform to public interests. Finally, strengthen education and popular science on algorithm applications to improve the public's understanding and supervision ability of algorithms. The government and enterprises should carry out algorithm popularization activities to popularize the basic principles and application risks of algorithms to the public, enhance the public's awareness of supervising algorithmic decision-making; at the same time, provide professional training for algorithm users to enable them to correctly understand and use algorithms, and avoid application problems caused by misunderstandings of algorithms.

4.3 Strengthen Talent Cultivation and Employment Transformation Support

To address the employment challenges brought by AI applications, the core lies in strengthening talent cultivation and employment transformation support, and improving the skill level and adaptability of workers. Firstly, optimize the education system and strengthen the cultivation of AI-related professionals. Universities should set up majors such as artificial intelligence, data science, and machine learning, optimize curriculum settings, and cultivate AI talents with solid professional knowledge and innovative capabilities; at the same time, integrate AI knowledge into the teaching of traditional majors to enhance students' AI application literacy and interdisciplinary capabilities, laying a foundation for adapting to the needs of the job market in the AI era. Secondly, increase the intensity of skill training for in-service workers to promote employment transformation. The government should increase investment in vocational skill training, establish and improve the vocational skill training system, provide free skill training courses for low-skilled workers replaced by AI, and help them master new skills required in the AI era (such as intelligent manufacturing operations, intelligent customer service management, and basic data analysis) to achieve employment transformation [8]. For example, carry out training on industrial robot operation and maintenance for laid-off workers in the manufacturing industry, and carry out training on e-commerce and online service operation for practitioners in traditional service industries. Finally, encourage enterprises to assume employment responsibilities and provide employment support. Enterprises should establish internal training mechanisms to provide AI technology-related training for employees, helping them improve their skills to meet the needs of enterprise technological innovation; at the same time, enterprises should strengthen cooperation with the government, universities, and vocational training institutions to jointly carry out employment transformation projects, create more job opportunities, and alleviate the pressure on the job market.

4.4 Build a Multi-Stakeholder Collaborative Governance Mechanism

The governance of AI application challenges is a systematic project that requires the collaborative cooperation of multiple subjects such as the government, enterprises, research institutions, social organizations, and the public.

Firstly, the government should play a leading role, formulate the overall strategy and policies for AI application governance, coordinate resources from all parties in a unified manner, and promote the orderly development of governance work. The government should strengthen exchanges and cooperation with other countries and international organizations, participate in the formulation of global AI application governance rules, and promote the formation of unified AI application standards.

Secondly, enterprises should assume the main responsibility and integrate considerations of public interests into the entire process of AI technology R&D and application. Enterprises should establish an internal AI application evaluation mechanism to promptly identify and solve problems in applications; strengthen cooperation with research institutions to jointly develop AI technologies and products that meet social needs.

Thirdly, research institutions should play a technical support role, strengthen research on AI application issues, and provide theoretical and technical support for governance. Research institutions should conduct research on AI application risk assessment and algorithm optimization, and develop technical solutions to solve AI application problems.

Finally, social organizations and the public should play a supervisory role. Social organizations should carry out popular science publicity on AI applications to improve the public's awareness of AI application issues; establish AI application supervision platforms to collect public feedback and promptly report problems to supervision agencies. The public should enhance their awareness of supervision, actively participate in discussions on AI applications, and supervise improper application behaviors to promote the healthy development of AI technology.

5 CONCLUSION AND OUTLOOK

Against the backdrop of technology innovation-driven economic development, AI technology, as a core driving force, brings huge opportunities for economic growth. However, it also faces various challenges in data application, algorithm application, and the job market. Behind these challenges lie value conflicts between efficiency and fairness, innovation and sustainable development, and individual rights and collective interests. If these challenges cannot be effectively addressed and the value conflicts cannot be resolved, the continuous application of AI technology will be restricted, and

the sustainability of economic development will be affected.

Through in-depth analysis of AI application challenges, value conflicts, and governance countermeasures, the following conclusions can be drawn: Firstly, AI application challenges are diverse and complex, involving multiple fields such as data, algorithms, and employment, and need to be comprehensively addressed from multiple dimensions. Secondly, value conflicts are the underlying causes of AI application challenges. Only by balancing the value relationships in different dimensions can the challenges be fundamentally solved. Finally, the governance of AI application challenges requires the collaborative cooperation of multiple subjects. Through measures such as improving laws and regulations, promoting algorithm transparency, strengthening talent cultivation, and building a collaborative governance mechanism, an all-round governance system can be formed to realize the coordinated development of AI technology, economy, and society.

Looking forward to the future, with the continuous innovation of AI technology, its application fields will be further expanded, and new challenges will continue to emerge. Therefore, it is necessary to continuously pay attention to the dynamics of AI applications, strengthen research and exploration on new problems, and constantly optimize governance countermeasures and mechanisms. On the premise of reasonable regulation, AI technology can be promoted to better serve high-quality economic development. At the same time, we should actively participate in global AI application governance cooperation, jointly address global challenges, and promote the formation of a fair and reasonable global AI application governance order.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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