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Analysis of the Application of Artificial Intelligence Technology in the Field of International Trade

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Abstract. With the rapid development of artificial intelligence technology, its application in the field of international trade has gradually become a hot spot for research. The purpose of this paper is to analyze in depth the prospects for the application of AI technology in international trade and to explore the opportunities it brings to international trade as well as the challenges it faces. Firstly, this paper reviews the development status of international trade and the latest progress in artificial intelligence technology to provide a background for the study. Subsequently, through the construction of a theoretical framework and the application of an integrated research methodology, the specific applications of AI in international trade are analyzed in detail, including smart contracts, data analytics, automated processes, and its role in logistics and supply chain management. Further, the paper discusses the positive impacts of AI technology applications, such as improved transaction efficiency, cost reduction, and enhanced market forecasting capabilities, while also pointing out the accompanying challenges, such as technological barriers, adaptation of laws and regulations, talent requirements, and data security. Through case studies, the paper demonstrates the effects and lessons learned from the application of AI technology in actual international trade. Finally, the paper summarizes the research findings, makes recommendations for future applications of AI technology in international trade, and explores directions for subsequent research. This study aims to provide some insights into the application of AI technology in the field of international trade as well as usable references for future development.

Keywords: Artificial intelligence technology; international trade; data analytics; smart contracts; supply chain management.

1. Introduction

With the development of the new global technological revolution, artificial intelligence, with its intelligent processing and universally applicable technological features, has gradually been integrated into international trade activities and has increasingly become a key driving force for global economic development. This technology not only triggers changes in the domestic market but also demonstrates its unique value in international trade, a key area of the global economy. The deepening of globalization, the growth and complexity of international trade itself require more efficient and smarter technological tools to meet the challenges of evolving market demands and the global economic environment. Among them, Artificial Intelligence (AI), as a cutting-edge technology with strong industry permeability and application, has become increasingly important in the economic development of various countries in recent years [1]. In this context, exploring the application of AI in international trade can not only promote the innovation of trade processes, but also provide new tools for market analysis, risk management, and supply chain optimization, which is of far-reaching significance for strengthening global trade connectivity, enhancing national competitiveness, and promoting technological progress [1, 2].

Previous studies have preliminarily explored the potential application of AI technologies in optimizing trading decisions and improving market efficiency. However, these studies are often limited to specific areas or case studies and lack a comprehensive and in-depth perspective to comprehensively interpret the role and impact of AI technology in the whole field of international trade. Given this, this paper aims to construct a comprehensive analytical framework to explore in

detail the current status and development prospects of AI applications in international trade, while systematically analyzing the opportunities and challenges it brings.

Specifically, this study first overviews the application cases of AI in international trade, revealing its role in promoting trade efficiency and other aspects [3]. Then, the article analyses the opportunities and challenges of the application of AI technology in this field, including how AI can bring new growth points for international trade, the complexity of the technology implementation, the adaptability issues of relevant laws and regulations, ethical considerations, and the cultivation of professional talents. Finally, the study proposes solutions and future development paths for these challenges.

The marginal contribution of this study is to provide a comprehensive perspective that not only describes the current status and potential of AI technology in international trade but also discusses in depth the various challenges and possible solution strategies in the implementation process. Through this comprehensive analysis, this paper aims to provide valuable insights and recommendations for policymakers, industry experts, and academics to promote the effective application and healthy development of AI technology in international trade.

2. Analysis of the Application of Artificial Intelligence Technology in International Trade

In today's rapidly evolving global economic environment, Artificial Intelligence (AI) technology has become a core driver of innovation and efficiency in international trade. The integration of AI has not only greatly enhanced the automation of international trade, but also optimized logistics and transportation processes, and strengthened supply chain management efficacy. By automating complex data analysis and decision-making processes, AI technology enables companies to rapidly analyze data and make market forecasts, thus taking the lead in the fierce competition in the international market. In addition, the use of AI has simplified cross-border transactions, enhancing the security and transparency of transactions through smart contracts and blockchain technology. This paper will delve into the extensive use of AI in international trade, analyzing how it is reshaping the trade model, improving the efficiency of the industry, and addressing the many challenges of traditional transactions.

2.1. Smart Contracts and Blockchain

Smart contracts and blockchain technology significantly facilitate the automated execution and validation of trade contracts through their inherent characteristics. Smart contracts are programmed protocols based on blockchain technology that enable the automatic enforcement of relevant terms when the conditions set out in the contract are met. This reduces the need for manual supervision, thereby lowering transaction costs and shortening processing times. The decentralized nature of the blockchain and the all-node consensus mechanism allow every node on the network to participate in the verification process, which not only enhances the system's security and resistance to tampering but also eliminates the need for a central authority. In actual international trade behavior, the application of smart contracts and blockchain technology greatly improves the transparency, security, and efficiency of transactions.

At the same time, the transactions and contract status on the blockchain are open, transparent, and immutable, greatly increasing the trust of both parties in the transaction and effectively reducing the possibility of fraudulent behavior. By providing a decentralized and tamper-proof record system for transactions, the trust of all parties involved is effectively enhanced. Automatically enforced contract terms reduce human error and transaction time, lowering costs. In addition, smart contracts can be programmed to comply with specific legal and regulatory requirements. These technologies also simplify cross-border payments and financing, enhance compliance, and bring greater stability and credibility to global trade. As the technologies mature, their impact in international trade is expected to expand further.

2.2. Data Analysis and Forecasting

The role of artificial intelligence in data analytics includes not only improving data processing efficiency for real-time data analysis but also aspects such as assessing market sentiment.

The primary role of artificial intelligence in data analysis is to improve data processing efficiency. In all areas of international trade, a large amount of data is generated in the delivery of goods, payment and settlement, and tax clearance. According to eMarketer, a global market research organization, about 2.56 billion people around the world will participate in online shopping in 2022, with e-commerce retail sales exceeding US$5 trillion, accounting for about one-fifth of total retail sales. Among them, China's e-commerce sales will reach RMB 45 trillion in 2022, making it the world's largest and most dynamic e-commerce market. And it is expected that in 2025, global e-commerce retail sales will exceed US$7 trillion. In the face of such a huge amount of data, AI can significantly improve the efficiency of data processing by automating and optimizing the data processing process compared to traditional manual data processing methods that are often time-consuming and prone to errors [3]. For example, data cleansing using AI can automatically identify and remove duplicate, erroneous, or incomplete data, thereby reducing manual intervention and time costs. In addition, AI can quickly analyze large amounts of data through pattern recognition and predictive models, providing more accurate and timely insights and predictions. In international trade, by analyzing massive datasets, AI can identify patterns and trends in market behaviors, thus providing businesses with insights on when, where, and how to trade. For example, AI algorithms can analyze global economic indicators, consumer behavior data, and supply chain dynamics to predict changes in demand for specific commodities. This predictive capability enables companies to adjust production plans and inventory management more precisely and optimize resource allocation. Multinational trading companies can make use of the characteristics of AI's efficient data processing to conduct business data analysis, make market trend forecasts, and make timely adjustments and optimizations to their own development strategies.

AI's prediction model is not limited to static data analysis but also includes the assessment of market sentiment, which is especially critical in international trade. Market sentiment is a comprehensive display of the views of all market participants in the overall market, and it is the feeling that all market participants show together. Back in 2015, the Coca-Cola Company announced to the outside world that it was going to apply artificial intelligence to launch a smart app integrated with Coca-Cola vending machines, through which consumers could order directly online and then pick up their products from the vending machines. It is even possible to buy drinks for family or friends from any location including other countries. At the same time, through the connection between the vending machine and the cloud, Coca-Cola can also achieve remote control of the machine, such as adjusting the price of the products sold by the vending machine, introducing discounts and promotions at specific locations, and so on. Through such a channel, Coca-Cola can also send personalized messages to consumers and provide an interactive chat platform. Such an approach not only brings convenience to consumers, but also allows Coca-Cola to better collect consumer-related data, understand consumer behavior, and adjust its products and services accordingly to improve the company's management operations.

Big data and AI technologies offer unparalleled depth and breadth in assisting companies to develop international trade strategies. Their application is redefining the competitive landscape and operations of global trade. By utilizing these technologies, companies can improve efficiency and discover new growth opportunities in the complex and volatile international marketplace.

2.3. Artificial Intelligence in Logistics and Supply Chain Management

The application of AI in logistics and supply chain management focuses on several key areas. The first is the optimization of transport routes. Through AI algorithms, companies can analyze traffic data, weather information, vehicle status, and route status in real-time to calculate the optimal distribution route. This not only reduces transport time but also helps reduce fuel consumption,

operating costs, and carbon emissions. In a world where almost anything can be ordered online and delivered in data, companies that don't have tight control over their logistics and distribution risk falling behind. Today's customers expect fast, accurate shipments, and when one company can't meet their expectations, they are happy to turn to others. McKinsey & Company reports that about 40% of customers who try grocery delivery for the first time intend to use these services indefinitely. Customers in major markets like New York and Chicago have dozens of options [4]. AI-powered route optimization platforms and AI-powered GPS tools such as ORION, used by logistics leader UPS, create the most efficient routes from all possibilities, a task that cannot be accomplished by traditional methods, which are insufficient to fully analyze the myriad of route possibilities.

Secondly, the use of AI in demand forecasting is also extremely important. By analyzing factors such as historical sales data, market trends, seasonal changes, and promotional activities, AI can help companies to more accurately predict future product demand and thus optimize inventory management. Such high-precision demand forecasting capabilities enable companies to optimize inventory levels, reduce backlogs and stock-outs, reduce costs, and improve customer satisfaction.

Automated warehouse management is another area where AI technology is coming into its own. In warehouse management, AI-powered robots have been able to automate many complex tasks such as picking, packing, and sorting [4]. These robots can work 24/7, greatly improving the efficiency of warehouse operations and reducing labor costs. At the same time, AI systems can operate without human intervention, increasing the speed and accuracy of warehouse operations while reducing labor costs and error rates, and monitoring the status of inventory in real-time to ensure it is accurate.

As AI technology continues to advance and costs are gradually reduced, it is expected that more logistics and supply chain management operations will be automated and the level of intelligence will be further increased in the coming years. This will enable companies to better respond to changes in market demand, improve responsiveness and service quality, and ultimately gain an edge in the fiercely competitive marketplace.

3. Opportunities and Challenges of Artificial Intelligence Technologies in International Trade

3.1. Opportunities

As AI technology can be applied to various industries, major countries around the world regard AI as an important strategy to enhance national competitiveness and safeguard national security and have actively invested in the development of AI in recent years. For example, Japan released the ‘Next Generation Artificial Intelligence Promotion Strategy’, and South Korea announced the ‘Artificial Intelligence National Strategic Plan’. 2017, China announced the ‘New Generation Artificial Intelligence Development Plan’, and Canada proposed the ‘New Generation Artificial Intelligence Development Plan’. In 2017, China announced the ‘New Generation Artificial Intelligence Development Plan’, Canada put forward the ‘Pan-Canadian Artificial Intelligence Strategy’, etc., and various countries have launched policies related to the development of artificial intelligence. in February 2019, the President of the United States even signed an executive order to stimulate domestic investment in artificial intelligence, to ensure that the United States maintains the advantage of the development of artificial intelligence [5].

Countries around the world are implementing AI strategies that not only focus on national competitiveness and security, but also aim to revolutionize international trade. This involves leveraging technology to automate and optimize processes, speed up customs clearance and logistics management, and identify new market opportunities through data analysis and pattern recognition. These innovations improve trade efficiency, enable businesses to adapt to changing supply and demand, and drive international trade towards a more efficient and intelligent future.

AI technology helps companies and countries adapt to the rapidly changing global economic environment [6]. Through powerful data processing and analysis, AI improves the quality of decision-

making, enabling decision-makers to develop strategies using market insights and forecasts [7]. On the operational side, AI optimizes supply chain management and logistics, reducing production disruptions, increasing productivity, and reducing costs [8, 9].

In addition, AI technology enhances customer satisfaction and loyalty through personalized services and promotes public service efficiency [10, 11]. Deloitte China reports that generative AI virtual assistants can act as a bridge of information between the public and the government, using natural language processing technology to understand emotions and deal with problems and issues [12], as well as distilling information across data sets and answering questions about service requests and booking options [13, 14].

AI has also spawned emerging industries such as smart manufacturing and health technology [15]. Which drive technological innovation, promote social progress, and provide new growth points for economic development [16]. In short, AI is expected to further increase its influence in the global economy as a powerful tool for coping with economic change, providing businesses and governments with the ability to address complex challenges and seize new opportunities [17].

3.2. Challenges

3.2.1. Technical Barriers and Security.

When deploying Artificial Intelligence (AI) technologies, organizations and researchers often face multiple technical hurdles. Firstly, the performance of AI models is highly dependent on the quality and quantity of data [18]. Inadequate or poor-quality data can lead to inadequate model training, which in turn affects the accuracy and fairness of predictions. Second, the increasing complexity of AI algorithms makes their decision-making process difficult to interpret, which is especially problematic in fields with strict requirements for interpretability, such as healthcare and law [17]. In addition, technical compatibility and interface adaptation are often challenges when integrating AI technologies into existing systems. What's more, AI's high computational demands are a huge drain on resources, which can be a major financial burden for many small and medium-sized enterprises (SMEs).

Security is also an issue that must be seriously considered when deploying AI, especially when dealing with personal and sensitive data. Finally, AI systems need to have the ability to continuously learn and adapt to changes in the environment [19]. At the same time, many existing models are still prone to performance setbacks when encountering new contexts. Addressing these technological barriers will require continuous technological innovation and research, as well as cross-disciplinary collaboration and standardization efforts to ensure the effective, fair, and safe application of AI technologies.

3.2.2. Legal Ethics Issues and the Identification and Attribution of Responsibility.

With the widespread use of artificial intelligence (AI), the legal and ethical issues it brings to the forefront, include algorithmic bias and privacy invasion. These issues require urgent legal intervention and regulation. The legal challenges are particularly complex in areas such as cross-border data flows and the legal status of smart contracts. For example, the stringent data privacy requirements of the EU's General Data Protection Regulation (GDPR) have challenged global corporations, forcing them to find a balance between different jurisdictions. The legal status of smart contracts is also unclear, with existing laws mostly based on traditional written contracts, while the self-executing nature of smart contracts may raise questions of legality and enforceability in the absence of legal application and interpretation. Legal experts, technology developers and policymakers need to work together to develop new regulations that accommodate the complexity and cross-border operation of AI technologies, ensuring that technological advances are made while protecting the public interest, to find a balance between technological innovation and the protection of the public interest [19].

The question of how to define the attribution of liability for errors or damages caused by AI has also become a complex one. Most legal systems are currently designed around human behavior, and the legal liability for AI behavior has yet to be clarified. In the judicial practice of dealing with AI infringement disputes, the court still holds a conservative and prudent attitude towards the determination of the main body of AI infringement liability. It believes that AI belongs to part of the platform service, and the corresponding network service provider needs to be held liable for its service activities under certain conditions. In the Supreme People's Court case, the court held that an AI software used the name, portrait, and personality characteristics of a public figure without permission and projected them onto an AI character to form a virtual image, infringing on his overall personality image. The AI software allowed the user to interact with the AI character through an algorithm, involving the personality freedom and dignity of natural persons. Although the specific graphic was uploaded by the user, the design and algorithmic application of the AI software operator encouraged such behavior and thus was no longer a neutral technical service provider subject to infringement liability. In addition, regarding accidents caused by self-driving cars, who should bear the responsibility (the vehicle manufacturer, the software developer, the user, or the AI itself) still needs to be further clarified by law [20].

The above examples show that it is particularly important to explore the legal issues and attribution of liability arising from the in-depth application and development of AI technology. This requires us to update the relevant legal provisions to cover special situations arising from AI behavior. To this end, legislators, academics, and technologists need to co-operate in exploring and developing a more precise legal framework that better defines liability and ensures a balance between fairness and efficiency. Only then will we be able to ensure that technological advances do not come at the expense of legal justice, while also protecting the rights of those individuals and collectives that may be affected by AI behaviors. At the junction of facing technological innovation and legal challenges, we must move forward with caution and prudence.

3.2.3. Shortage of Applied Artificial Intelligence Technology.

The complexity of international trade has been exacerbated in the global economy by trade wars, changes in tariff policies, and the rise of emerging markets. These changes have made talent shortages a central challenge, especially in areas that require a combination of advanced AI skills and international trade expertise. International trade professionals need to master complex legal, policy interpretation, market analysis, and cross-cultural communication skills; while the field of AI requires proficiency in advanced skills such as deep learning, machine learning, data analysis, and algorithm development. However, the current education system is lagging in developing people with these complex skills. Educational institutions face several challenges: the traditional education system is slow to adapt to technological advances, and the existing education model fails to adequately develop students' cross-disciplinary thinking skills. In addition, there is limited cross-collaboration between AI technology and international trade in higher education, making it difficult for students to gain the necessary practical experience.

In the field of export trade, due to the late start of the application of AI technology, the current staff's skills in operating, using, and maintaining AI technology are insufficient, which limits the effectiveness of the application of AI technology and affects the quality of exports. At the same time, companies face challenges in attracting and developing such talent, with existing training processes struggling to keep pace with rapid changes in technology and markets. The high global demand for such talent has also triggered intense competition, which further highlights the imbalance between supply and demand, seriously affecting the competitiveness of enterprises and countries.

4. Conclusion

4.1. Integrated Discussion of Opportunities and Challenges

The widespread use of AI technology raises concerns about data privacy and security. Differences in data protection regulations in different countries pose international trade compliance risks, requiring the international community to develop uniform or compatible standards to protect individual privacy and national security in cross-border data flows.

In international trade, technical standards and system compatibility issues limit the integration and application of AI. Countries should promote the unification of AI technical standards and system compatibility to support the smooth conduct of international trade. ethical issues brought about by AI require governments and international organizations to formulate fair and transparent norms and address possible employment shocks, and help the labor force transition through education and social security policies.

Meanwhile, technological advances may exacerbate the digital divide and affect trade equity. International organizations and developed countries should provide support to help developing countries upgrade their AI capabilities and ensure global trade equity.

4.2. Practical Applications and Policy Recommendations

The use of artificial intelligence technology in foreign trade export business has become an inevitable trend. Foreign trade enterprises will establish a close partnership with artificial intelligence technology solution providers in the future. Professional technology service providers will provide artificial intelligence solutions that meet the characteristics of the enterprise's export business. Through the establishment of a perfect data storage and analysis system, data resource integration and management capabilities will be strengthened and enhanced, thus laying a reliable data foundation for data-driven foreign trade export business.

In the current international trade environment, companies should invest in AI technology development and integration and provide employees with AI skills training to optimize data analysis, logistics, and supply chain management. Multinational corporation can use smart contracts and blockchain technologies to automate the transaction process and improve transaction speed and security, as well as use AI for market forecasting and production plan adjustment.

International cooperation and harmonized standards are crucial for cross-border applications of AI technology. The government should introduce policies to support the application of AI in international trade, including tax incentives, research and development subsidies, and technological innovation support, and develop legal standards for smart contracts and blockchain. At the same time, it should promote AI education and vocational training to enhance the labor force's ability to apply AI technology and ensure business competitiveness. About transnational data flows, the Government should work with other countries to establish international data protection standards to ensure data security and privacy protection.

4.3. Deficiencies in the Study

The application of AI in international trade involves several fields, such as law, economics, information technology, etc. This article may fail to fully integrate the perspectives and knowledge of these different disciplines, resulting in an incomplete analysis of certain issues. Moreover, this article may focus too much on theoretical analyses and conceptual discussions and lacks specific enterprise or industry case studies to support its arguments. Limited by research time and research practice, it does not delve into the specific implementation and technical details of AI technology, such as the algorithms used, data processing methods, and so on. These details are important for understanding how AI can be applied in specific scenarios and its potential limitations.

In terms of the negative impacts of AI, the potential negative impacts of the application of AI technologies in international trade, such as the impact on employment, data privacy issues, and the potential for increased international inequality, may not be fully explored. Regarding the negative impacts of AI and the suggestions for the subsequent development of AI applications in international trade, the relevant suggestions given in this article may be more general, lacking in operability and relevance.

In the concluding part of the article for future trend prediction, there are certain limitations. This article has limitations in predicting the future development trend and impact of AI technology and does not fully take into account the uncertainty brought about by the rapid development of technology and changes in the international environment.

4.4. Concluding Remarks

In summary, the impact of artificial intelligence technology in international trade behavior is reflected in the application of smart contract and blockchain technology, optimization of logistics and transportation and supply chain management, enhancement of the production efficiency and quality control capacity of trading enterprises, and strengthening of data prediction, analysis, and management capabilities. At the same time, the application of AI technology in the field of international trade has also brought brand new challenges to enterprises, society, and the international environment, including ethical issues under the innovation of AI technology, the change and innovation of traditional human-centered laws, the identification and attribution of AI responsibilities, and the cultivation of AI-applied talents in the field of international trade. In the face of the development of artificial intelligence technology, we should actively embrace artificial intelligence, constantly innovate, change the traditional concept, form a foreign trade operation and management mode driven by new technology, and comprehensively promote the high-quality and sustainable development of China's foreign trade export field.

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