

Opportunities and Challenges of AIGC in the Development of Cross-border E-commerce in the Digital Economy

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Abstract—In the context of the rapid development of the digital economy, the Artificial Intelligence Generated Content (AIGC) is playing an increasingly important role in the development of cross-border E-commerce. This article aims to explore the opportunities and challenges brought by AIGC in the development of cross-border E-commerce. By analyzing the core functions and application scenarios of AIGC, the research reveals its applications in areas such as personalized marketing, customer service automation, and data-driven decision-making, and how these applications can improve the operational efficiency and customer satisfaction of cross-border E-commerce. At the same time, this article also points out the main challenges faced by AIGC in cross-border e-commerce, including data privacy and security issues, compliance with laws and regulations in different countries and regions, as well as technological adaptability and consumer acceptance.

Keywords—digital economy, AIGC, personalized marketing, sustainable development, virtual reality

I. LITERATURE REVIEW

Zhu (2018) verified the role of artificial intelligence in strengthening the supply chain management of cross-border E-commerce through case analyses of Opportunities and Challenges of AIGC in the Development of Cross-border E-commerce in the Digital Economy

platforms such as Yihaodian and Kaola Gou. This strengthening promotes the development of cross-border E-commerce from the perspective of enhancing the logistics level. Zhao *et al.* (2019) predicted the development trends of cross-border e-commerce in China, pointing out that the role of new information technologies has become increasingly prominent in multiple aspects of cross-border E-commerce, and has become a key driving force for its improvement and continuous development. Especially in areas such as marketing, product pricing, and optimization of E-commerce platform processes, the comprehensive application of new information technologies such as big data and artificial intelligence not only improves the accuracy of user analysis and product pricing, but also optimizes the design process of E-commerce platforms, promoting the continuous progress of the industry.

Ma (2020) pointed out that cross-border E-commerce enterprises in China face problems such as lack of data and information, absence of precise procurement management strategies, and lack of localized marketing strategies. With the help of the new generation of artificial intelligence, Chinese enterprises should build an intelligent data exchange platform of “E-commerce platform + enterprise + supplier” to promote the flexible production of products, and improve the localization level of product services through the “construction of overseas intelligent warehouses”. Lu

(2021) concluded through an empirical analysis of the impact of the development of artificial intelligence on the development of cross-border E-commerce in 29 provinces in China that the development of artificial intelligence improves the local informatization level, thereby promoting the development of cross-border E-commerce.

Fan (2022) deeply expounded on the driving factors of artificial intelligence in cross-border E-commerce from four perspectives: application, market, technology, and policies. Analyzed its application effects from three dimensions: improving efficiency, saving costs, and enhancing the user experience. Since artificial intelligence is mainly applied to improve the user service level in cross-border E-commerce, the sentiment analysis method was used to evaluate its effects. The research found that users mainly focus on areas such as logistics and personalized services, and have a positive attitude towards the application of artificial intelligence in different aspects. There is still much room for further exploration, especially in inventory management, payments, pricing, and information visualization. At the same time, it is also necessary to increase users’ attention to potential data security issues.

In summary, the comprehensive application of artificial intelligence in the field of cross-border E-commerce shows a significant promoting effect. Its combination with multiple participants in cross-border E-commerce (including sellers, platforms, logistics operators, etc.) effectively improves the operational efficiency of the entire cross-border E-commerce industry by improving supply chain management, promoting market development, and optimizing operations. At the same time, it shows greater potential for further exploration in areas such as inventory management, payments, and pricing. Overall, the deep integration of artificial intelligence and cross-border E-commerce is an inevitable trend in future development, bringing higher operational efficiency and a better user experience to the industry.

Due to the short development history of the combination of cross-border E-commerce and artificial intelligence, there is relatively little research on this topic abroad. Gonzalez-Cabañas and Mochón (2016) concluded through an empirical analysis of the impact of new Internet technologies on advertising marketing strategies that artificial intelligence can provide simpler marketing strategies for product promotion. Tapsoba (2017) believed that artificial intelligence can improve the business performance of E-commerce. Taking Taobao as an example, it was found that the application of artificial intelligence in Taobao product analysis can help buyers identify product quality problems, thus promoting the iteration and update of products. Ti, Huang, and Pei (2020)

believed that 60% of the success of Amazon sellers depends on product selection. Sellers need to select sales sites with market space for their products through preliminary research on market competitiveness and saturation, and then achieve product differentiation through technological innovation and updates to the product feature series. Cheng (2023) believed that the popularization of digital technology and the Internet promotes E-commerce technological innovation through the integration of artificial intelligence. However, privacy is an important risk factor that users need to consider when using artificial intelligence. In this context, how to establish a long-term trust relationship between users and artificial intelligence has become a key focus that platforms and enterprises need to pay attention to.

II. DEVELOPMENT OF CROSS-BORDER E-COMMERCE IN THE CONTEXT OF THE DIGITAL ECONOMY

With the advancement of technology and social development, the world has gradually entered the era of the digital economy driven by artificial intelligence. Different countries have diverse definitions of the digital economy. The definition provided by the G20 Digital Economy Development and Cooperation Initiative, which is widely recognized, states that the digital economy refers to a series of economic activities that use digitalized knowledge and information as key production factors, modern information networks as important carriers, and effectively utilize information and communication technologies to improve economic efficiency and optimize the economic structure.

According to this definition, the digital economy places special emphasis on the importance of information. Information digitalization serves as not only a production factor but also a production method and can be the result of economic activities. In the era of the digital economy, the past decade has witnessed technological innovations such as blockchain, the rise of the virtual space of the metaverse, and the current prevalence of artificial intelligence. Blockchain technological innovation focuses on the encryption and traceability of digital information. The metaverse brings digital information into the “visualization” of the virtual world, expanding people’s social lives into virtual space. Based on these two, artificial intelligence, especially generative artificial intelligence represented by ChatGPT, Midjourney, etc., namely AIGC, has drawn much attention as a production tool. The birth and popularization of AIGC represent a new technological update and transformation in the digital economy, promoting technological innovation and growth and expanding the boundaries of the digital economy.

Taking cross-border E-commerce as an example, the COVID-19 pandemic, while affecting human society, also accelerated the development of the online economy in various countries. The pandemic unleashed the demand for E-commerce, compelling service providers to open logistics routes and enhance logistics efficiency. During this period, social media marketing and cross-border payments also entered a new stage of development, making global connections even closer. As shown in Fig. 1, from 2019 to 2020, the total global retail sales volume increased significantly. It is expected that the global retail E-commerce sales will grow by 8% by 2024.

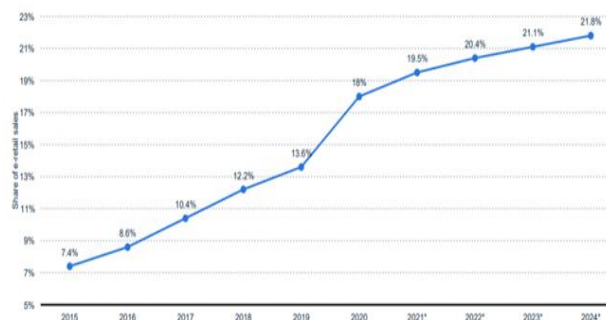


Fig. 1. Global retail sales volume 2015–2024.
International Trade Administration

During this period, the competitive landscape of cross-border E-commerce has also changed. Emerging local platforms have seized market share from traditional E-commerce platforms. The growth of small-scale enterprises has accelerated, and small and specialized handicraft stores like Etsy have gradually expanded their market share. Sellers have shifted from general-type stores to vertical stores and have gradually evolved into independent and personalized brand websites.

III. OPPORTUNITIES OF AIGC IN CROSS-BORDER E-COMMERCE

AIGC is a type of artificial intelligence system that can interact with users and generate new content such as text, images, and audio according to instructions, rather than merely analyzing or classifying existing data. These systems typically rely on deep-learning technologies, which can learn patterns from input data and generate similar new data. The application fields of generative artificial intelligence are extensive, covering natural language generation, image generation, music synthesis, and other aspects.

Currently, the commercial applications of AIGC mainly focus on tools such as ChatGPT, Midjourney, and Jasper, which are used for text and image generation. Different from technologies like blockchain and the metaverse, AIGC is a tangible digital tool that can significantly improve production efficiency. The applications of AIGC on cross-border E-commerce platforms mainly concentrate on three key areas: First, leveraging artificial intelligence tools to handle tasks such as image design, product descriptions, and marketing, helping sellers improve operational efficiency. Second, using artificial intelligence technology for pre-sales and after-sales services, such as intelligent chatbots and automated customer service, thereby reducing the demand for human resources. Third, training artificial intelligence with a large amount of data to extract consumers’ purchasing preferences and consumption habits, enabling more precise targeting of target consumers and increasing product sales conversion rates. These development trends highlight the importance and diversity of artificial intelligence applications in the cross-border E-commerce industry.

1) Product Development: In the field of cross-border E-commerce, there is a saying that “product selection accounts for 70% and operation accounts for 30%.” Success often depends on product selection and operation strategies. AIGC’s function in cross-border E-commerce product development is based on artificial intelligence technology. The main process

involves inputting natural language to describe an image, which is then generated by AIGC. Its underlying logic mainly relies on the Generative Adversarial Network (GAN) and diffusion algorithms. This process usually includes stages such as market research, demand analysis, technology selection, product development, and market testing. In Chinese cross-border E-commerce, sellers mainly use tools like Dell-E and Midjourney to analyze and extract market research data, identify product keywords, and confirm the main terms of the input products. Subsequently, they continuously adjust product attributes such as materials, colors, and sizes to match the brand style. Finally, they optimize and adjust based on the sales data after the products are launched into the market. Some AIGC software can assist sellers in making intelligent product-selection decisions through data analysis, market research, demand analysis, and price recommendations according to specific platforms.

2) Product Details editing: Editing product details incurs significant human-resource costs. On the one hand, due to differences in consumer behavior, operators need to deeply understand the online consumption habits of target-market consumers. For example, AliExpress and Amazon represent the operation styles of the Chinese and US markets, respectively. For the same product, AliExpress displays all relevant product information on the homepage, while Amazon requires a white-background product image with the product occupying more than 85% of the image area. On the other hand, cultural and language differences make it difficult for operators to accurately present information. Take AliExpress as an example. Although the background uses artificial-intelligence-based automatic translation to translate product keywords into 17 different languages, the translation accuracy is poor. This is because the translation software provided by cross-border E-commerce platforms is based on the Statistical Machine Translation (SMT) method. This method uses a large number of bilingual texts and statistical models to predict the best translation results. However, this method has limitations in handling language complexity and usually provides a single translation result with limited interactivity. In contrast, AIGC has achieved technological iterations. For example, ChatGPT is based on the Generative Pre-trained Transformer large-scale pre-training model, which can understand the context and generate coherent text according to the context, performing better in understanding sentence meanings and contexts, thus improving translation accuracy. In addition, for some factory-type stores with many Stock Keeping Units (SKUs), operators need to spend a lot of time every day on product editing. Due to different people's personal understandings and expression habits during creation, product editing may vary greatly in style and language, which is not conducive to standardization. AIGC can ensure a unified product-description style, accurate information, avoid human errors, and enhance brand image and customer trust. Before the popularization of AIGC, some E-commerce auxiliary enterprises began to use artificial-intelligence functions to improve product operation efficiency. Take the Seller Spirit application on the Amazon platform as an example. Amazon's product-detail pages, also known as "Listings," contain detailed product information. The importance of

product Listings is reflected in many aspects. First, it affects product rankings. To achieve good sales performance, products need to occupy a prominent position in search results, which depends on Amazon's A9 algorithm for product identification and classification. Seller Spirit has an "automatic listing generation" function. Before using this function, sellers need to determine reference products, that is, products similar to or competing with their own products. This selection is crucial as it directly affects the quality and effectiveness of the generated listings. Sellers need to enter the ASIN (Amazon Standard Identification Number) of the reference products into the system so that Seller Spirit can capture and analyze the listings of these products, use them as learning and modeling objects, and then screen keywords.

There are many cross-border E-commerce plugins like SellerApp on the market, which are based on massive data and use artificial-intelligence technology. Although these plugins make the listings written by sellers more professional, they also have some problems:

1) High economic cost: Artificial-intelligence tools like SellerApp are mainly used for market research on E-commerce platforms, keyword analysis, product optimization, and other functions. The prices of these tools usually range from \$500 to \$2,000 per year, depending on the selected service package and the depth of functions. Many tools offer free-trial periods or monthly subscriptions for users to choose according to their needs. For most sellers, choosing the right tool and package requires comprehensive consideration of business scale, budget, and specific requirements.

2) Operational complexity: Artificial-intelligence software represented by AIGC is constantly evolving, with numerous functions and tools. This means that users face a steep learning curve. For sellers without relevant experience, it takes a lot of time and effort to master its usage methods and skills. In addition, the rapid update and iteration of software require sellers to continuously learn new software knowledge and process new data, increasing the complexity of use.

3) Data silo problem: Take SellerApp on Amazon as an example. As an independent tool provided by Amazon, its data usually cannot be integrated with other tools used by sellers. This means that sellers may need to switch frequently between different platforms, causing inconvenience in management.

4) Cross-border E-commerce Marketing: According to data from Similarweb, Microsoft integrated the chatbot ChatGPT into its search engine Bing, prompting more users to choose Bing over Google. From February 7, 2023, when Bing launched its artificial-intelligence version, to March 20, 2023, the number of visits to Bing's pages increased by 15.8%, while the number of visits to Google's pages decreased by nearly 1% during the same period. Data from Data.ai shows that since the integration of artificial-intelligence functions, the global downloads of Bing's search app have increased 7-fold, while the downloads of Google's search app have decreased by 2% during the same period. These data have driven the growth of Bing's traffic.

Cross-border E-commerce sellers will shift their Search Engine Optimization (SEO) strategies from Google to Bing to take the lead in enjoying the traffic dividend.

5) Customer Service and After-sales: The application of AIGC in customer service and after-sales is usually indirect. For example, customer-service staff use AIGC for real-time

translation or to find solutions. AIGC can also be used to develop intelligent chatbots or virtual assistants. These can identify and understand customers' questions or needs through natural-language-processing technology and automatically provide corresponding answers and solutions. These automatic replies can greatly reduce the workload of customer service, improve response speed and efficiency. In addition, they can provide personalized services and recommendations. Based on the analysis of customer data and historical records, AIGC can generate personalized product recommendations, customization suggestions, or service plans.

This personalized service can not only improve customer satisfaction but also promote transactions and increase sales. These softwares can also analyze a large amount of customer data to identify potential problem trends or customer needs, predict future problems or hot topics. This helps enterprises adjust strategies and allocate resources in advance, prevent problems, and enhance the predictive and responsive capabilities of after-sales services. Currently, many artificial-intelligence software can even recognize and analyze the emotions in customers' phone calls or voice messages, helping customer-service staff better handle emotional communication with customers.

Platforms such as Google Dialogflow, Amazon Lex, and Microsoft Azure Bot Service are constantly improving their voice-based customer-service functions. Through automation, personalization, and intelligence, AIGC significantly enhances the efficiency and quality of customer service and after-sales, enabling enterprises to better meet customer needs, optimize the customer experience, and maintain a leading position in the highly competitive market.

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IV. CHALLENGES AND COPING STRATEGIES OF AIGC TECHNOLOGY IN CROSS-BORDER E-COMMERCE

In the dynamic realm of cross-border E-commerce, where market landscapes shift overnight, staying ahead requires leveraging cutting-edge technologies. AIGC offers unprecedented opportunities for enhancing customer experiences, streamlining operations, and driving growth. But, like any disruptive technology, it confronts a unique set of obstacles in the cross-border E-commerce space.

1) Difficulties in technology integration and cost pressure: As an emerging information technology, AIGC incurs high costs. In the cross-border E-commerce field, which covers multilingual and multicultural markets, AIGC needs to be capable of handling and adapting to the generation and understanding of content in different languages and conforming to different expression forms and consumption habits in various cultural backgrounds. This diversity increases the complexity of technology integration. Enterprises need to invest more resources and costs in

developing and maintaining multi-language-supported AIGC systems. Cross-border E-commerce platforms usually integrate multiple technology systems and third-party services. For AIGC to be perfectly integrated with them, it is necessary to develop Application Programming Interfaces (APIs), adapt data formats, adjust operation processes, etc. These tasks require additional resource and cost inputs to ensure system compatibility and stability.

The difficulty of technology integration is also affected by available language corpora. For example, Chinese language corpora only account for 1% of the data used by GPT-3. This means that GPT has relatively limited knowledge of Chinese history and culture. To improve its understanding ability, it needs to be specifically trained with Chinese language corpora.

2) Data privacy and security risks: In AIGC technology, a large amount of user data is used for model training and algorithm optimization. This data includes users' personal information, behavioral data, preferences, etc. If these data are not properly protected, there is a risk of privacy leakage, which may expose users' personal information.

In addition, data-protection laws and regulations vary in different countries and regions. For example, the European Union's General Data Protection Regulation (GDPR) and China's Personal Information Protection Law (PIPL) have different focuses. The GDPR focuses more on building a comprehensive and unified framework, with strict requirements for cross-border data transfer and a high-penalty mechanism. In contrast, the PIPL mainly focuses on data-processing requirements within China and the security review of cross-border data transfer, reflecting a regulatory model with Chinese characteristics. AIGC may face compliance challenges when collecting and using user data, especially when the data is used for unauthorized purposes such as advertising targeting, user-profile construction, or market research.

3) Algorithmic bias: The application of generative artificial intelligence (AIGC) in cross-border E-commerce may be affected by algorithmic bias. Algorithmic bias refers to systematic deviations in algorithm results caused by algorithm design, training-data selection, or usage methods. The most common bias originates from training data, including data imbalance and biases in historical data. For example, the data volume of certain product categories, brands, or consumer groups may be much larger than others. This may lead AIGC to recommend certain products or user groups more frequently while ignoring equally important but less-represented options in the data. If the training data reflects historical biases or past injustices (such as biases against certain product types or consumers), the model will learn and amplify these biases, resulting in unfair outcomes. There may also be biases in cross-border E-commerce recommendation systems. When AIGC is used for personalized recommendations, it may tend to promote popular or best-selling products while ignoring new or niche products, making it difficult for these products to be discovered by consumers.

4) Bias in advertising and promotions: Advertising and promotions are important sources of traffic for cross-border E-commerce stores. When AIGC is used to generate advertising content, it may show favoritism towards certain user groups based on historical data and behavior patterns. This may cause some user groups to receive more frequent advertising pushes

than others. For example, if the training data is biased towards American culture and values, the generated advertising content may reflect American cultural perspectives and backgrounds, ignoring cultural differences and consumption habits in other regions. If the training data is biased towards specific consumer groups, such as young people or high-income groups, the generated advertising content may tend to meet the needs and preferences of these groups while ignoring the diversity of other consumer groups.

5) Ethical and social impacts: Biases in generative artificial-intelligence (AIGC) systems may have a negative impact on social fairness. For example, recommending high-price products may ignore consumers with weak economic capabilities, exacerbating social inequality. In addition, the generated content may contain inappropriate language, images, or viewpoints, triggering ethical controversies. For instance, the generated advertising content may involve discrimination related to gender, race, or other sensitive topics, damaging the brand's reputation and causing public dissatisfaction.

In conclusion, AIGC brings both opportunities and challenges to the development of cross-border e-commerce and to social and human progress. In the process of developing artificial intelligence, humanity needs to strengthen technological innovation and R & D investment. Each country should form specialized multidisciplinary teams dedicated to the research and development of its own large-scale AIGC models, integrating talents such as data scientists, machine-learning experts, software engineers, cross-border E-commerce experts, and business analysts to ensure the full utilization of various professional knowledge. Governments of various countries should actively promote global information exchange. Currently, the most advanced artificial-intelligence models are developed through the cooperation of experts from different countries and disciplines. However, with the emergence of anti-globalization trends, problems such as technical and trade barriers, the de-globalization of supply chains, geopolitical tensions, nationalism, and localization have gradually emerged, restricting technological exchanges and personnel mobility to a certain extent and thus affecting the development of AIGC. The so-called "winner-takes-all" concept. To achieve technological innovation, we should follow the principle of globalization to facilitate the flow of information, personnel, and technology.

In terms of R & D investment, in addition to increasing financial support, we should also encourage cooperation between enterprises and universities, as well as with technology companies, start-ups, and research institutions. Jointly promote innovation projects and share technical resources and research results. At the same time, optimize the R & D process, form multidisciplinary teams, ensure close collaboration between the R & D team and departments such as marketing, sales, and operations, and respond quickly to business needs. In addition, use advanced project-management tools (such as Jira and Trello) to improve the efficiency and transparency of R & D project management. For researchers, establish a complete incentive mechanism, including bonuses, equity incentives, and career-development opportunities, to stimulate the innovation

vitality of the R & D team.

V. CONCLUSION

In the context of the digital economy, AIGC presents numerous opportunities and a series of challenges for the development of cross-border E-commerce. This article has explored these opportunities and challenges from multiple aspects and drawn the following conclusions:

Firstly, AIGC brings significant opportunities for cross-border E-commerce. With its powerful data-analysis and prediction capabilities, AIGC can help enterprises achieve precise market segmentation and personalized user experiences, increasing sales conversion rates and customer satisfaction. Especially in multilingual and multicultural environments, AIGC can effectively meet the needs of consumers in different countries and regions, facilitating and accelerating the development of international trade.

Secondly, AIGC faces some challenges in cross-border E-commerce applications. Among them, data-privacy and security protection are major concerns, especially when collecting, storing, and processing the data of users from multiple countries. It is crucial to strictly comply with the data-protection regulations of each country to ensure the security of user data and protect their privacy rights. In addition, continuous technological innovation and updates are also necessary to cope with the changing market demands and competitive pressures.

To address these challenges, it is recommended that enterprises and research institutions continuously increase their investment in the research and development of AIGC technology and talent cultivation, promote technological progress, and improve the effectiveness of its application. At the same time, strengthening international cooperation and exchanges to jointly address technical challenges and legal regulatory issues in cross-border E-commerce is also essential for the healthy development of the digital economy.

In summary, in the context of the digital economy, AIGC technology demonstrates great development potential and broad market prospects in the field of cross-border E-commerce. By overcoming technical challenges and strengthening cooperation, we are confident in opening new opportunities and spaces for the development of cross-border E-commerce in the wave of the global digital economy.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Bian Linghe conducted the research and wrote the paper; Cai Yueyue and Mao Yutian analyzed the data; all authors had approved the final version.

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