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Research on the Development of Cross-Border E-commerce D2C Live Streaming Based on AIGC Technology

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Abstract

With the rapid advancement of internet technology and the digital trade industry, propelled by the digitization and globalization engines, the growth of digital trade, including cross-border e-commerce, has entered a feverish phase. Social media has progressively transformed into a crucial purchasing and sales platform, with the D2C live streaming model of cross-border e-commerce being preferred by consumers. This paper aims to investigate the viability and applications of cross-border e-commerce D2C live streaming based on AIGC technology.

Keywords: Artificial Intelligence; Cross-Border E-Commerce; Live Streaming.

1. Introduction

In the post-pandemic era, the COVID-19 pandemic has had a widespread negative impact on the global real economy. Numerous industries, including but not limited to tourism, catering, and retail, have faced significant shocks. The global supply chain has also been affected by the pandemic. Restrictions on offline channels during the pandemic accelerated the prevalence of online transactions, making consumers more inclined towards online shopping and further promoting the increase in global e-commerce penetration rates. Cross-border e-commerce D2C live streaming has provided considerable convenience for global consumers and has become a significant way for a considerable portion of consumers to understand and purchase overseas products. Through live streaming, consumers can intuitively grasp key information about products, such as their true appearance, dimensions, materials, and specific usage methods.

Cross-border e-commerce D2C live streaming has numerous advantages in promoting cross-border trade and expanding market reach; however, it also faces certain limitations, such as language barriers and product adaptability issues. AIGC technology can help address many of the current problems faced by cross-border e-commerce D2C live streaming.

2. Literature Review

Since the Dartmouth Conference in 1956, convened by John McCarthy and other scholars, AI has been formally established as a discipline for over sixty years. Prior to this, there were already some early works and ideas related to AI in academia. The Dartmouth Conference not only laid the foundation for AI research but also defined the development direction of AI technology for the next several decades. Therefore, the holding of the Dartmouth Conference is regarded as the landmark for the formal birth of AI, marking 1956 as the inaugural year of artificial intelligence.

Currently, there is no unified definition of the concept of AIGC. In domestic academia, industry, and research, AIGC is understood as a new production method utilizing artificial intelligence technology to automatically generate content following professional generated content (PGC) and user generated content (UGC) [1]. The corresponding international term is "AI-generated Media" or "Synthetic Media," defined as a collective term for the production, manipulation, and modification of data and media through artificial intelligence algorithms. According to Roger C. Schank (1991) in his article "Where's the AI," AI is described as "the magic bullet, a reasoning engine, enabling machines to learn," and "making machines do what you think they can't do."[2] In summary, we believe that AIGC is both a category of content classified from the perspective of content producers and a set of technologies used for automated content generation.

Over these sixty years, AI has been widely applied in various fields, including finance, healthcare, education, and marketing. However, the application of artificial intelligence (AI) in e-commerce and cross-border e-commerce does not have a clear starting year or region; rather, it has gradually increased and expanded with the development of technology. According to the official definition by the Ministry of Commerce of China, cross-border e-commerce refers to "international business activities conducted through e-commerce platforms, including various aspects of import and export, payment and settlement, cross-border logistics, and after-sales services." According to the World Trade Organization (WTO), e-commerce refers to the process of transactions between consumers and enterprises using electronic means (including the internet). This transaction can cover online purchases and sales of products, services, or information, as well as online payments and digital delivery systems. Compared to e-commerce, research on AI technology in the field of cross-border e-commerce is minimal. Therefore, when studying the application of AI technology in cross-border e-commerce, we must reference relevant literature on e-commerce.

Some early applications of AI technology in e-commerce can be traced back to the late 1990s and early 2000s. These applications primarily focused on search engine optimization, personalized recommendation systems, intelligent customer service, and data analysis. Some large e-commerce platforms and technology companies in the United States, Europe, and Asia began exploring and applying AI technology during this period to enhance user experience and increase sales efficiency. For instance, Amazon and Alibaba are among the earliest companies to use AI algorithms to improve recommendation systems and optimize intelligent engines.

Specifically in cross-border e-commerce, with the globalization and popularization of the internet, AI technology has gradually penetrated various aspects of cross-border e-commerce, including market analysis, multilingual translation, international payments, and logistics optimization. According to Song Xia (2019) and others, AI technology in the field of e-commerce is mainly applied in three areas: AI assistants (chatbots), recommendation engines, and intelligent logistics. Harikumar Pallathadka and others elaborated further on the applications of AI technology in this field, including image search, processing customer data, network security, and inventory management.[3] It is worth mentioning that different countries and regions have varying progress in the application of AI technology in cross-border e-commerce, but most countries and regions are utilizing AI to enhance the efficiency and competitiveness of their international trade.

2016 marked the rapid development of China's live-streaming industry, signifying the entry of the live-streaming economy into a phase of rapid growth and diversification. Prior to this, there was minimal academic research on the application of AI technology in the live-streaming field. According to Shao Keyuan (2024), social media, especially live media, has become a new choice for DTC brands to go global.[4] Compared to overseas e-commerce, Chinese e-commerce has a significant advantage in live-

streaming sales, and the rise of cross-border e-commerce live streaming may become the next industry trend, providing new opportunities for DTC brands to expand internationally. With the development of AIGC technologies like ChatGPT, cross-border e-commerce live streaming will also usher in new opportunities.

3. Development History and Current Status of Cross-Border E-commerce D2C Live Streaming

3.1. Basics of Cross-Border E-commerce Live Streaming

The rapid development of cross-border e-commerce live streaming in China is largely attributed to the foundational success of e-commerce live streaming domestically. Internationally, China is widely recognized as a leader in the cross-border e-commerce D2C live streaming sector. According to the "2023 China Live E-commerce Market Data Report" released by the Internet Economy Research Center, the transaction scale of live e-commerce reached 49,168 billion yuan in 2023, a year-on-year increase of 40.48%; the average annual consumption per user in live e-commerce was 8,660 yuan, up 17.03% year-on-year, as shown in Figure 1.

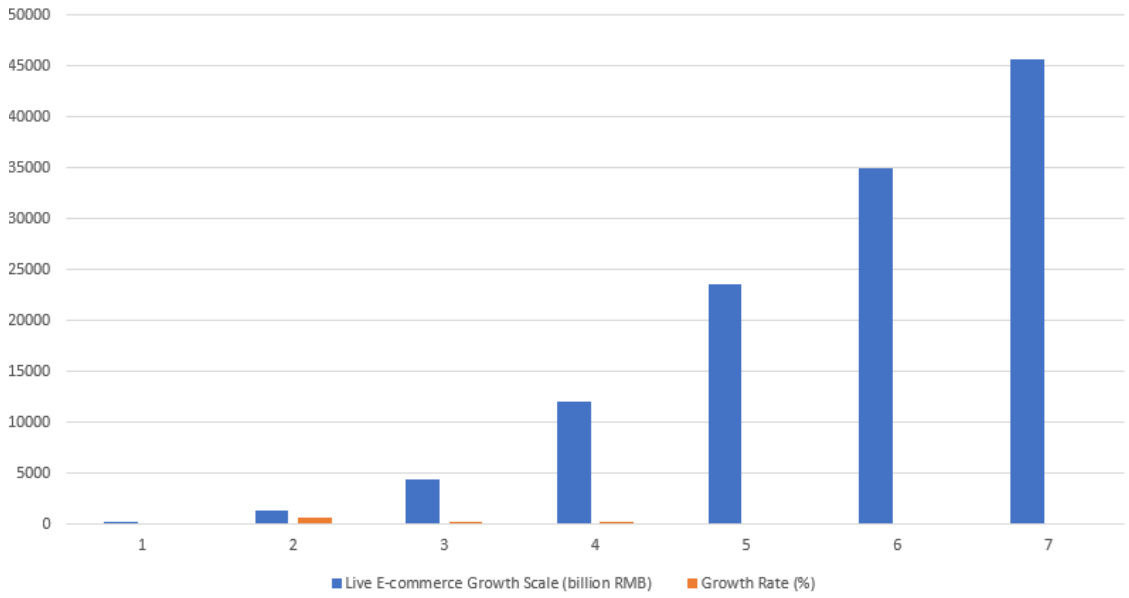

Figure 1. Market Size and Growth Data of China's Live E-commerce from 2017 to 2023

China is the pioneer of live e-commerce, leading the world in terms of market scale, technological advancement, and consumer engagement. Based on the extensive experience in domestic e-commerce live streaming, we can infer the essential conditions required for cross-border e-commerce live streaming. These include, but are not limited to, language proficiency and professional expertise. Hosts, for instance, need to be proficient in at least one foreign language, such as English, Spanish, or Russian, which are widely used in international trade.

Cross-border e-commerce D2C live streaming faces significant challenges due to language and cultural barriers. These differences necessitate a high level of international cultural awareness and foreign language proficiency from hosts. To effectively engage with viewers, hosts must be able to describe products in detail during live streams and answer questions in real time. While English is the primary language used in live streaming, proficiency in other languages such as Spanish and Russian may also be crucial depending on

the target audience. Additionally, hosts must possess a foundational understanding of the cultures of key consumer markets, such as those in Spain, Russia, Canada, and the United States.

To facilitate successful cross-border e-commerce live streaming, hosts require comprehensive professional training. This includes language proficiency as well as expertise in sales techniques, product knowledge, and effective communication. As the demand for versatile talent increases, so too do the costs associated with live streaming, which undermines its original advantage of being a low-cost sales tool.

Consumer preferences for brands vary significantly across different countries and regions due to cultural differences. In Latin America, for instance, consumers tend to favor brands that offer good value for money and resonate with local culture. A brand's social responsibility and involvement in community activities also play a significant role in shaping consumer brand recognition. Brands like Nike and Adidas have a strong presence in the Latin American sportswear market, largely because they actively engage in high-profile sports events such as soccer. The passionate sports culture in the region, combined with these brands' commitment to social responsibility, helps them resonate with local consumers.

3.2. Development History of Cross-Border E-commerce Live Streaming

According to the definition by the Ministry of Commerce of China, cross-border e-commerce refers to transaction activities between different countries and regions conducted through e-commerce platforms. Cross-border e-commerce live streaming is an innovative format that uses real-time video technology to showcase and sell products to overseas consumers. Through live streaming, sellers can interact with consumers in real time, thereby increasing conversion rates.

Based on the live streaming channels, cross-border e-commerce live streaming can be divided into on-platform live streaming (platform-based live streaming) and off-platform live streaming. On-platform live streaming refers to live streaming activities conducted within the e-commerce platform itself. This type of live streaming is directly embedded in the ecosystem of the e-commerce platform, allowing consumers to browse products, add items to their shopping carts, and make payments while watching the live broadcast, creating an integrated shopping experience. Amazon Live and AliExpress Live are examples of typical on-platform live streaming. Off-platform live streaming, on the other hand, refers to live streaming activities conducted on external social media and video platforms. This format primarily relies on the dissemination and influence of social media to attract viewers and guide them to purchase on e-commerce platforms. Platforms like Facebook, Instagram, and TikTok are typical examples of off-platform live streaming. Table 1 shows the similarities and differences between on-platform and off-platform live streaming [5].

Amazon first explored video content through Amazon Video Direct in 2016, focusing mainly on on-demand content. This laid the foundation for Amazon Live, which was officially launched in 2019. Amazon Live introduced a live shopping feature that allows users to watch real-time videos and purchase products recommended by hosts directly. The broadcasts include product showcases, unboxings, tutorials, and special offers, with hosts engaging with viewers in real-time to answer their questions. AliExpress, a subsidiary of Alibaba Group, began its journey into live e-commerce in 2016, accumulating experience through Taobao Live in the Chinese market. By 2018, it expanded this feature to the global market, helping Chinese sellers connect with overseas consumers via live streaming. Leveraging Alibaba's advanced live streaming technology and e-commerce resources, AliExpress created a one-stop solution for sellers. This innovation gained particular traction in countries like Russia, Spain, and Brazil, where live streaming helps local consumers better understand products.

Table 1. Similarities and Differences between On-Platform and Off-Platform Live Streaming

Feature	In-Platform Live Streaming	Off-Platform Live Streaming
Platform Integration	High, offering a unified user experience.	Low, requiring users to switch between platforms.
User Stickiness	High, extends user stay within the platform.	Relies on platform traffic and social media engagement.
Data Precision	Comprehensive, facilitates data analysis and optimization.	Partial, data varies across platforms.
Brand Exposure	Relatively limited, primarily focused within the platform.	Broad, achieved through social media and cross-platform sharing.
Interactive Communication	Strong platform-based interaction and feedback.	Enhanced by social media interaction and broad communication.

Around the same time, Facebook launched Facebook Live in 2016, allowing users to live stream directly from their mobile devices. Over the years, Facebook integrated interactive features like real-time comments, likes, and playback options, blending live streaming with its powerful social networking capabilities. This integration fueled the rise of social commerce, making Facebook Live a popular tool for product promotions, live sales, and brand advertising. During the pandemic, live shopping gained even greater prominence, further cementing Facebook Live's role in e-commerce.Building on this trend, Instagram introduced its live streaming feature in 2016 through Instagram Stories. As the platform grew, it added features like real-time audience interaction and, eventually, live shopping in 2020. This allowed users to buy products directly during broadcasts, providing brands and influencers with a visually appealing way to engage audiences, increase exposure, and drive sales.

In 2018, TikTok entered the live streaming space, combining real-time broadcasts with its already popular short video platform. Over time, it integrated e-commerce functionalities, enabling hosts to recommend and sell products directly. This unique blend of short videos and live streaming quickly expanded TikTok's influence in global markets, particularly in the U.S. and Southeast Asia, where its highly engaging format resonates strongly with younger audiences.

In summary, the development history of major cross-border e-commerce platforms is quite similar and can be categorized into initial, intermediate, and developmental stages of cross-border e-commerce.

Based on streaming methods, cross-border e-commerce live streaming can be divided into OBS streaming, mobile streaming, and hardware streaming.

OBS (Open Broadcaster Software) is an open-source live streaming software known for its extensive features, including audio and video capture, encoding, streaming, multiple scene switching, video effects, picture-in-picture, and real-time processing functions. It supports a wide range of plugins, scripts, encoding formats, and streaming protocols, making it highly versatile. These capabilities have made OBS a popular choice for large-scale events such as game streaming and concerts. Typically reliant on PC devices, OBS is best suited for scenarios that demand complex scene switching and high-quality audio and video output.

In contrast, mobile streaming leverages the camera of a smartphone and a live streaming app (e.g., Douyin, Kuaishou, Douyu) to facilitate real-time broadcasting. With minimal setup requirements, users can stream anytime, anywhere by simply installing the corresponding app. While mobile streaming lacks the advanced features of OBS and hardware streaming—such as complex scene switching and video effects

processing—it does not require additional hardware. This simplicity makes it an excellent option for outdoor broadcasts, interviews, daily life sharing, and other quick, low-threshold streaming scenarios.

For professional-grade streaming, hardware streaming involves the use of specialized devices such as hardware encoders, cameras, and recording equipment. These devices are designed to deliver high stability, reliability, and superior video quality, making them the preferred choice for large-scale events and professional productions. Hardware streaming supports high-resolution output and various input and output interfaces, catering to advanced live streaming needs. However, compared to OBS and mobile streaming, hardware solutions come with higher costs and require more complex setup and operation, positioning them as tools for dedicated professionals.

Each of the three streaming methods has its own strengths, catering to different customer groups and usage scenarios, as shown in Table 2.

Table 2. Similarities and Differences between Three Streaming Methods

Feature	OBS	Mobile Streaming	Hardware Streaming Devices
Functional Richness	Provides extensive audio and video capture and special effect features	Simplified streaming and basic special effect handling.	Professional-grade output and specialized functionality.
Dependence on Software	Limited by computer performance and network stability.	Dependent on smartphone performance and network quality.	Independent of computer performance, highly stable.
Flexibility	Customizable via plugins to achieve diverse effects.	Easy to operate, with relatively simple functionality.	Requires learning and setup, suitable for long-term use.
Applicable Scenarios	Customizable via plugins to achieve diverse effects.	Suitable for quick, low-threshold streaming and outdoor events.	Ideal for large events and high-quality professional broadcasts.
Cost	Free.	Free or low cost.	High cost.
Stability	Affected by computer performance, network stability not guaranteed.	Affected by phone performance and network quality.	Devices are stable and highly reliable.

3.3. Current Status of Cross-Border E-commerce Live Streaming

3.3.1. Volume of Cross-Border E-commerce Live Streaming Abroad

The United States is regarded as one of the most typical representatives of global cross-border e-commerce. Although there is still a significant gap in market size and user activity compared to China, the U.S. ranks first in the world in cross-border e-commerce live streaming volume outside of China, thanks to its large market scale, consumer purchasing power, platform advantages such as Amazon and Facebook,

and technological innovations. In 2023, the live e-commerce sales in the U.S. reached $50 billion, accounting for approximately 0.18% of that year's GDP. This indicates that live commerce still constitutes a relatively small part of the U.S. economy, despite its rapid development and significant growth potential. It also shows that live commerce, as an emerging sales and marketing model, is gradually gaining recognition and acceptance, and may become one of the more important economic activities globally in the future.

3.3.2. Main Markets

As an internationally recognized leader in live e-commerce, China still plays a pivotal role in the global cross-border e-commerce market, followed by the U.S. and several Southeast Asian countries, such as Vietnam, Indonesia, and the Philippines. According to a recent report from Statista, in a survey of social media users in 2023, those who watched shopping live streams in the previous week were highest in Indonesia, accounting for 40%. Additionally, the other five countries also exceeded 30% in their proportions. The presence of Brazil and Kenya indicates that cross-border e-commerce live streaming in Latin America and Africa still holds enormous potential, but is currently restricted by economic conditions and infrastructure limitations, which hinder its development.

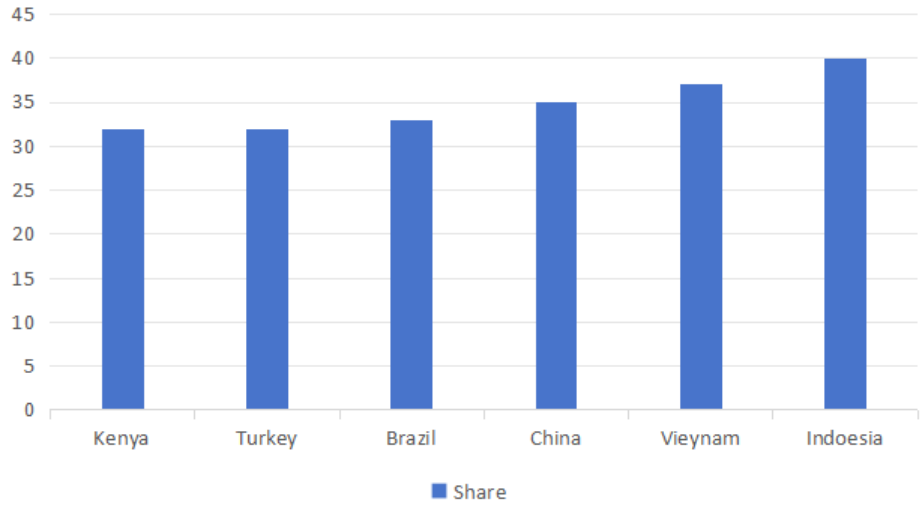

Figure 2. Proportion of Social Media Users in Selected Countries Who Watched Live Shopping Streams in the Past Week (2023)

3.3.3. Economic Benefits

Since the development of live e-commerce in 2016, cross-border e-commerce live streaming has brought considerable economic benefits to Chinese enterprises. For example, the financial revenue of Alibaba, a leading company in the domestic e-commerce industry, has increased year by year, reaching 944.168 billion yuan in the 2024 fiscal year [6-7]. Financial reports indicate that in the 2021 fiscal year, approximately 66% of Alibaba's revenue came from retail business, with significant growth in live streaming business. Live e-commerce has become a crucial component, contributing significantly to Alibaba's overall revenue growth.

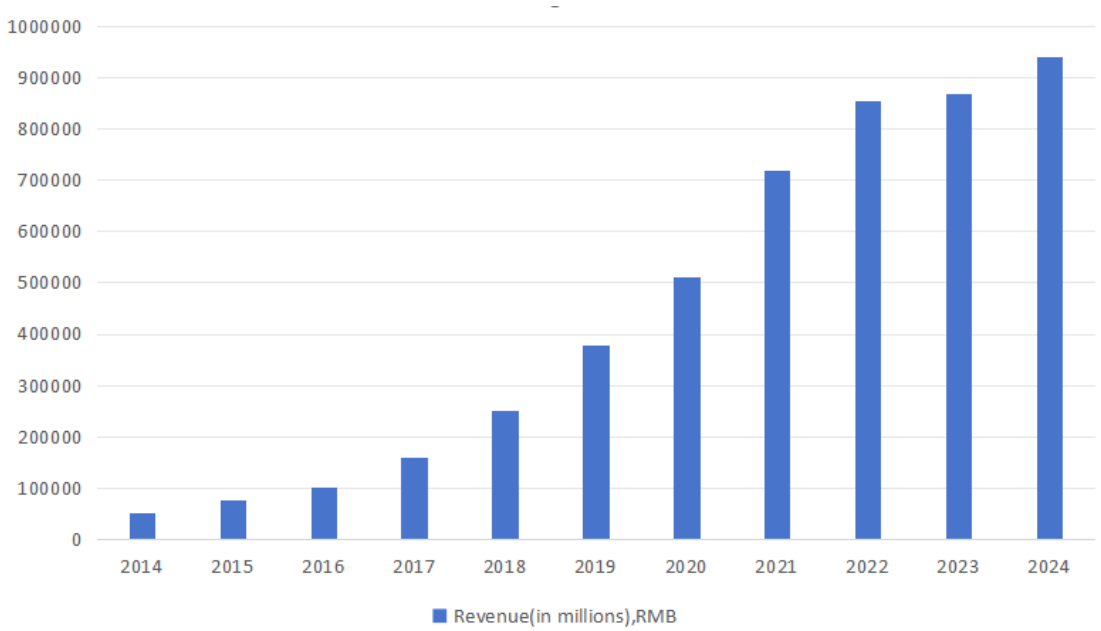

Figure 3. Alibaba Group: Annual Revenue (FY 2014–FY 2024)

4. Application of AIGC Technology in Cross-Border E-commerce D2C Live Streaming

4.1. Digital Human Live Streaming

Digital humans are virtual characters created using computer graphics (CG) technology and artificial intelligence. In terms of interactivity, digital humans can be categorized into interactive and non-interactive types, with interactive digital humans capable of simulating human actions and perceptions, enabling interaction with the real world.

Digital human live streaming is an activity that showcases virtual characters or digitally altered individuals to the audience via live streaming, leveraging AIGC technology. This format has wide applications in entertainment, education, and marketing, providing audiences with a novel audiovisual experience and offering flexibility and controllability. Compared to traditional live streaming, digital human live streaming has several advantages: (1) Digital humans allow for the creation of unique virtual personas in appearance, personality, and voice, which can be adjusted and modified as needed. This enables creators to express their ideas more freely, breaking the constraints of the real world. (2) Digital humans can engage with the audience in real time through technological means, providing viewers with a richer and more personalized viewing experience. (3) As mentioned earlier, cross-border e-commerce live streaming requires hosts to be proficient in multiple languages. The demand for versatile talent has significantly increased the costs associated with D2C live streaming. However, the application of digital human live streaming can cleverly address this issue. By using digital human live streaming, voice synthesis technology can enable virtual characters to conduct live streams fluently in multiple languages. Virtual characters can use pre-recorded audio or real-time voice synthesis technology to provide natural and smooth multilingual presentations without relying on real-life multilingual talent.

However, digital human live streaming also faces some technical limitations, as it cannot fully replace the real cultural background and linguistic characteristics. Therefore, it is still essential to ensure content accuracy and respect for local cultures. Overall, digital human live streaming can provide an alternative

solution for cultivating multilingual talent in cross-border e-commerce live streaming, but it still requires continuous upgrades and innovations in technology, content, and user experience.

4.2. Live Streaming Scripts

OpenAI launched the first version based on the generative pre-training model, known as GPT-1, in 2018. Since then, four generations have been developed, leading to the widely used generative artificial intelligence, Chat-GPT. The applications of Chat-GPT in cross-border e-commerce live streaming include but are not limited to real-time translation, content analysis, interactive assistance, and data analysis.

Using AIGC technology to write live streaming scripts can quickly generate a large volume of text. Compared to manual writing, this can save considerable effort and time, greatly improving efficiency and freeing individuals from monotonous repetitive tasks. AIGC can check grammar, correct spelling errors, and provide alternative vocabulary suggestions, thereby helping practitioners create more accurate and fluent text. Additionally, AIGC can offer feedback and improvement suggestions, provide inspiration and creativity, making the content of live streaming more diverse and appealing. Incorporating AIGC's suggestions into script design can help create content that captures audience attention and stimulates purchasing desire.

4.3. Virtual Scene Construction

Constructing virtual scenes is an essential component of cross-border e-commerce D2C live streaming. By creating virtual environments, hosts and content creators can showcase richer creative content while saving costs on physical setups and special effects production. The flexibility and real-time update capabilities of virtual scenes allow them to adapt to the needs of different live streaming themes and play an important role in brand promotion and marketing, effectively enhancing the professionalism of the content and the viewing experience of the audience. However, constructing virtual scenes faces challenges, including high technical complexity, expensive costs, high demands on equipment performance and network stability, and the need for real-time adjustments and updates. These factors limit ordinary users and small teams from utilizing virtual scenes to improve the quality and attractiveness of their live streams.

AIGC technology can effectively address these issues. Discord is a popular instant messaging application primarily used by gamers and communities. Through its rich mini-programs and plugin functionalities, Discord provides many tools and services to enhance user experience. Midjourney is one such AIGC mini-program focused on image generation.

Users can interact with Midjourney on Discord servers by entering simple text commands. For example, by inputting the "/imagine" command followed by a textual description, they can generate images that match the description. Users can also specify parameters such as the theme, style, and colors of the image to further customize the visual effects. Midjourney can generate various styles of images based on text commands or reference images, ranging from abstract art to specific scenes, catering to diverse user needs, whether it be cartoonish, realistic, or science fiction styles. Additionally, the quality of the generated images is high, suitable for various uses, including high-definition live streaming backgrounds and promotional materials.

Using Midjourney for virtual scene construction offers two significant advantages. First, it allows for the rapid generation of high-quality images and backgrounds without the need to hire professional graphic designers or use expensive software, thus reducing production costs. Second, images can be generated instantaneously. Midjourney takes less than a minute on average to produce a high-quality image, requiring

only one person to operate it, which significantly saves time and labor resources and improves work efficiency.

4.4. Precision Targeting

AIGC technology is transforming cross-border e-commerce D2C live streaming by enabling precise product targeting through a combination of audience insights, creative positioning, and market intelligence.

One of its key strengths lies in target audience analysis. By leveraging advanced algorithms, AIGC can deeply understand audience characteristics such as gender, age, interests, and hobbies. These insights allow brands to select the most relevant products and craft tailored marketing content for live streaming sessions. The result is a more personalized and engaging experience that resonates with viewers, driving higher conversion rates.

Beyond understanding the audience, AIGC significantly enhances product positioning by uncovering unique selling points. It generates contextually relevant content ideas based on product features and market demand, enabling brands to define their distinct value propositions and stand out in competitive markets. Additionally, AIGC serves as a creative powerhouse, offering fresh inspiration for brand storytelling and promotional strategy design. Whether through compelling ad campaigns, persuasive copywriting, or targeted social media marketing, it amplifies brand recognition and influence across channels.

Equally important is AIGC's role in market research and analysis. With its ability to continuously monitor evolving trends and competitive dynamics in the cross-border e-commerce landscape, AIGC empowers businesses to make data-driven decisions. These insights help brands refine procurement strategies, optimize live streaming content, and seize emerging opportunities. By integrating real-time market intelligence into their operations, businesses can remain agile and maintain a competitive edge in the fast-paced global marketplace.

5. Conclusion and Outlook

AIGC technology provides strong support for cross-border e-commerce D2C live streaming in several areas, including multilingual support, cultural differences, market trends, consumer demand analysis, and copywriting. However, there are also certain shortcomings of AIGC technology.

First, AIGC has limited capabilities in handling complex tasks. While AIGC can integrate and learn knowledge from various fields, it may not provide satisfactory answers to complex and in-depth questions due to limitations in data and training. AIGC also lacks a degree of personalization; during cross-border e-commerce live streaming, it may not offer interaction experiences consistent with those provided by real human hosts.

Second, AIGC is constrained by training data and environment. Although AIGC technology is becoming increasingly sophisticated, there are still flaws in key technological aspects. Currently, AIGC technology algorithms are easily influenced by external factors such as data and training environments. If the training data includes particular political, cultural, or other biases, it may affect the application effectiveness of AIGC technology in cross-border e-commerce live streaming.

With the rapid development of internet technology and the trend of economic globalization, the development trend of cross-border e-commerce remains stable and positive. Although there are still challenges such as technology immaturity, overall, cross-border e-commerce D2C live streaming based on AIGC technology is showing a good development trend.

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