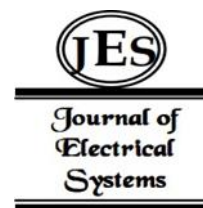


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Research on the Application of Virtual Anchors based on Artificial Intelligence Technology in Live Streaming E-commerce



Abstract: - With the increasing training and labor costs of live streaming e-commerce industry anchors, as well as the continuous progress of artificial intelligence technology, virtual live streaming anchors have gradually become the new favorite of live streaming e-commerce enterprises due to their strong stability and low cost characteristics. In this context, this article takes virtual anchors in live streaming e-commerce as the research object, and uses literature research and case analysis methods to study the application of virtual anchors. This article analyzes the current application status of virtual anchors in live streaming e-commerce, and analyzes the problems that exist in the application process, such as weak social functions of virtual anchors, low number of main consumer users, low degree of differentiated competition, and facing information security governance risks. Finally, based on the current reality of virtual live streaming e-commerce, strategies and suggestions are proposed to optimize the use of live streamers and virtual streamers, select appropriate product categories for virtual streamers, strengthen the cultivation of virtual live streaming operation talents, and build a diverse collaborative governance framework to enhance the application of virtual streamers.

Keywords: Artificial Intelligence (AI), Virtual Anchor (VA), Sell Goods Through Livestreaming (SGTL), Electronic Commerce (EC).

I. INTRODUCTION

Live streaming e-commerce, as a new type of e-commerce shopping model, presents consumers with rich and colorful product content in its intuitive and vivid form, attracting a large number of users' attention and participation [1]. With the rapid development of live streaming e-commerce, competition has become increasingly fierce, gradually leading to issues of scarce anchor resources and high training costs. According to the "Development Report on China's Online Performance (Live and Short Video) Industry (2022-2023)" jointly prepared by the China Performance Industry Association and other institutions, the report shows that the talent gap in China's live streaming industry was 8 million in 2021, and it is expected that this number will increase to 19.415 million by 2025. This means that the demand for talent in the live streaming industry will grow rapidly. Under the wave of the metaverse, enterprises have targeted virtual anchors based on artificial intelligence technology to alleviate brand marketing difficulties and applied them to the field of live streaming e-commerce. AI anchors are virtual digital human anchors created by the application of artificial intelligence technology in the field of e-commerce live streaming, which can help enterprises reduce labor costs and effectively release the pressure of live streamers [2]. At present, the main application scenarios of virtual anchors are media services and brand marketing services aimed at the B-end. Especially in terms of corporate brand marketing, virtual anchors have enormous potential and development space, with a focus on live streaming sales [3]. From the application practice of virtual anchors, their live streaming sales effect is not inferior to that of live streamers. On May 1, 2020, virtual idol Luo Tianyi landed in the Taobao live broadcast room to test the waters and promote products for Bosch Lun, Midea, Ou Shudan, and others. After Luo Tianyi was launched, the number of live streaming viewers reached as high as 2.7 million, with nearly 2 million people tipping and interacting. Its live streaming performance directly surpassed that of Taobao's top anchors Li Jiaqi and Viya. At present, existing research mainly focuses on the comparative study of sales effects between virtual anchors and live anchors, the impact of virtual anchors on consumer purchase intention, and governance research under the background of virtual anchors. However, there is a lack of systematic description and analysis of the application status of virtual anchors in live streaming e-commerce. Based on this, this article focuses on the current application status, characteristics, and some existing problems of virtual anchors in the field of live streaming e-commerce, and provides certain countermeasures and suggestions for the healthy development of virtual anchors in live streaming e-commerce.

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II. RELATED CONCEPTS

A. Artificial Intelligence

Artificial Intelligence, abbreviated as AI, is an interdisciplinary and emerging discipline based on Computer Science, integrating multiple disciplines such as computer science, psychology, and philosophy. It is a new technological science that studies and develops theories, methods, technologies, and application systems for simulating, extending, and expanding human intelligence, aiming to understand the essence of intelligence, and produce a new intelligent machine that can respond in a way similar to human intelligence. Research in this field includes robots, language recognition, image recognition, natural language processing, and expert systems.

B. Live E-Commerce

Live streaming e-commerce, also known as "online live streaming + e-commerce shopping," refers to a new form of e-commerce where internet celebrities or other KOLs recommend products and ultimately make transactions through video live streaming, short videos, and other forms [4]. In 2016, Mogujie was the first to launch a video live streaming function on its website, thus opening the prelude to China's live streaming e-commerce. Therefore, 2016 is considered by scholars as the first year of China's live streaming e-commerce. Compared to traditional graphic e-commerce, live streaming e-commerce has stronger interaction with consumers and can create a sense of presence, thereby promoting and enhancing consumer purchasing desire.

C. Virtual Anchors

Virtual anchor is a digital image based on artificial intelligence and computer graphics technology, which can simulate the speech and behavior of human anchors, and carry out live streaming, interaction and other activities. Its image is diverse and can be in the form of cartoons, lifelike characters, etc., and its behavior, language, etc. can be customized. The earliest virtual anchors originated from an artificial intelligence called KizunaAI. The meaning of KizunaAI is derived from the Japanese Romanized word "tie", which translates to "tie love" in Chinese, meaning to establish ties with humans. The designer added pink highlights to KizunaAI's long black hair, paired with white and pink clothing and white shorts, to make this virtual character look very cute and loved by fans [5]. With the continuous advancement of technology, the image and performance of virtual anchors are becoming more and more realistic, attracting more and more user attention.

III. THE CURRENT APPLICATION STATUS OF VIRTUAL ANCHORS IN THE FIELD OF LIVE STREAMING E-COMMERCE

A. Main Types of Virtual Anchors in Live Streaming E-Commerce

On e-commerce platforms, there are various types of virtual anchors that are designed and applied according to different functions and requirements. The following are the main types of virtual anchors on e-commerce platforms, specifically, as shown in Table 1:

Table 1: Main Types of Virtual Anchors on E-Commerce Platforms

Serial Number	Virtual anchor type	Mmajor function
1	Intelligent customer service virtual anchor	Mainly used as an intelligent customer service system for e-commerce platforms, it can answer user inquiries, provide shopping guidance and after-sales service
2	Live streaming sales virtual anchor	By showcasing the characteristics and usage methods of products through live streaming, attract consumer attention and facilitate purchasing behavior
3	Brand endorsement virtual anchor	As the brand's image spokesperson, showcasing the unique charm and values of the brand through customized images and words and actions, enhancing user awareness and favorability towards the brand
4	Interactive entertainment virtual anchor	By interacting with users in real-time, we can increase their engagement and stickiness, and enhance the user experience of e-commerce platforms

The application of AI virtual anchors in the e-commerce field is mainly reflected in live streaming sales. With the rise of e-commerce live streaming, more and more businesses are using AI virtual anchors for product introduction, promotion, and sales. AI virtual anchors can perform intelligent voice interaction and image display based on different products and scenes, providing consumers with a richer, more vivid, and interesting shopping experience. In this article, research is mainly focused on virtual anchors of the live streaming sales type. As this type of anchor can effectively solve the current problems of scarcity and easy turnover of live streamers, it has been sought after by many capital in 2023. By searching for key "virtual human enterprises" on Qichamao, as of December 26, 2023, there are currently 10.008 million "virtual human" enterprises in China, with 2.4806 million established in 2023, an increase of 24.20% from 1.9972 million in 2022. Virtual anchors selling products can help businesses cover various live streaming platforms. As virtual assets, virtual anchors have unlimited energy

and an inexhaustible state. They can break away from traditional live streaming fixed scenes and create an immersive virtual experience. This technology application is bound to be fully developed in the future [6].

B. Application of Virtual Anchors in Live Streaming E-Commerce

According to relevant information, virtual anchors have been gradually entering major e-commerce platforms since 2019. In 2019, JD.com and Xiangxin Technology teamed up to create a virtual anchor named Jing Xiaoshuai for the Double Eleven "Digital Reading" event, reporting in real-time the "record breaking" events during JD.com's Double Eleven period. This has led to the integration and innovation of AI technology and e-commerce. In October 2020, Taobao used AI virtual anchors developed by Damo Academy on the eve of Double Eleven. These virtual anchors have both physical and mental abilities, with voices, emotions, and movements approaching real people. They can listen and speak, answer questions, coordinate their body movements, and dance. Live streamers have high costs and limited online time, but virtual streamers with cognitive abilities do not need to consider these factors, making them the best alternative to live streamers. In order to warm up for Double Eleven, Philips implemented a joint mode of live and virtual anchors in six core stores on October 28th, ensuring 24-hour broadcast status of the stores. Although it is an AI virtual anchor, the views are not low, and the highest number of views reached 80000, greatly exceeding Philips' expectations. AI virtual anchors are therefore attracting more attention from businesses.

With the rise of the younger generation of Z, AI virtual anchors are entering a period of development dividend. In addition, with the maturity of the underlying technology of virtual anchor with goods, multiple forms of virtual anchor with goods are emerging in platforms such as Tmall, Tiktok, Kwai and Station B, the sales situation of some virtual anchors on these platforms is shown in Table 2.

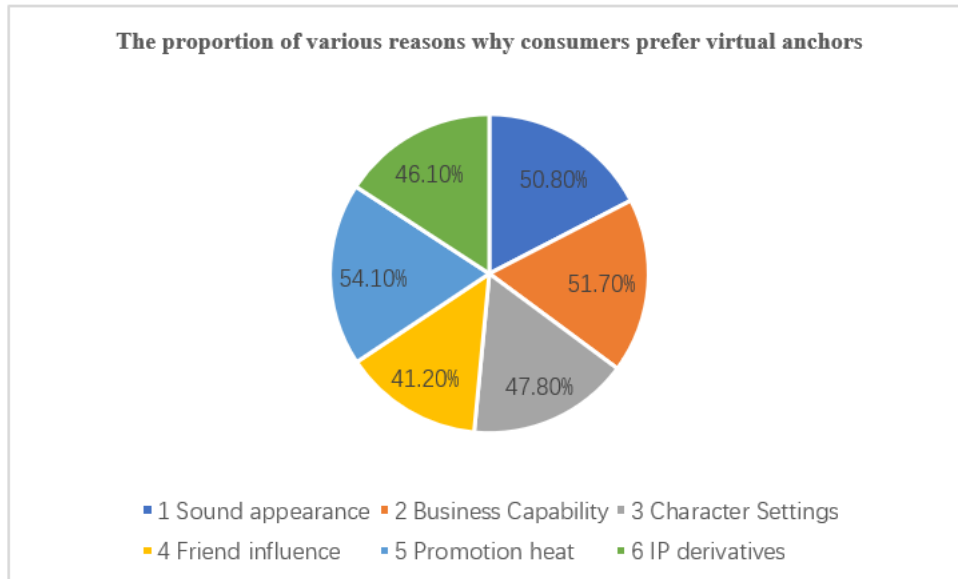
Table 2: Virtual Sales Anchors on Some Platforms

Serial Number	Platform Name	Virtualanchor name	Virtual anchor format	Live streaming effect
1	Tiktok	Lingyan Huan	Super realistic style	The peak number of online viewers is 55000, with 1.52 million viewers in live streaming venues
2	Kwai	Li Haoya	Anime Virtual Anchor	Full virtual scene interaction+virtual item explanation
3	Station B	Star pupil	Fashion virtual idol	The GMV of the first live streaming test is close to one million
4	Taobao/Tmall	Luo Tianyi	Virtual Idol	Nearly 3 million people watched the first time I brought the product

Data source: Pengpai News

From Table 2, it can be seen that major platforms are currently exploring virtual anchor sales, and some virtual anchors have achieved good results in sales. In addition, with the high training and employment costs of live streamers, many companies adopt low-cost virtual anchors to seize the dividend period of live streaming sales. Since 2019, the term "virtual sales anchor" has not only received the pursuit of e-commerce capital, but also attracted the attention of scholars. By using the Octopus data collection tool to collect "virtual anchors" and "live streaming sales" on China National Knowledge Infrastructure (CNKI) By searching for keywords, a total of 400 relevant literature were searched, of which only 22 met both keywords simultaneously, and these literature were published from May 2023 to January 2024, indicating that there is currently not much research in this field. In addition, the Octopus data collection tool was used to collect virtual e-commerce anchors on Baidu's public webpage A total of 74 pieces of related information were searched for keywords, and after removing advertising information, 49 pieces of related information remained. These pieces of information were mainly released since June 2020, indicating that virtual e-commerce hosts also entered the sight of merchants from that time, thus attracting the attention of Guangzhou Capital.

With the rise of concepts such as the metaverse and the increasing maturity of the virtual anchor industry, as well as the continuous improvement of business models and operational ideas, virtual anchor sales have gradually become a form accepted by the younger generation, According to relevant data, the main consumer group of virtual anchors is Generation Z teenagers [7]. According to the "2023 China Virtual Anchor Industry Research Report" released by iMedia Consulting, since 2019, the number of registered virtual anchor enterprises in China has been continuously increasing, mainly distributed in South China, East China and other regions. The report shows that the distribution of reasons why consumers like virtual anchors is shown in Figure 1:



Data source: iMedia Data Center (data. iimedia. cn)

Figure 1: Investigation on the Reasons Why Consumers Like Virtual Anchors

From Figure 1, it can be seen that the reasons why consumers like virtual anchors are relatively diverse and not concentrated on a single reason, which is consistent with the diverse values of the younger generation.

C. Analysis of Virtual Anchor's Sales Ability in Live E-Commerce

In live streaming e-commerce, the main indicators for evaluating live streaming hosts include number of viewers, sales conversion rate, sales revenue, user retention rate, and word-of-mouth communication effectiveness. Take the live broadcast of Lingyanhuan virtual anchor in Tiktok platform in the last 30 days as an example, and its live broadcast data is shown in Table 3:

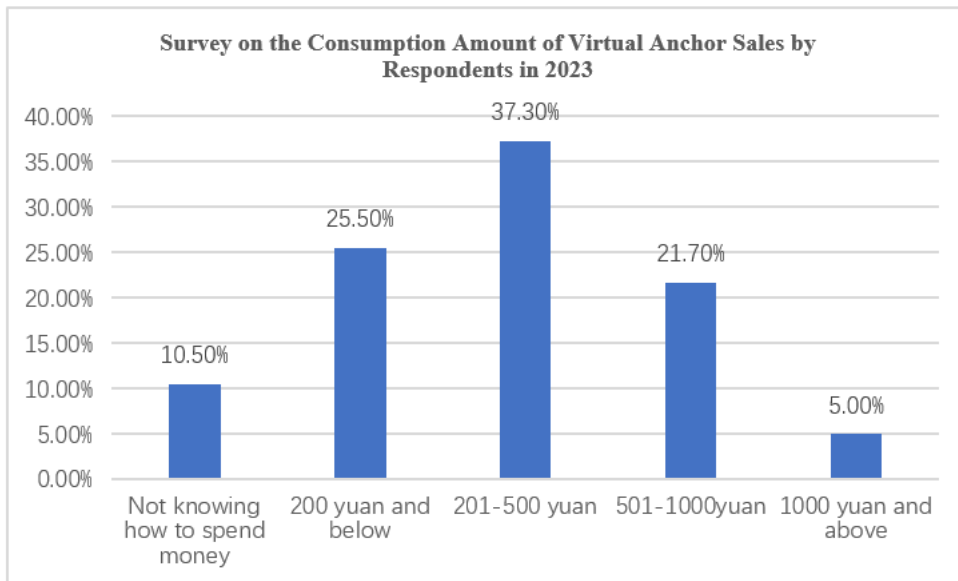
Table 3: Live Broadcast Data of Yan Huan on Tiktok Platform in Recent 30 Days

Average number of viewers per session	Average live broadcast duration per session	Peak Field Average Popularity	Live streaming customer price	Live sales
13000 people	92 minutes	699	0	0
Sales conversion rate	Per session user retention	Per session user sharing	Average comments per session	Average likes per game
0	15 %	30 times	75	13 thousand

Data source: Feigua Data Platform (<https://dy.feigua.cn/app>)

Comparing the data in Tables 3 and 2, it was found that there were significant changes in the number of viewers and peak popularity during the live broadcast of Yan Huan's virtual anchor. Recently, the average number of viewers per session was 13000, which is a significant difference compared to the peak of 1.52 million; In addition, the peak average popularity per game is only 699, which is a significant difference from the previous 55000. The popularity value of a live broadcast room is usually calculated by a combination of the number of viewers, interactive behavior (gift giving, comments, likes, and sharing), and the duration of the live broadcast. According to the above evaluation formula for the live streaming sales ability of the virtual anchor, it can be concluded that there is still significant room for improvement in Yan Huan's live streaming sales ability.

The 2023 Virtual Anchor Research Report investigated the amount of spending by respondents on virtual anchor sales, and the survey results showed that 37.3% of respondents spent between 200 and 500 yuan in virtual anchor sales, 25.5% of respondents spent 200 yuan or less, 21.7% of respondents spent between 501 and 1000 yuan, and 10.5% of respondents said they did not spend in virtual anchor sales, 5% of the respondents also indicated that they spent more than 1000 yuan on virtual anchor sales, as shown in Figure 2.

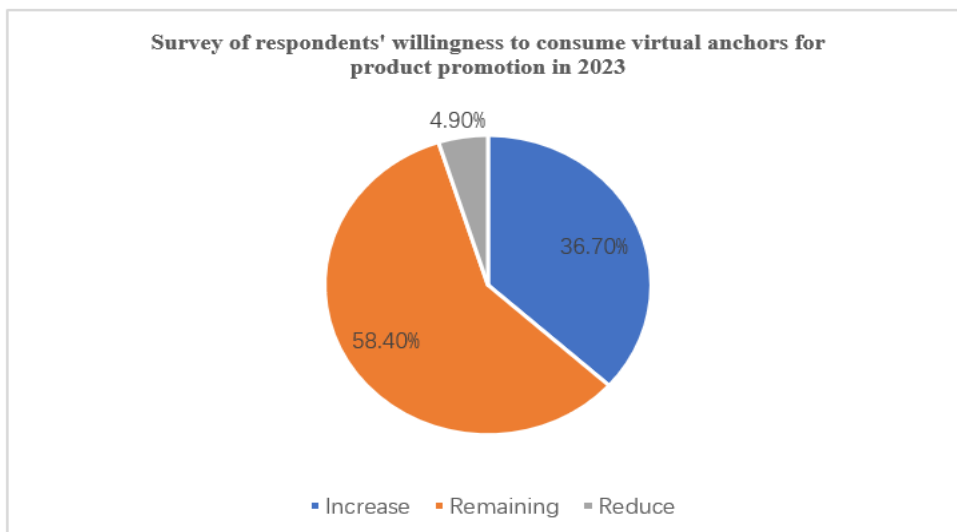


Data source: iMedia Data Center (data. iimedia. cn)

Figure 2: Survey on the Consumption Amount of Virtual Anchor Sales by Respondents in 2023

The consumption situation of the above-mentioned interviewees in virtual anchor sales in 2023 is quite consistent with the user profile of virtual anchors in China. According to a survey, the users of virtual anchors in China are mainly women living in new first tier cities, aged 22-40, with middle to high incomes [8]. These types of users have a high acceptance of new things and also pay more attention to the emotional value of influencers; In addition, due to the current focus of virtual anchors on low value and strong standard products, the overall consumption amount of users will not be very high. According to the "Dianshipubao" e-commerce database, the per capita annual consumption of live streaming e-commerce users in the first half of the year was about 3830 yuan, and the per capita annual consumption of the live streaming e-commerce industry is expected to be 8660 yuan in 2023. Compared with the overall per capita consumption situation in the live streaming e-commerce industry, the consumption amount of consumers in virtual anchor sales is relatively low. In addition to the low value of products sold by virtual anchors, the main reason is that the interaction between consumers and virtual anchors is not strong, making it difficult to stimulate consumer shopping impulse.

In the survey of respondents' willingness to spend on virtual anchor with goods, the survey results show that 58.4% of respondents said they would maintain their current consumption attitude, 36.7% said they would increase consumption, and 4.9% said they would reduce consumption. From the above results, it can be seen that consumers have a relatively positive and accepting attitude towards virtual anchors for sales, which also indicates that there is still considerable development space for this live streaming sales method, as shown in Figure 3.



Data source: iMedia Data Center (data. iimedia. cn)

Figure 3: Survey on Consumer Willingness of Respondents towards Virtual Anchor Sales in 2023

IV. ANALYSIS OF THE PROBLEMS OF VIRTUAL ANCHORS IN LIVE STREAMING E-COMMERCE APPLICATIONS

A. *Weak Social Function with Consumers*

The attraction of live streaming e-commerce to consumers is due to the effective and multi-form interaction between hosts and consumers in the live streaming scene, which greatly narrows the emotional distance between hosts and consumers [9], thereby enhancing consumer stickiness to a specific e-commerce host. Wang Qiang and Lv Qinghua (2024) verified through empirical analysis that interactivity in e-commerce live streaming has a significant impact on user purchase intention [10]. Wang Cuicui, Xu Jing (2023), and others have also demonstrated through a combination of questionnaire surveys and eye tracking experiments that the interactivity of virtual anchors has a mediating and moderating mechanism on consumer purchase intention [11]. The interactive experience of consumers in live streaming rooms can be analyzed from data such as interactive comments, likes, and shares, which correspond to indicators such as participation, pleasure, and acceptance to measure the interactive experience in live streaming rooms. However, from the analysis of relevant data, it can be concluded that currently, consumers do not give high ratings in these three aspects. In virtual anchor sales, virtual anchors are completely based on preset content and environment, and can only answer some basic or set range questions during interaction with users. Unlike live anchors, they can flexibly handle various questions from consumers at any time and provide warm and emotional interactions that can bring them closer, resulting in a poor consumer interaction experience. Although with the continuous advancement of AI technology, the training ability of various large models has been enhanced, the social interaction of virtual sales anchors still needs to be strengthened compared to real people.

B. *Failure to Attract the Main User Group in Live Streaming E-Commerce*

According to the data center of iMedia, currently, among the users of live streaming e-commerce shopping in China, male consumers account for 58% and female consumers account for 42%; the majority of consumers are those born in the 1980s and 1990s, with a proportion exceeding 80% of the overall consumer group. From the above data, we can see that the post-80s and post-90s groups are the main consumers of China's live broadcast e-commerce, and these consumer groups have relatively strong economic strength and high dependence on the Internet. According to the previous data, the main group interested in virtual anchors are Generation Z users, who have a high cultural level, focus on appearance and experience, and emphasize personalized needs [12]. Currently, this group is gradually graduating from school and entering society. According to relevant data, there are currently about 260 million people in Generation Z in China, accounting for approximately 19% of the national population. But currently, the economic strength of this consumer group is slightly weaker compared to the post-80s and post-90s groups. In order for virtual live streaming to quickly rise, in addition to seizing the appeal of Generation Z, it also needs to attract and retain the consumption power of the post-80s and post-90s groups. However, currently, the proportion of post-80s and post-90s consumer groups in virtual live streaming sales is relatively small, mainly consisting of first and second tier women.

C. *Difficulty in Achieving Differentiated Competition*

With the lowering of the threshold for live streaming and the visibility of profits, a large number of groups have integrated into the live streaming field. At the same time, their increasingly standardized and homogeneous live broadcasts have caused aesthetic fatigue and serious stereotypes among viewers and users. Although artificial intelligence technology can achieve rapid changes in live streaming scenes and rich effect settings, the openness of the network can quickly lead to new ideas being imitated and plagiarized, thus continuing to fall into homogeneous competition. In addition, due to the relative shortage of virtual live streaming operators, the production of operational creativity is limited. Taking all of the above factors into consideration, it is difficult for virtual live streaming e-commerce to achieve differentiated competition, which is not conducive to its participation in market competition and development.

D. *Governance Risks Related to Technology and Information Ethics the Word "Data" Is Plural, Not Singular*

Due to the technical characteristics of virtual anchors, a large amount of information and model training are required to achieve better intelligence display. In the process of collecting these training information, it will involve the privacy information of consumers and other stakeholders. If the technical security protection is not in place, it is easy to infringe on the privacy rights of consumers [13]. In addition, both the implementation path and governance of virtual live streaming e-commerce rely on technology. Whether the transformative and effective cycle mechanism driven by technological innovation can operate smoothly mainly depends on the two

components of "key technology improvement" and "technology transformation efficiency" in the operation of virtual live streaming e-commerce mode, The technical challenges brought about by these two components directly affect the current speed of promoting the optimization of the governance mechanism for virtual live streaming e-commerce [14].

V. STRATEGIES FOR OPTIMIZING THE APPLICATION OF VIRTUAL ANCHORS IN LIVE STREAMING E-COMMERCE

A. *Optimize Collaboration Between Live and Virtual Anchors*

The reason why live streaming marketing attracts consumers is not only due to its strong scene experience and interactivity, but also due to the influence of the personality of the live streaming hosts. Wang Zhaoxi (2023) used empirical research methods based on SOR theory and communication persuasion theory to verify that the professionalism and attractiveness of anchors can affect consumer purchase intention [15]. In live streaming sales scenarios, anchors often use their own characteristics to establish emotional connections with consumers, while providing emotional value to consumers through certain entertainment, in order to persuade consumers to make purchases. Establishing emotional connections with consumers and being able to flexibly handle problems that arise at any time is the most valuable aspect of live streamers. However, due to the high cost of training and cultivating a live streamer, there may also be a phenomenon of job hopping when a live streamer's brand awareness increases, which can cause losses to MCN institutions or live streaming enterprises. Compared to live streamers, virtual streamers have the characteristics of low cost, high efficiency, and strong stability. They can achieve uninterrupted live streaming 24 hours a day, which can better help enterprises achieve traffic diversion. However, given the current low overall acceptance of virtual anchors and the high cost of live streamers, it is possible to further explore the combination of live streamers and virtual anchors for live streaming sales. On the one hand, virtual anchors can leverage their powerful information storage and processing capabilities to explain product characteristics, enhance live streaming technology, and enrich live streaming modes; On the other hand, it can effectively leverage the affinity and emotional value of live streamers, driving live sales. In the stage where virtual live streaming technology and acceptance are not high, we can focus on using this combination of digital and live streaming to promote our products. On the one hand, we can fully leverage the advantages of both, and on the other hand, we can effectively prevent risks. When a live streamer changes jobs or is missing, we can rely on a virtual streamer who works with the live streamer to assist us. This is because through collaborative promotion with live streamers, virtual streamers can achieve IP recognition and accumulate popularity.

B. *Selecting Suitable Categories for Virtual Anchors in Live Streaming E-Commerce*

Virtual live streaming e-commerce is still in its early stages, and consumers have a relatively limited understanding and acceptance of virtual anchors, with a relatively narrow range of consumer groups. Another reason why consumer users in live streaming e-commerce are not interested in virtual anchor sales is that the majority of consumers born in the 1980s and 1990s are economically stable and pragmatic. These consumers have specific preferences for the products sold in live streaming sales, and the sensory experience during the live streaming process can affect their willingness to consume. Chinese scholars Professor Zhou Xinyue from Zhejiang University and Professor Jiang Yuwei from the Hong Kong Polytechnic University published their research findings in 2023 on the promotion of consumption by virtual digital humans. They stated that consumers tend to believe that virtual humans have far sensory (including visual and auditory) abilities, but do not have near sensory (including smell, touch, and taste) abilities, which leads to virtual humans allowing consumers to purchase far sensory products, but it cannot make consumers purchase sensory products. When virtual humans (compared to real people) promote the near sensory experience of a product or service, consumers will reduce their willingness and preference to purchase the product or service [16]. Based on this, virtual anchors can bring some far sensory products, such as daily necessities, family department stores, and cultural and tourism products.

C. *Strengthen the Cultivation of Virtual Live Streaming E-Commerce Operation Talents*

Whether it is traditional live streaming e-commerce or virtual live streaming e-commerce, they cannot do without the creativity and planning of the operators behind them. It is precisely because of the different creativity of the operators that live streaming presents a differentiated form. If the creativity is novel, it is easy to improve the effectiveness of the anchor and live broadcast, while conversely, it can easily lead to reverse effects. It can be seen that live streaming operators will greatly affect the effectiveness of live streaming. Although virtual live streaming e-commerce largely relies on related technologies such as artificial intelligence, with the continuous progress and popularization of technology, the success or failure of virtual live streaming e-commerce will

depend more on the operational talents behind it. Huang Liang (2022) also pointed out that with the development of live streaming e-commerce, there will be a shortage of technical talents in virtual online live streaming e-commerce in the future [17].

D. Building a Systematic and Diverse Collaborative Governance Framework

The rapid development of live streaming e-commerce has brought huge economic benefits to society, but it has also encountered many problems in its operation, whether it is the industry's system or the government's regulatory system, which is not perfect enough [18]. Virtual live streaming e-commerce, which heavily relies on technology, is even more complex in terms of technical risks and governance difficulties. To ensure the healthy operation of virtual live streaming e-commerce, it is necessary to strengthen the real-time connectivity of the e-commerce industry, public service big data platforms, industry regulatory platforms, and government service platforms, Form a "four in one" collaborative governance system. Through real-time connectivity, it is convenient for industry and government regulatory platforms to timely identify problems, so as to quickly introduce relevant policy adjustments and maintain the healthy development of the industry, thereby enabling virtual live streaming e-commerce to enter a healthy development state.

VI. CONCLUSION

With the continuous development of artificial intelligence technology, although virtual anchors have been adopted by many live streaming e-commerce enterprises, some virtual anchors have achieved good results, but there are still many problems in their rapid development. For example, the main consumer groups of live streaming e-commerce have low acceptance of it, there is homogeneous competition within the industry, and there are risks in information security governance. But with the rise of the Z generation consumer group, as well as its low cost, stable performance, and high efficiency, virtual anchors will have great development space in future live streaming e-commerce. In addition, with the introduction of good policies and the rise of the concept of the metaverse, virtual anchors have very good policies and market nurturing.

ACKNOWLEDGMENT

2022 Guangdong Province Social Science Discipline Co construction Project (GD22XGL42); 2023 Guangdong Province Social Science Discipline Co construction Project (GD23XGL051); The 2022 Guangdong University of Science and Technology Innovation Strong Campus Project (GKY-2022CQJG-2); General Research Projects of Guangdong University of Science and Technology in 2022 (GKY-2022KYYBW-30). Research Institute of Effective Marketing at Guangdong University of Science and Technology (XJ2022000801).

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