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Research on the Mechanism and Path of Enhancing the Efficiency of Smart Supervision in Live Streaming Economy Empowered by Artificial Intelligence Technology

Kebiao Yuan*, Zhijian Xu
School of Economics and Management, Ningbo University of Technology, Ningbo, 315211, China
Corresponding Author: Kebiao Yuan, ykbjob@163.com

Abstract: With the development of information technology and the transformation of consumer culture, the live streaming economy has been integrated into China's digital economic system, driving urban economic growth. However, it has also brought about regulatory issues such as information asymmetry, false advertising, difficulty in ensuring quality, and high costs of rights protection. This new economic form of virtualization, real-time, and cross-domain is facing enormous challenges. Traditional methods, such as manual sampling, reporting, and post-event tracing, are unable to meet the complex and ever-changing live streaming economic ecology. The powerful perception, recognition, and understanding capabilities of artificial intelligence provide new possibilities for building a scientific regulatory system in real-time, accurately, and efficiently. This article uses the theory of technological empowerment to explore the operational mechanism of artificial intelligence in regulating the live streaming economy, with a focus on the role of artificial intelligence in empowering live streaming economy regulation in four aspects: data intelligence, behavior recognition, risk warning, and intelligent decision-making. In addition, this article proposes a feasible path for building a smart regulatory system from three aspects: technology integration, institutional collaboration, and talent cultivation, providing relevant inspiration and reference for exploring the construction of a government platform collaborative governance mechanism and achieving modernization of platform economic governance in practice.

Keywords: Artificial Intelligence; Live Streaming Economy; Smart Supervision; Technological Empowerment; Mechanism and Path
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1.Introduction

With the adjustment of China's industrial structure, the mode of economic growth has undergone significant changes; the proportion of the service industry continues to increase, and new industrial models relying on information technology continue to emerge. The live streaming economy has become a significant part of China's digital economy development. The elements of immersive experience, zero-distance interaction, and seamless transactions in live streaming rooms are changing traditional business travel rules and consumption habits. Live streaming is creating entrepreneurial and employment opportunities that can be filmed and broadcast by everyone, while also deconstructing the elements of "one person, one object, one scene" to create a new type of trust-based consumption scenario. According to data from NetEase, the transaction

volume of live streaming e-commerce in China will reach 53256 trillion yuan in 2024, a year-on-year increase of 8.31%. At the same time, the transaction volume of private domain e-commerce will increase by 8.69% year-on-year, reaching an astonishing 5 trillion yuan. Live streaming sales have a significant driving effect on domestic consumption, especially in the circulation of agricultural products, domestic goods, and regional industries.

Along with the wild growth of the market, chaos inevitably breeds: the traffic war is becoming increasingly fierce, and some businesses, in pursuit of economic benefits, have repeatedly banned the phenomenon of unlimited limits, such as the proliferation of false advertising. Some anchors even rely on creating experience effects and using false information to confuse the public; Big data fraud has become a hidden rule in the industry, with generating traffic, likes, and comments becoming common methods; The after-sales service is unsatisfactory, and consumers often fall into disputes between platforms, hosts, and merchants, making it difficult for them to protect their rights. Consumers find it difficult to protect their rights through normal channels and can only use other information dissemination methods to protect their rights[1]. All of these have damaged the direct interests of consumers, undermined credibility, and are not conducive to the development of the entire industry. The root of the problem lies in the inherent characteristics of the live streaming economy itself. Live streaming content is real-time and fleeting, with thousands of live streams happening simultaneously every moment. Violations also occur and disappear instantly; The massive scale of millions of events per day makes it impossible for traditional regulatory methods to fully cover. What's more troublesome is that illegal content itself has cross-platform dissemination characteristics. When illegal content appears on a certain platform, it is highly likely to be copied to other platforms in the near future, which increases the difficulty of supervision[2] The existing regulatory measures mainly include manual spot checks, post event evidence collection, and public reporting, but they have significant problems: firstly, they lag behind and only proceed when the negative impact expands; Secondly, it is highly probable and impossible to conduct a comprehensive manual review; Thirdly, it is difficult to obtain evidence, and once the live broadcast ends, it may be deleted or modified.

The development of artificial intelligence technology has provided a turning point for it. The multimodal fusion analysis of artificial intelligence can simultaneously recognize and analyze video, audio, text data, and user behavior data. Computer vision integrates real-time image recognition of prohibited products, illegal labels, natural speech recognition of false advertisements, exaggerated advertisements, speech recognition technology to recognize illegal audio content, behavior modeling technology to recognize brushing orders, brushing volume, and other technologies, greatly improving the accuracy and efficiency of identifying prohibited products and illegal labels. The accuracy can reach over 90%, and the speed is more than a hundred times faster than manual labor[3]. Artificial intelligence provides a closed-loop system for supervision, which includes "discovering problems - early warning - timely disposal - feedback on disposal results". The intelligent recognition system automatically alerts when problems are discovered, notifies the platform and regulatory personnel, and the disposal system limits, stops broadcasting, and suspends operations. Based on machine learning, it absorbs disposal results, continuously improves regulatory efficiency, and turns post-disposal into pre-disposal and in-process disposal, greatly enhancing the initiative and foresight of supervision[4].

The article first integrates and analyzes the practical problems existing in the regulation of the live streaming economy, and then comprehensively summarizes the mechanism and path analysis of AI-driven smart regulation of the live streaming economy. It helps to broaden the theoretical perspective of technology empowerment governance, explore new paradigms for digital regulatory transformation, and has important practical significance for promoting the prosperity and development of the digital economy, safeguarding the legitimate rights and interests of consumers, and creating a trust-based digital ecosystem. It provides theoretical reference for achieving the prosperity and development of the live streaming economy and efficient regulation of the live streaming economy, and contributes wisdom to building a modern governance system in the new economic ecosystem.

2.The Realistic Dilemma of Live Streaming Economic Regulation

2.1 The regulatory targets are complex and ever-changing

The live streaming economy can be roughly divided into three categories. The first type is to sell goods or services in one's

own live broadcast room through live streaming; The second type is that the operator of the live streaming room is self operated by the live streaming platform, or the products and services sold in the live streaming room are supplied by the live streaming platform where they are located, that is, the self operated model; The third type is the promotion and marketing model, which involves using live streaming to attract, redirect, or advertise sales activities outside of the live streaming room. There are diverse types of participants in the live streaming economy ecosystem, forming a complex multi-level collaborative network. There are many types and levels of roles in the live streaming economy ecosystem, and as the source of live streaming content, individual broadcasters have multiple identities, such as amateur enthusiasts, broadcasters, professional broadcasters, celebrities, and entrepreneurs. MCN institutions act as intermediaries to undertake functions such as training, planning, business coordination, and cooperation for broadcasters; Merchants provide sales platforms and technical support; Live streaming platforms provide trading platforms, product services, logistics services, etc; Advertisers provide advertising and marketing services[5]. Private domain live streaming has gradually developed into an important model in fields such as e-commerce, knowledge payment, and community operation, thanks to its strong closed nature, precise audience, and efficient interaction. However, this closed nature also makes it easy to detach from the public and regulatory perspective, becoming a high-risk place for false advertising, induced transactions, and even fraudulent behavior. Compared with traditional public domain live streaming, private domain live streaming often occurs in relatively hidden scenarios such as WeChat groups, mini programs, or exclusive Apps. Conventional regulatory measures, such as public inspections and web crawlers, are difficult to effectively cover, resulting in regulatory blind spots.

Different entities play different roles in business processes, and their behavioral characteristics and motivations for violations also vary. In order to pursue profits, MCN institutions engage in behaviors such as creating fake popularity, hiring influencers to boost orders, and even creating traffic platforms. In order to increase the transfer rate during live streaming, the anchor exaggerates the content of the live stream, promises high benefits, and even engages in off-exchange transactions with buyers to evade platform inspections. Merchants engage in the behavior of selling counterfeit goods, using fake origin information, and selling counterfeit goods at a discount in order to pursue profits. And this multiple relationship has resulted in different types of irregularities: pornographic songs and dances in content, counterfeit goods; Exchange of goods and bargaining for sale during exchange; Not bad for not pushing in after-sales service, not fulfilling service terms[6]. Due to the multiple intertwining of subject relationships, various non-standard and interrelated intertwining, such as whether a certain product is sold or not, may be planned by the company, accepted by the MCN company, and completed by the anchor.

The traditional regulatory model based on industry and subject segmentation is no longer suitable. Different regulatory entities cannot adapt to the cross-regional and cross-domain characteristics of the current live streaming economy through segmented supervision and territorial management. There are gaps or law enforcement conflicts in the supervision of different regulatory entities, such as A hosts, B institutions, and C platforms. Traditional regulatory measures are aimed at traditional commercial activities, and it is difficult to effectively regulate new online marketing behaviors.

2.2 Strong real-time monitoring of regulatory content

The core characteristics of live streaming are strong real-time performance and interactivity. Live streaming violations, such as false promotions, vulgar content, and inducing off-exchange transactions, often occur instantaneously during the live streaming process and have a wide impact. Evidence collection and disposal are usually carried out after the fact, and the effect is not ideal. Evidence loss may also occur due to the deletion or modification of product details[2]. Especially for large-scale promotional live broadcasts and emergencies, regulatory authorities lack timely and efficient technical means to conduct comprehensive supervision, making it difficult to detect their violations. The existing regulatory measures heavily rely on manual review and platform self-inspection, making it difficult to cope with massive live streaming content[7]. If it is not possible to directly extract and identify dynamic videos during live streaming, real-time identification of illegal language, false advertising, tempting advertising, etc., and early prediction and intervention in the supervision of live streaming content, the illegal content can quickly spread and expand to a larger scope through the live streaming room, and its social impact is irreversible. During the “Double Eleven” period in 2024, CCTV detected a total of 230675 negative messages related to “live streaming sales”, with an average of 8238 negative messages per day.

Therefore, building a real-time monitoring system using artificial intelligence technology, big data technology, and blockchain certification technology is a feasible way to improve regulatory effectiveness by capturing live content in real time, semantic analysis and recognition, risk alarm, etc[8]. Only by empowering technology and building a comprehensive regulatory mechanism of "online supervision-real-time warning-rapid action" can we ensure timely and effective control of real-time and covert issues in live streaming e-commerce, and effectively safeguard consumer rights and market order.

2.3 Insufficient regulatory basis

At present, the legal and regulatory system for the live streaming economy is still not sound, and there is a significant problem of "insufficient regulatory basis". On the one hand, there is controversy over the legal nature of live streaming sales, whether it belongs to commercial advertising, e-commerce activities, or audio-visual programs. There is still a vague area in the determination, which leads to unclear legal provisions. In the "Xinba fake bird's nest incident", the regulatory authorities did not directly apply the Advertising Law or the E-commerce Law when handling it, but instead cited the Anti-Unfair Competition Law, reflecting the enforcement dilemma caused by unclear legal classification. On the other hand, existing legislation has not clearly defined the responsibility boundaries of multiple parties, such as platforms, hosts, merchants, and MCN institutions in e-commerce live streaming, nor has it made detailed provisions on their legal relationship attributes, resulting in difficulties in identifying the responsible parties and inconsistent standards for joint liability in actual supervision. There are significant differences in the handling of whether a broadcaster should be recognized as an advertising spokesperson, seller, or content creator, and whether the platform should bear the liability for advance compensation in different cases[2]. There is a lack of unified standards and collaborative mechanisms for cross-regional law enforcement and cross-platform evidence collection, and regulatory authorities often face operational difficulties, such as jurisdictional disputes and the determination of electronic evidence effectiveness in actual law enforcement. Especially in situations where live streaming content is highly real-time, widely disseminated, and evidence is difficult to fix, there is a lack of clear legal and technical support in areas such as remote investigation, data retrieval, and evidence identification, which seriously affects the effectiveness and credibility of law enforcement.

There is no unified national platform for sharing credit information and law enforcement cooperation in live streaming e-commerce, and the regulatory standards vary from place to place at present, resulting in obvious information silos. Some regions have explored the introduction of local regulatory guidelines, but there are significant differences in their scope of application, punishment intensity, and execution standards, which further leads to insufficient regulatory coordination and overall low efficiency[9]. This regional and fragmented regulatory pattern not only fails to cope with the cross-domain diffusion of the live streaming economy but also objectively condones the cross-platform migration and repeated occurrence of violations.

2.4 Limited regulatory resources

It is unrealistic to rely solely on manual review and supervision in the face of millions of live broadcasts and user comments. According to research, the key monitored e-commerce platforms have accumulated over 120 million live broadcasts, with nearly 1.1 million active hosts. The live content is real-time, interactive, and unpredictable, making it difficult to regulate[8]. At present, there is a shortage of regulatory personnel, a limited level weak technical strength, numerous regulatory entities, overlapping responsibilities, and fragmented power in market supervision, broadcasting, and other departments in many cities, which affects the effectiveness of supervision. The platform itself has certain auditing capabilities, but its role as an "athlete" conflicts with its role as a "referee" in pursuing commercial interests and regulatory requirements. The pressure for the platform to self-correct is insufficient, the level is uneven, and there is a possibility of seeking personal gain from merchants. Moreover, due to the inability of existing technological means to achieve real-time monitoring and ownership confirmation of live streaming content, and the lack of timely and effective risk warning and credit reporting, the structural shortage of regulatory resources has become increasingly apparent.

3.The Mechanism of Empowering Intelligent Supervision with Artificial Intelligence

3.1 Data intelligence mechanism

The live streaming economy model injects new vitality into economic development and leads society towards intelligent

and smart development under the influence of technological innovation. However, the various problems that the platform economy has shown in its development have put forward new requirements for regulation. Artificial intelligence utilizes natural language recognition, image recognition, speech recognition, and other technologies to analyze live streaming data, transforming chaotic audio and video data into structured text, images, action symbols, etc. It establishes a comprehensive regulatory database covering anchor speech, product information, user behavior data, transaction information, emotional information, compliance labeling, and other content. On the one hand, it provides a basis for regulatory traceability, and on the other hand, it provides data support for model analysis and risk warning. By using OCR recognition to quickly identify the product labeling information and price codes on the screen, and then using natural language recognition of the host's speech, it is possible to automatically identify whether the original price or false price has been falsely quoted; and whether the content of user comments gathers negative emotions, whether it matches the statistical information of abnormal transactions, and whether it belongs to brushing orders or false transactions[10]. Thus, with the help of machine learning models and evolutionary game models, regulation can shift from post-punishment to pre-warning and in-process intervention. At the same time, the application of blockchain technology has achieved data immutability and watchability, providing trust guarantees for reliability evaluation and incentives, and creating a closed-loop full process intelligent supervision system of "monitoring-analysis-processing-response".

3.2 Behavior recognition mechanism

Artificial intelligence models based on deep learning can recognize and classify behaviors commonly found in live streaming. Unlike single modal, it is multimodal, which means it uses computer vision recognition, NLP natural language recognition, and speech recognition separately. Object recognition algorithms such as YOLO and Faster R-CNN can perform real-time recognition of prohibited items, violation signs, and discordant images appearing in the image; Keyword overlay recognition technology based on deep language models such as BERT and Transformer can identify false advertising or promises in anchor language; Combined with voiceprint recognition, facial expression recognition, etc., it can authenticate the identity of the anchor and identify their emotions, preventing fake live broadcasts or counterfeit anchors[11]. Partial introduction of temporal modeling, such as 3D-CNN and LSTM, for continuous analysis of action sequences and semantic fragments, and recognition of complex action combination patterns. In this way, the recognition rate and accuracy of prohibited content are greatly improved, and the missed detection rate and false detection rate of manual investigation are greatly reduced. The governance of live streaming is more efficient and real-time.

3.3 Risk warning mechanism

Based on recognition, artificial intelligence can even further conduct risk assessment and warning, forming accurate prediction models based on cross-comparison of historical and real-time data, and dynamically outputting the risk levels of anchors, products, and events in real time. Using a graph neural network (GNN) model to detect the association between "anchor merchant consumer" and capture fraud groups that engage in virtual buying and selling, buying and selling goods, and collectively deceiving people[12]. Using time series models such as LSTM or Transformer to capture comments with abnormal data, such as comment count, like count, and gift giving for early warning can not only capture water armies or public opinion manipulation, but also comprehensively judge false advertising or inducement language through multimodal analysis of live broadcast images, voice, bullet comments, and other methods[13]. This kind of warning shifts the threshold of risk management forward, achieving a transformation from "post governance" to "prevention in advance-intervention in the process-retrospective after the fact". At the same time, supporting credit ratings can also be classified and regulated based on different risk levels of frontline anchors and merchants, improving the efficiency of regulatory resources and the level of platform self-discipline.

3.4 Intelligent decision-making mechanism

After identifying warnings, artificial intelligence can continue to support intelligent decision-making and handling. AI can use rule engines and reinforcement learning algorithms to automatically match and take different disposal measures based on the type, severity, historical performance, anchor credit rating, product risk, complaint performance, etc. of violations, such as automatic pop-up reminders, automatic flow limit recommendations, cut-off, human review, credit rating reduction, deduction

of deposit until blacklisting[14]. At the same time, as the system continues to learn and absorb the disposal results, it adjusts the decision-making strategy, constantly improves the automation level, and at the same time, the measures are more precise and powerful. In this way, the shift from passive regulation to active regulation, from static punishment to dynamic governance, is more in line with the development trends of diversified collaboration and credit supervision.

4.The Implementation Path of Empowering Intelligent Supervision with Artificial Intelligence

4.1 Technology integration

Technology integration is the primary step in intelligent supervision. Existing research has shown that the integration of artificial intelligence and blockchain can establish tamper-proof and traceable evidence of data in a regulatory environment, which is helpful for later accountability and tracing the source of goods[15]. For the Internet field, Wan's (2023) research shows that 5G can achieve real-time transmission of high-definition live video streams with the characteristics of high speed and low delay, and improve the supervision efficiency by deploying edge nodes for real-time processing. At the data processing level, the distributed architecture and elastic computing power of cloud computing provide the necessary foundation for scheduling, parallel analysis, and processing of massive amounts of data. Under this technological architecture, methods such as computer vision and natural language processing are applied to live streaming content review work, making false advertising or sensitive behavior more quickly identified and intercepted[16]. Multiple studies generally indicate that "cloud-edge-end" is the key to cross-platform and cross-regional integration of regulatory work, which helps to improve regulatory efficiency and transform from manual spot checks to real-time prevention and control.

The technological path of intelligent supervision is not just one technology, but the cooperation of multiple new technologies. Blockchain provides authentic and trustworthy data, 5G technology provides transmission, and cloud computing power provides computing resources. Only through cooperation can artificial intelligence be achieved. Therefore, future research needs to delve into reality and study the combination of multiple technologies in real-world regulation, rather than staying at theoretical speculation.

4.2 Institutional synergy

Artificial intelligence-driven intelligent supervision cannot be separated from the institutional support and collaborative guarantee of the legal system, standard specifications, and collaborative mechanisms. It is suggested to improve the legal positioning and legal responsibilities of multiple entities such as live streaming e-commerce hosts, platforms, merchant enterprises, MCN institutions, etc., establish specialized regulatory rules and law enforcement standards, guide regulatory enforcement, promote the establishment of government and platform data collaboration and joint punitive measures, such as establishing a "live streaming merchant credit system" covering major e-commerce and video content platforms, sharing credit information and conducting credit evaluations, and building a credit punishment system of "one loss of trust, everywhere difficult to act"[17].

Based on this, we will leverage the intermediary function of industry associations in leading standards and behavioral norms, formulate industry conventions, quality standards, technical specifications, ethical norms, promote standardization of regulatory rules, ports, data disposal, etc., encourage and support the participation of the third sector, consumers, and the public in supervision, build a multidimensional regulatory system of government supervision and platform autonomy, industry self-discipline, and social supervision, and jointly enhance the smart regulatory level and institutional synergy efficiency of the live streaming e-commerce industry.

4.3 Talent cultivation

The issue of talent cultivation is frequently mentioned in existing research. Li (2025) pointed out that the shortage of composite talents intersecting with artificial intelligence technology and legal policy literacy is a major factor restricting the development of smart regulation. From an educational perspective, cultivating talents with cross-border abilities requires interdisciplinary courses and new majors (such as digital supervision, computational law, etc.). The experience accumulated in the process of practical exploration has become increasingly rich and diverse[18]. Gao (2025) found through case studies that the joint construction of practical training bases and talent certification systems by the government, platforms, and

research institutes can help existing regulatory personnel develop digital thinking and skills in applying digital technology[19]. Zhang (2024) found through comparative case studies that multi-departmental and cross-disciplinary talent mobility breaks through departmental barriers, and also introduces the practical experience of smart supervision from different countries and regions to the local area, enriching the knowledge of talents[20].

The literature generally emphasizes that talent supply should not only be a single technical training, but also a collection of "education-training-certification-practice". Its research conclusions all point to future intelligent supervision, which requires interdisciplinary knowledge and comprehensive governance thinking. New talents who can understand both technical issues and the inherent connections between legal theory and ethics, market, and law in complex social phenomena.

5.Conclusions and Recommendations

5.1 Research findings

This article takes the intelligent regulation of the live streaming economy empowered by artificial intelligence as the research background. Starting from the status, shortcomings, and technological empowerment of intelligent regulation of the live streaming economy, some overall conclusions are drawn. Artificial intelligence has a positive impact on regulatory capabilities in data mining, data analysis, risk warning, intelligent decision-making, and other aspects. It has broken through the previous manual inspection mode of regulation, made violations more timely in detection and handling, and partially solved problems such as difficulty in obtaining evidence and fixing evidence. At the same time, the empowerment of artificial intelligence relies on the support of various emerging technologies. Blockchain provides conditions for real and traceable data sources, 5G provides real-time data transmission and reduces latency, and cloud computing makes high-density data processing possible. All of these provide conditions for intelligent supervision. However, the institutional supply is still insufficient, and the current laws and regulations have poor adaptability to new business models, unclear division of responsibilities, and difficulties in platform and regional law enforcement, which still exist to a certain extent. Business models that prevent artificial intelligence from playing a role still exist. Lack of talent is another pain point, as there is an extreme shortage of compound high-tech talents who understand both artificial intelligence technology, law, and policies, resulting in a technological and institutional disconnect in regulatory implementation. These commonalities indicate that intelligent regulation empowered by artificial intelligence is driving a shift in regulatory logic from post-investigation to pre-prevention and mid-event intervention, and the true implementation relies on the synergy of technology, systems, and talent.

5.2 Research recommendations

In the future, the live streaming economy industry will continue to promote intelligent supervision at three levels. At the technical level, through the deep integration of artificial intelligence with new generation technologies such as blockchain, 5G, and cloud computing, a system platform for real-time monitoring, certificate retention, and intelligent analysis will be constructed; At the institutional level, improve the legal and regulatory systems, clarify the boundaries of responsibilities of all parties, improve cross regional and cross platform collaboration mechanisms, and establish long-term constraint mechanisms through credit governance and industry autonomy; At the level of talent cultivation, it is necessary to establish a system for interdisciplinary integration of education and training, a system for the integration of technical knowledge, legal knowledge, and governance knowledge, and a system for talent exchange. This will promote the integration of talents across departments and industries, and work together from the three levels of technology, system, and talent to fully leverage the intelligent regulatory role of artificial intelligence and achieve long-term balance in the regulation and development of the live streaming economy.

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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