

Empowering Sports in the Digital Economy: Change, Opportunity and the Future

Zikun Chen *

Haining Jing'an Senior High School, 314400 Xiashi jiedao Jiangnan boulevard, Haining, China

* Corresponding Author Email: czk20071209@outlook.com

Abstract. The rapid evolution of digital economy is profoundly reshaping the ecological pattern of global sports. With the popularization of 5G communication, artificial intelligence, Internet of Things, blockchain and other techniques, sports have accelerated from the traditional offline scene to the digital space of virtual and real integration, which has spawned a brand-new participation model, business model and value network. In this context, this paper takes digital technology to enhance sports as the core proposition, and systematically discusses the industry changes, market opportunities and prospects under technology empowerment. By analysing that big data and artificial intelligence are the key features of the current digital economy, this paper further discusses the reasons why the traditional sports industry needs to be integrated with the digital economy and then analyses the current specific application scenarios and finds that the digital economy promotes the reform of sports events in terms of marketing methods and user experience.

Keywords: Digital Economy, Empowering Sports, big data, artificial intelligence.

1. Introduction

In modern society, the sports industry has long gone beyond the scope of simple sports events and sports products. As a huge and diversified economic field, it plays an irreplaceable key role in economic growth, social well-being and cultural shaping. From an economic perspective, the sports industry is an important engine to stimulate economic growth. On the one hand, the sports industry directly creates significant economic benefits. Take professional sports events as an example, a top football league event, from ticket sales, broadcast rights sales, on-site catering, souvenir sales, etc., can bring considerable income. Many professional sports clubs, with their own business operation mode, have created many jobs and economic benefits. Large-scale sports events, such as the Olympic Games and the World Cup, can attract global tourists, greatly promote the prosperity of tourism and related service industries in the host places, and bring huge economic benefits to the local areas.

At the social level, the sports industry has a significant effect on enhancing social well-being. It offers the public a rich variety of sports activities and fitness options, encouraging people to actively participate in sports and thereby improving the physical fitness of the nation. From a cultural perspective, the sports industry serves as a significant career for the dissemination of sports culture and values. International sports events act as platforms for cultural exchanges among countries. The sports industry also holds significant importance for enhancing a country's image and international influence. Nations that achieve outstanding results on the international sports stage can greatly enhance their global recognition and reputation. The sports industry, with its powerful economic driving force, social welfare enhancement capability, cultural dissemination value and international influence shaping function, has become an indispensable and important component of modern society. In the future, with the sustaining evolution of the economy and society and the sustained growth of people's demand for sports, the sports industry will surely play a more significant role and inject continuous vitality into the progress and development of human society. However, the sports industry's evolution still encountered several bottlenecks. The development of the sports industry still encounters many bottlenecks. Although the concept of "mass fitness" has been widely disseminated globally, the proportion of people participating in sports activities is still relatively low. The lack of effective organization and incentive measures, as well as changes in people's lifestyles, have led to a lack of interest in sports activities among some people, which has affected the scale and vitality of

the sports consumption market. Therefore, we will start from the prospects and future trends of the digital economy, analyse the influence of the digital economy on the sports industry, search for relevant literature, explore the global development trends of the digital economy and the transformation demands of the sports industry in the digital era, and propose corresponding measures.

2. Literature review

Some scholars believe that digital sports can promote the modernization of the sports industry and cultivate new economic growth points, and analyse the opportunities and challenges faced by sports events in the digital economy era and put forward a data-driven management model [1,2]. Some scholars emphasize the importance of collecting and analysing sports statistical information for making effective management decisions and reveal the changes in digital technology in the sports industry business model, consumer behaviour and value chain [3,4]. Some scholars have established a sports economic database and designed a cloud platform module and believe that digital technology is helpful to optimize sports organizations and increase people's participation in sports [5,6]. In addition, relevant scholars analysed the interactive relationship among digital economy, artificial intelligence and sports industry development by constructing PVAR model, and put forward strategies to promote the development of the sports service industry from macro, mesa and micro levels [7,8]. Drawing lessons from the successful cases of digital transformation of sports events in developed countries, this paper discusses the opportunities and challenges of digital transformation of sports industry in China, and the role of digital economy in promoting the sustainable development of sports industry [9,10]. Based on the above viewpoints, this paper further expounds the transformation direction and specific measures of future sports events from the perspective of digital economy empowerment.

3. Digital economy empowers the development of sports industry

In the current era, information systems have permeated every aspect of human life. Whether it is the implementation of national laws, the conduct of business activities, the operation in the financial sector, the exploration of science and technology, the advancement of education, or the prosperity of the entertainment industry, none of these can do without the support of information systems. During the past several decades, the things of information system development have become hot topics in academic research and practical exploration. Through unremitting efforts, people have achieved remarkable results in the design and repair of basic database components and have selected a series of optimal methods and classic solutions, which have effectively promoted the development and improvement of information systems.

Big data and artificial intelligence are the key features of the current digital economy. Big data is one of the core elements of the digital economy. It has four characteristics: Volume, Variety, Velocity, and Value. In the digital economy era, a vast amount of data is continuously generated from various devices, platforms and activities. For instance, browsing behaviours of internet users, interaction information on social media, transaction records in e-commerce, etc. These data are not only large in scale but also cover various forms such as text, images, audio and video. Big data technology can collect, store, manage and analyse these complex data. Through data mining, machine learning algorithms and other means, enterprises and organizations can extract valuable information from big data, gain insights into market trends, consumer behaviour patterns and optimize business processes. In the commercial application of the digital economy, big data analysis helps enterprises achieve precise marketing, push personalized product recommendations based on consumers' preferences and purchase history, and improve marketing effectiveness and customer conversion rate. Artificial intelligence is a powerful force for the evolution of the digital economy, covering multiple fields such as machine learning, deep learning, language disposing, and computer vision. Machine learning enables computers to learn from data and automatically improve algorithms to complete specific tasks.

Deep learning has achieved breakthroughs in image identification, speech identification, and language disposing by constructing multi-layer neural networks. In the digital economy, artificial intelligence is widely applied in areas such as intelligent customer service, automated decision-making systems, and intelligent logistics. Intelligent customer service utilizes natural language processing technology to understand users' questions and provide accurate responses quickly, reducing the cost of human customer service and improving customer service efficiency. Automated decision-making systems are based on artificial intelligence algorithms and make real-time investment decisions, risk assessments, etc. based on a large amount of data, enhancing the scientific and timeliness of decisions. Against the backdrop of China's "dual carbon" goal, a PVAR model was built using data from 15 provinces from 2014 to 2020 to study the relationships among the digital economy, AI, and the sports industry. Results show the digital economy has short-term effects on AI and the sports industry. The digital economy and AI are mainly self-driven, while the sports industry has a weaker self-driving force. Moreover, the sports industry is more influenced by AI applications than the digital economy's development level.

The reasons why traditional sports industry needs to integrate with the digital economy: Traditional sports event operations mainly rely on ticket sales, sponsor cooperation and television broadcasting rights income. The event organizers are responsible for organizing the events, from the early stage of venue preparation, athlete invitation to on-site execution and post-event publicity. Sponsors obtain brand exposure opportunities through sponsoring events, and television broadcasting rights are an important channel for event content dissemination and revenue acquisition. For example, large-scale sports events such as the Olympics and the World Cup attract a large number of viewers through global television broadcasting, bringing huge income to the event organizers. 2. Sports goods manufacturing and sales model: Sports goods manufacturers focus on product design, production and manufacturing, and promote their products to the market through traditional channels such as distributors and retailers. Manufacturers pay attention to the functionality and quality of the products and enhance brand awareness and product sales through advertising and celebrity endorsements. For example, well-known sports brands such as Nike and Adidas promote their sports shoes, sportswear and other products by signing sports stars and placing advertisements in traditional media such as television and magazines. The market coverage of traditional sports industries is limited by geographical regions and communication channels. The number of on-site spectators for events is limited, and the sales of sports goods relieve the reach of physical stores. For some niche sports events, due to the lack of extensive communication channels and market promotion, it is difficult to attract sufficient audiences and consumers, which restricts the further development of the industry. Traditional sports events' audiences can only watch the games through TV or on-site, lacking interactivity and personalized experiences. Audiences cannot choose viewing angles according to their preferences or obtain more detailed player data and event analyses. In terms of sports goods consumption, consumers have difficulty obtaining comprehensive product information and personalized shopping advice when shopping in physical stores. The sports industry involves multiple links such as event operation, sports goods manufacturing, and sports media. However, in the traditional model, the synergy and cooperation among these links are not tight enough. There is a lack of effective information sharing and cooperation mechanisms between event operators and sports goods manufacturers, resulting in the inability to integrate event resources and product promotion, which affects the overall industry efficiency.

4. Development of digital economy and sports industry

4.1. Digital economy stimulates industry evolution

Current research indicates that the digital economy has offered new occasions to the marketing of the sports industry. Through digital channels such as social media and live streaming platforms, sports events and sports brands may reach global fans more directly. The interactive functions on social media platforms enable fans to discuss events in real time and interact with athletes, enhancing their

sense of participation and loyalty. For instance, some football clubs attract fans' attention by posting content such as players' training routines and behind-the-scenes footage on social media, thereby enhancing the brand value of the clubs. Meanwhile, digital marketing can also conduct precise marketing based on fans' interests and behavioural data, improving marketing effectiveness. The research focuses on how digital technologies enhance the experience of sports event viewers.

Virtual Reality (VR) and Augmented Reality (AR) technologies offer immersive viewing experiences for the audience. Through VR devices, viewers can feel as if they are right in the midst of the game at home and freely choose their viewing perspectives. Real-time data statistics and player tracking technologies integrated into live event broadcasts enable viewers to have a more comprehensive understanding of the game dynamics. Additionally, digital tools such as online ticketing systems and mobile applications provide convenient services for viewers, including ticket purchasing, seat selection, and query of event information. The digital economy is driving the development of sports goods manufacturing towards an intelligent direction. The application of Internet of Things technology enables sports goods to have intelligent perception capabilities. For instance, smart sports activity trackers can monitor users' movement data in real time, such as heart rate, steps taken, and movement distance, and provide users with sports advice and health analysis through mobile application programs.

3D printing technology offers the possibility for personalized customization of sports goods. Consumers can customize unique sports shoes, sports protective gear, and other products according to their own needs. The key feature of the digital economy offers new ideas and methods to the sports industry' evolution. Through integration with the sports industry, it is expected to break through the bottlenecks of traditional models and stimulate the innovative evolution of the sports industry, creating greater economic and social value. In the future, with the continuous progress of digital technique, the integration of the digital economy and the industry will be more in-depth, bringing more development opportunities and changes to the sports industry.

4.2. Analysis the influence path of digital economy on the sports industry

In the digital wave, the digital economy is profoundly altering the landscape of the sports industry. Its influence permeates every aspect of the sports industry, especially in the realms of business model innovation and operation management, opening brand-new paths for the development of the sports industry.

Innovation of business model. The traditional sports industry mainly relies on ticket sales, sponsorships and broadcasting rights income. The digital economy' evolution has broken this limitation and given rise to new profit models. For instance, the online paid viewing model has been widely applied through digital platforms. Through Internet live-streaming technology, sports events can reach global audiences. Audiences only need to pay a certain fee to watch exciting events online. This not only increases the income sources for event organizers but also breaks geographical restrictions, allowing more people to have the opportunity to enjoy sports events. After the sports activities, they can also share their sports achievements and feelings online, which further stimulates the purchasing desires of other consumers. Digital technology has made connections among all the participants in the sports industry more closely, promoting the formation of the sports industry's ecological platform. Taking a comprehensive sports service platform as an example, it integrates various businesses such as event operation, sports training, sports goods sales, and fitness services. On this platform, event organizers can release event information, recruit contestants and volunteers; sports training institutions can promote courses and recruit students; sports goods merchants can display and sell products; fitness enthusiasts can search for suitable fitness venues and coaches. Through the integration effect of the platform, the optimization of resource allocation is achieved, and the overall operational efficiency of the sports industry is improved.

Operational Management Transformation. In terms of athlete training, the digital economy has brought about revolutionary changes. Big data and artificial intelligence technologies can comprehensively collect and analyse athletes' training data, including physical performance

indicators, technical movement data, and competition performance. Based on these data, coaches can formulate personalized training plans for athletes, precisely enhancing their competitive levels. For instance, in track and field events, sensors can be installed on athletes' running shoes, sports clothing, and other equipment to collect real-time data such as stride frequency, stride length, and landing methods. During the event preparation stage, through big data analysis, one can reasonably plan the event scale, determine the participants, select the competition venue and time. For instance, based on the audience flow data of previous events and the geographical distribution of the participants, an appropriate venue and time can be chosen to attract more audiences and participants to participate. During the event process, digital technology enables real-time monitoring and management of the event. Through high-definition cameras, sensors and other equipment, the competition site can be comprehensively, and multi-angle filmed and monitored to ensure the fairness and impartiality of the competition. At the same time, by using artificial intelligence technology to conduct real-time analysis of competition data, such as the running distance of players, the success rate of passing the ball, and the number of fouls, it provides reference for the judges' decisions and offers richer event information for the audience. Simultaneously, through online reservation systems and mobile payment technologies, audiences can conveniently and quickly reserve venue spaces and seats, thereby increasing the venues' utilization rate. Digital economy is developing the sports industry through innovative business models and operational management reforms. With the persistent progress and application of digital technique, the sports industry will have a broader development space, providing more high-quality sports products and services for people, and contributing to national fitness and the construction of sports power.

5. Conclusion

The combination of the digital economy and the sports industry is a very promising development direction. Whether from an economic perspective or a social one, the digital economy will inevitably become a significant factor promoting development. Through big data and AI in the digital economy, the industrial sports will surely be elevated to a new level, benefiting the public. However, the digital economy will also encounter problems such as data privacy and security, technological innovation and application difficulties, insufficient talent reserves, and imperfect laws and regulations. Therefore, it is necessary to strengthen data protection mechanisms. Sports enterprises should establish strict data encryption, access control, and backup and recovery systems to prevent data leakage and tampering. At the same time, enhance data security awareness education and raise the data protection awareness of sports practitioners and consumers. The government and industry associations should increase funding support for the research and development of sports digital technologies, encourage research institutions to collaborate with sports enterprises, and universities should set up related digital sports majors, optimize the curriculum system, and focus on practical teaching to provide professional talents for the industry. Legislative departments need to keep up with the pace of industry integration, promptly revise and formulate relevant laws and regulations, and create a favourable legal environment for industry development.

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