

Review Article

Application Scenarios and Promotion Strategies of High-Quality Development of Sports Service Industry Empowered by Digital Technology

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The new generation of digital technology brings new opportunities and new momentum to the development of sports service industry. Reviewing literature and case analysis were used in this study as the methods. Examine the important value and theoretical mechanism of high-quality development of sports service industry empowered by digital technology. Research analyzes the following practical application scenarios and typical cases systematically: The sports competition and performance industry enabled by 5G technology, the sports and health promotion industry empowered by blockchain technology, and the sports venue service industry empowered by Internet technology. And put forward the overall promotion strategy based on macro, medium, and micro levels. It is concluded that the rise and application of digital technology provide important technical support for the high-quality development of modern sports service industry. And it keeps great value to the optimization of sports service structure, the integration of formats, the matching of supply and demand, and the improvement of efficiency. Digital technology enables high-quality development of modern sports service industry. At the macro level, the top-level design led by the government is supposed to be strengthened. At the middle level, a multi-industry coordination mechanism is supposed to be established. At the micro level, we should perfect the professional talent cultivation system oriented by market demand.

1. Introduction

Sports service industry is an important symbol to measure the level of economic development and the maturity of sports industry in a country or region, and to improve its service level and efficiency is the focus of high-quality development of sports service industry. According to the market characteristics and manifestations of sports service industry, it can be divided into sports goods and related products sales, sports fitness and leisure activities, sports competition performance, and sports media and information services (Figure 1). From the overall development trend, Chinese sports service industry has shown a momentum of rapid development (in 2019, the added value of Chinese sports service industry reached 761.5 billion yuan, accounting for 67.7% of the sports industry). However, with the rapid growth, Chinese sports service industry was increasingly exposed to the imbalance of regional development, technical innovation level and low labor efficiency, and other problems, which

seriously hinder the overall development process of sports service industry. With the rapid development of digital technologies such as the IOT, cloud computing, artificial intelligence, blockchain, and 5G, China has gradually entered the era of digital economy in recent years. The new generation of digital technology creates conditions for the transformation and upgrading of industrial structure by means of reintegrating resources and improving total factor production efficiency and also brings new momentum and new growth point for the development of Chinese sports service industry. With the new generation of digital technology, pain points existing in the development of sports service industry technology could be solved, and service efficiency and quality will be greatly improved. In order to promote the sustainable and high-quality development of sports service industry, it can deal with the contradiction between supply and demand fundamentally under the support, and the service function, health function, and economic function of sports service industry are fully demonstrated.



FIGURE 1: Structure chart of sports service industry.

2. Value Survey of High-Quality Development of Sports Service Industry Endowed by Digital Technology

2.1. Digital Technology Empowers the Integration of Sports Service Industry. Marx believed that economic development was promoted by the direct influence of science and technology on productive forces [1]. With the development of sports service industry to digital economy era, digitalization will empower service economy from the dimensions of new business form and element allocation and become the focus of new development [2, 3]. At present, China is entering a new development stage with digital economy as the engine. The integration of digital technology and sports service industry will produce great tension. The application of digital technology makes sports services more closely linked with external industries such as medical care, tourism, and online education. At the same time, the emergence of these new formats not only expands the influence of sports service industry, but also enables sports service industry to take the express train of external industry development. Secondly, digital technology encourages the sports service industry to continuously integrate product manufacturing with product R&D and design, raw material procurement, storage, and transportation at the front end of the industrial chain and product brand and channel marketing services at the back end of the industrial chain, thus strengthening the integration of business forms within the sports service industry [4, 5].

2.2. Digital Technology Empowers Sports Service Industry Structure Optimization. Structural optimization and upgrading have always been the goal of high-quality

development of the sports industry. Especially with the support of digital technology, accelerating the transformation and upgrading of emerging technologies and modern service industry is a significant measure to boost the rapid development of Chinese economy [6]. The structural optimization of sports service industry promoted by digital technology will gradually realize the economic benefits of the scale growth of sports service industry and the social benefits of health promotion. Relying on the characteristics of deepening division of labor, reducing transaction costs, and expanding network externalities, digital technology continues to penetrate deeply into sports service industry. For example, the integrated application of artificial intelligence technology in Chinese traditional sports service industry has redefined the process of production, operation, and management. And it promoted the improvement of production, operation, and management efficiency in the whole related industry [7]. The new generation of information technologies, such as 5G and the Internet of Things, promotes the integration of leading industries such as sports fitness and leisure and sports competition and performance with digital technology and gives play to the advantages of platform economy. In this way, it could promote the rationalization and advanced development of sports service industry structure [8].

2.3. Digital Technology Empowers Sports Service Industry to Match Supply and Demand. The mismatch of supply and demand has always been the key content of the supply-side structural problems of the industry, which is mainly manifested as slow disposal of excess capacity, difficult to meet diversified, high-end, and personalized demands, excessive ineffective and low-end supply, and insufficient effective and

mid-high-end supply [9]. Digital technology can be assigned to break traditional deployment model of supply and demand; supply and demand to customized, personalized new matching method, such as sports products and related products sales, could extract users' browsing traces and consumption data by artificial intelligence and information technology. And it analyzes consumers' preferences to targeted supply of sports products to meet consumer demand. While sports marketing efficiency has improved dramatically online, conversion rates to consumer purchases have continued to increase.

2.4. Digitization Empowers Sports Service Industry to Improve Efficiency. According to McKinsey, the three driving forces of digital disintermediation, dematerialization, and decentralization will reshape industrial value chains and improve labor productivity, creating 10–45% of total industry revenue by 2030 [10]. The role of digital technology in business operations is becoming more strategic and not just complementary. Digital transformation drives the improvement of industrial efficiency, which is not only reflected in the change of collaboration mode brought by technological upgrading, but also reflected in the customization and intelligence of information processing [11]. On the one hand, the sports service industry empowered by digital technology can reconstruct the competition mode of sports organizations and comprehensively improve the development efficiency. Digitalization breaks the constraint of physical environment on the development of sports service industry. Taking sports consumers as the core, it forms the cooperation mechanism of interconnection with external industries, reduces the resistance of industry barriers to outsiders, and creates new opportunities for cross-border integrated development. On the other hand, sports service industry empowered by digital technology can construct three-dimensional network platform and effectively improve the utilization efficiency of sports resources, through the use of the Internet and mobile communication technology, to build a direct and efficient three-dimensional, interactive network platform, for comprehensive integration of sports industry resources, data resources management, and operation.

3. The Theoretical Mechanism of Digital Technology Enabling High-Quality Development of Sports Service Industry

Special Organon argues that digital technology provided the technical scheme for promoting economic and social development. And its greater significance is digital technology with its own technical advantages and economic and social connection and integration, consequently to create valuable productivity, greatly improve the production efficiency of

the services sector, and ultimately promote the development of economic and social purposes [12]. Digital technology has not only reformed the traditional and inefficient mode of production and supply and consumption exchange but also promoted the high-quality development of sports service industry from the aspects of cost reduction, producer skill improvement, production efficiency improvement, and resource optimal allocation. Meanwhile, it has also promoted the fundamental transformation of production mode and consumption activities. Based on the models of Acemoglu and Restrepo [13], the application of digital technology in sports service industry can be divided into two categories: one is to realize post automation, such as unmanned ticket sales, intelligent venue management, etc.; second, the emergence of new forms of business and new models can create new jobs, such as online sports trainers, blockchain technology application operators, and so on [14]. Based on this, the theoretical framework of the impact of digital technology on sports service industry can be constructed as follows:

- (1) The utility function of the consumer:

$$u(C, L) = \frac{(Ce^{-v(L)})^{1-\theta} - 1}{1 - \theta}, \quad (1)$$

where C represents consumption; L represents labor supply; $v(L)$ represents the utility cost of labor supply. Assuming that it is continuously differentiable, increasing, and convex, it satisfies $v''(L) + (\theta - 1)v'(L)^2/\theta > 0$.

- (2) Production function of final product:

$$Y = \tilde{B} \left(\int_{N-1}^N y(i) \frac{\sigma-1}{\sigma} di \right)^{\sigma-1/\sigma}. \quad (2)$$

Among them, $\tilde{B} > 0$, $y(i)$ stands for different positions, σ represents elasticity of substitution. N represents the number of new positions created; high-skilled positions can replace or upgrade low-skilled ones. An increase in N represents an increase in the quality or productivity of a unit of work.

Every post $y(i)$ is produced by labor $y(i)$, intermediate goods $q(i)$, and other factors. $q(i)$ may be produced by factors of labor, or it may be produced by automated technology. Not all positions can be automated, and there is a constraint to the realization of automation: There is a $I, I \in [N - 1, 1]$. If and only if $i \leq I$, positions can be automated. On the contrary, when $i > I$, the position cannot be automated. The function of $y(i)$ is shown in the following equation:

$$y(i) = \begin{cases} \tilde{B}(\zeta) \left[\eta^{1/\zeta} q(i)^{\zeta-1/\zeta} + (1-\eta)^{1/\zeta} (r(i)l(i))^{\zeta-1/\zeta} \right]^{\zeta/\zeta-1} & i > I, \\ \tilde{B}(\zeta) \left[\eta^{1/\zeta} q(i)^{\zeta-1/\zeta} + (1-\eta)^{1/\zeta} (k(i) + r(i)l(i))^{\zeta/\zeta-1} \right]^{\zeta/\zeta-1}, & i \leq I, \end{cases} \quad (3)$$

where $r(i)$ represents the labor productivity in post i , which is strictly monotonically increasing. $\zeta \in (0, \infty)$ represents the elasticity of substitution of intermediate inputs and labor. $\eta \in (0, 1)$ is a constant substitute for the fractional parameter of the elastic production function.

- (3) Equilibrium price formula: In a perfectly competitive market, the price of the position is equal to the marginal costs of production. When $i > I$, $y(i)$ is entirely produced by labor factors. The unit cost of labor is $W/r(i)$; when $i \leq I$, $y(i)$'s factors of production include labor and capital. In this case, labor and capital factors are substitutes, and the unit cost depends on the minimum capital rental rate and labor factor cost. The price formula is shown in the following equation:

$$p(i) = \begin{cases} \left(\frac{W}{r(i)}\right)^{1-\eta}, & i > I, \\ \min\left\{R, \frac{W}{r(i)}\right\}^{1-\eta}, & i \leq I. \end{cases} \quad (4)$$

Among this, W is the wage rate, and R is the capital rent rate.

The price formula says that there is a \tilde{I} that makes $W/R = \tilde{I}$. So this shows that the cost of capital production is the same as that of labor production. When $i < \tilde{I}$, $R < W/r(i)$, all positions are produced by the capital factor; when $\tilde{I} > I$, because of the limitations of available automation technologies, companies cannot always use capital to complete production. That means that there is a unique equilibrium that is $I^* = \min\{I, \tilde{I}\}$, when $i < I^*$, all posts are produced by capital factors, and when $i > I^*$ all posts are produced by labor factors.

In conclusion, because labor productivity is strictly monotonically increasing, highly skilled labor has a comparative advantage. In other words, digital technology boosts productivity in services. Whether the application of digital technology in the service sector takes the form of position automation or the creation of new positions, it can improve service productivity.

4. Application Scenarios and Practical Cases of Sports Service Industry Empowered by Digital Technology

4.1. Application Scenarios of 5G Communication Technology in Sports Competition and Performance Industry

4.1.1. *Technical Features.* The explosive growth of mobile data traffic in the era of digital economy promotes the birth of 5G. Compared with the previous generation of mobile communication technology, 5G has significantly improved transmission rate, transmission reliability, device connection density, traffic density, and other key capabilities. According

to the characteristics of practical application, 5G data collection and transmission mode can be divided into on-site collection and production and remote production. On-site collection and production means that the video and audio signals collected are directly transmitted to the rebroadcasting car located at the site of preaching and reporting activities through 5G network after preliminary processing. According to the number of each station and the complexity of the system, the IP signal can be selectively deployed to dispatch the device. After the signal is made on the relay car, it is sent back to the TV station headquarters [15]. However, different from the on-site production, the material should be sent back to the staff of the TV station headquarters through 5G for remote post production (Figure 2).

4.1.2. *Advantage Analysis.* For a long time, sports competition performance industry has been faced with problems such as backward technology level, low degree of digitalization, poor definition of video viewing, unstable transmission, and video lag. With the iterative innovation and penetration integration of 5G information and communication technology, especially the innovative application of 5G communication technology in the live broadcast of sports competition performance, there is no doubt that the service level of sports competition performance industry will be greatly improved and high-quality watching experience will be brought to the audience both on-site and via video. The outstanding advantages of 5G in the application of sports competition performance industry mainly include the following points: ① 5G subverts the traditional TV editing model. It can be directly applied to the links of “collecting, editing, broadcasting, and transmitting” of live events. It provides a cheap and efficient solution for event signal acquisition, greatly improving the work efficiency. ② 5G solves the problems such as voice synchronization, unstable transmission, and video lag in the event broadcast and brings a better viewing experience for the event live broadcast. ③ Compared with 4G network, the connection density of 5G equipment has increased by 10–100 times, and the traffic density has increased by 1,000 times. The substantial increase in connection density and flow density not only meets the communication demand of the crowded area of the stadium, but also provides sufficient guarantee for the stable access of massive devices in the Internet of Things. ④ The combination of 5G with VR and we-media can not only enhance the audience’s immersive sense of “presence”, but also significantly improve the audience’s role subjectivity.

4.1.3. Practical Cases.

Case 1: In the first leg of the 2019 Silk Road Cup International Women’s Ice Hockey League, the application scenario of 5G communication technology provides a typical practical case for live broadcasting of sports events. From 8K camera signal acquisition to 5G communication technology transmission, and then to 8K large screen multiperspective viewing, the whole process is seamless and unimpeded in this live broadcast. Thus, it verifies the scientificity and

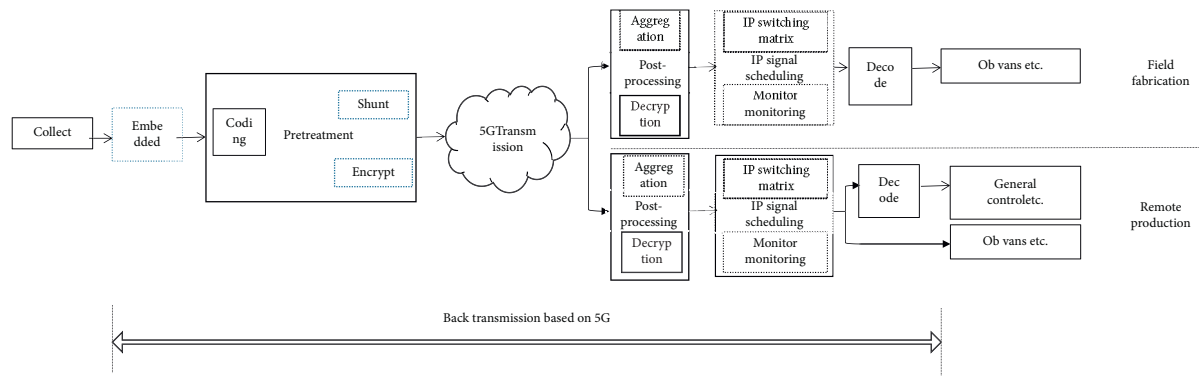


FIGURE 2: Flowchart of 5G video and audio acquisition and transmission.

effectiveness of the overall solution of 5G technology applied to match broadcast.

This exploration broke the traditional business model of event broadcast. It involved more disciplines, fields, and industries in terms of technology, equipment, and standards with more than 20 units directly participating. Due to the lack of ready-made experience to follow, all units made joint efforts under the overall planning and coordination organization of Beijing Radio and Television Bureau to overcome the compatibility problems of technology, equipment, and standards and determine a complete set of 5G + 8K event broadcasting solutions. The biggest highlights of this live test are as follows: Firstly, Beijing Sports Media built a “luxurious” 8K audio-visual experience hall in the Stadium of Beijing Sports University, which is 2 kilometers away from the stadium. The huge 8K screen, which is the size of 10 table tennis tables, is very eye-catching in the venues. The athletes’ faces can be seen perfectly in the scene, which is absolutely comparable to the real experience in face to face. Secondly, 5.1 surround sound was embedded into 8K live broadcast for the first time, which truly restored the sound of the puck and club banging and the shouts of players on the field, greatly improving the user’s sense of immersion in watching. Thirdly, during the live broadcast, the on-site user experience survey of more than one thousand people is also carried out simultaneously. This is also the first 8K user experience survey focusing on consumer experience and large sample in China. Later, Beijing Sports Media will release the first investigation report in China, providing precious first-hand data for the development of 8K video application scenarios in the future.

Case 2: The 2022 Winter Olympic Games were held in Beijing as scheduled, which made Beijing the world’s first double Olympic City. 5G technology brought a brand new experience to the audience at this grand event once again. The Beijing Winter Olympics live broadcast technology delivers live scenes to every 5G user with 100-megabit bandwidth and millisecond delay. The characteristics of 5G large bandwidth with 8K technology achieved ultra HD live video with tickets for the Winter Olympics in short supply. It realized and

made up for the regret of spectators not attending the games at the period of regular epidemic. First of all, one of the most notable achievements of the Winter Olympics is the 5G driverless torch relay. It enables the fact that the robot carried the torch under water. This is the first time in Olympic history driverless car relay based on 5G. Second, 5G cloud direct broadcasting helps all-round real-time viewing of games. In order to enable people from every corner of the world village to enjoy the game in an “immersive” way, a new free perspective has been added to the live broadcast of “5G Smart Watch Match,” with the functions of watching highlights, replays of bullet time, and custom video sharing. In addition, there are several differences between the 5G + for this Winter Olympics and the 5G for the Tokyo Olympics. It has 200 M carrier aggregation, super uplink, network slice and other features, fast transmission rate, 4K or even 8K class HD viewing experience, watching without worry, and download unimpeded. The Beijing Winter Olympic Games let the world see the application scenario based on 5G technology, and it also once again verified the enabling value of 5G technology applied in the broadcast of sports events.

Case 3: In view of the demand for VR panoramic broadcasting of the 7th World Military Sports Games in 2019, the VR technical team of the China Media Group carefully analyzed and summarized the fusion methods of large-scale comprehensive sports events and VR technology and formulated an efficient and high-quality 5G + VR technical scheme (Figure 3). The VR production of this event is the first VR broadcast of an international comprehensive sports event in China. The whole technical team made full preparations in the early stage of scheme design, focusing on the design of the production and broadcast mode of VR panoramic video in the 5G network environment. Among them, the live broadcast signal production and on-demand content shooting and editing team completed the production of VR content for 8 competition items in total and used 6 VR standalone cameras to produce some on-demand content unsuitable for VR live competition items. VR technology team made full use of the 5G network

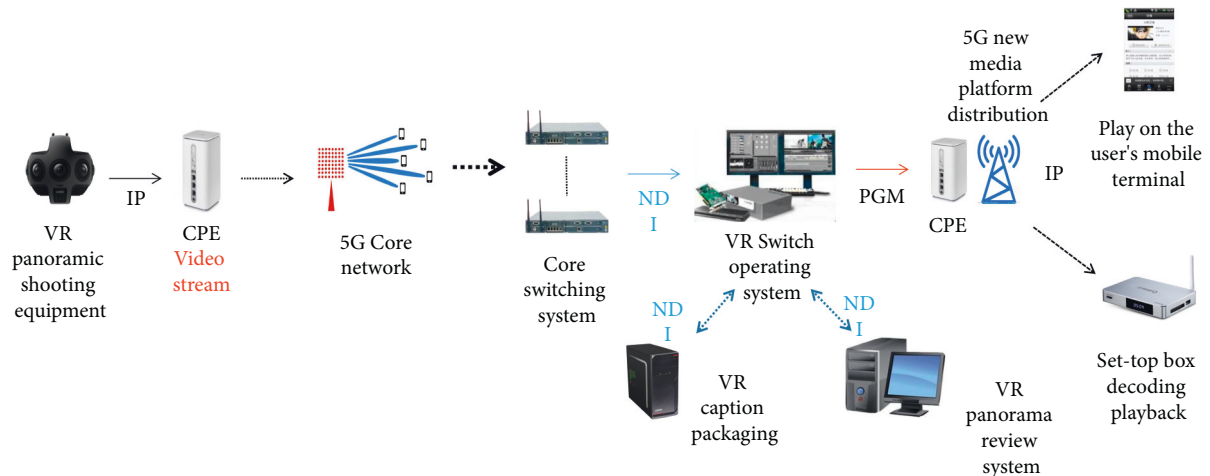


FIGURE 3: Schematic diagram of the whole process of 5G+VR production system for the 7th World Military Sports Games.

resources of the organizing committee's venue area and the main media center to enhance the flexibility of VR shooting and transmission production. It has provided a large number of high-quality and efficient VR videos for each new media platform of the PLA Games, which has become a strong support in terms of content. The continuous maturity and market of 5G network communication technology will bring smoother viewing and interactive experience for VR event broadcast. VR broadcasting is opening a new door for the vast audience watching sports events [16].

4.2. Application Scenarios of Blockchain Technology in Fitness and Leisure Industry

4.2.1. Technical Features. As digital currencies and cryptographic algorithms mature, the blockchain technology is gradually developing. At present, blockchain technology has become the forefront of global digital technology development, regarded as the fifth subversive innovation of computing paradigm after mainframe, personal computer, and mobile/social network. It is one of the key technologies indispensable for the future development of digital economy and the construction of a new trust system [17]. As can be seen from its development trajectory, blockchain has gradually evolved from the initial cryptocurrency into an information product integrating data storage, information transmission, encryption algorithm and consensus mechanism, and other digital technologies. These technologies interact in special combinations that enable blockchain to record, store, and transmit data. At the same time, the unique timestamp function of blockchain technology enables the blocks in the chain to form a series of ordered data record storage structure that cannot be changed [18]. Blockchain technology is immutable and traceable [19], and it uses a point-to-point network structure and decentralized storage model (Figure 4).

4.2.2. Advantage Analysis. "Blockchain + fitness leisure industry" is a new form of business with scientific and

technological innovation as the core driving force and it is a new driving force for the innovation and development of sports fitness leisure industry in the digital era. Blockchain empowers the sports and fitness industry mainly to realize the safe storage of information resources in the fitness industry, to realize the information sharing within the main body of the resource, to ensure the authenticity of the fitness industry transaction information, and to achieve rapid transactions within the subject, so as to speed up the transformation and upgrading of the operation mode of sports and fitness enterprises and improve the innovation and intelligence of fitness service products. The main characteristics of the fitness leisure industry enabled by blockchain technology are reflected in the following aspects: ① Blockchain adopts asymmetric cryptography technology to sign the transactions between the information resources of the fitness industry and adopts hash algorithm to ensure that the transaction data and records are difficult to be tampered with, thus ensuring the security of the information resources of the fitness industry. ② Blockchain can create a "decentralized" distributed ledger of information resources in the fitness industry without a central node. All nodes can fully and reliably record accounts and have the power to send and obtain information, so as to build a bridge for information transmission. ③ Consensus mechanism enables all nodes to jointly maintain the same data through consensus algorithm to solve the problem of consensus among nodes. The blockchain-based sports and health big data platform achieves the common certification among the information resources of the fitness industry through the consensus mechanism. ④ Smart contracts can automatically perform transaction tracing and right confirmation and record every transaction and contract in the chain and cannot be tampered with. The execution process is open and transparent to all information resource subjects of the fitness industry.

4.2.3. Practical Cases.

Case 1: Launched in 2015, the Keep App aims to provide one-stop exercise solutions with the spirit of openness

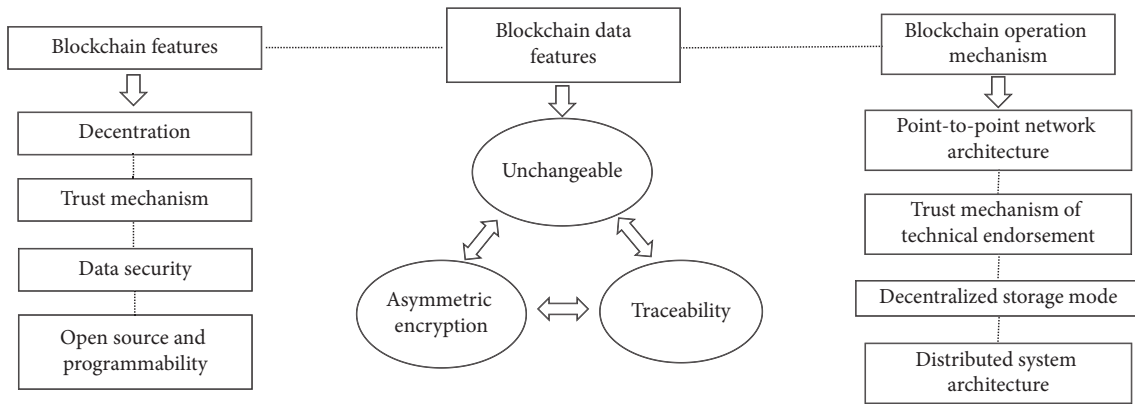


FIGURE 4: Characteristics of blockchain technology.

and sharing and has influenced the exercise habits of more than 100 million people. Keep App can not only ensure direct offline transactions and booking payment between the platform and users, but also realize browsing of training videos and generation of sports analysis, etc. The platform information is distributed storage without the intervention of the third party, that is, to achieve efficient alliance between platforms and realize information openness and sharing.

Case 2: Shanghai Wildebeest Private Education App is the world’s first online fitness education platform based on block chain technology. By intelligently combining blockchain with sports and fitness, an online mutual trust system can be created to ensure the privacy of user information and the transparency of business expense information. Connecting with Shanghai Jing’an Sports public welfare distribution, Wildebeest App creates an online and offline fitness teaching system. It is a representative of the fitness industry with a good combination of block chain technology in China. Wildebeest Private Education App has created a safe, scientific, and informationalized fitness platform through the reasonable application of blockchain technology architecture and the accurate application of various network protocols, which is advanced in the sports and fitness industry. The establishment of Wildebeest Private Education App makes accurate use of the six levels of blockchain functions [20], ensuring the efficient operation of the platform (Table 1).

Case 3: The “Sports Time Bank” of TNB and Nirvana Sports is also a typical case of deep integration of blockchain technology and traditional real economy, which conforms to the requirements of the current era of industrial digitalization. It provides application scenarios for the high-quality development of fitness and leisure industry enabled by blockchain technology [4]. First of all, block chain is used as the underlying technical support to create an accurate time value transmission network for the “sports time bank” and break down the flow barrier of sports resources in the upstream and downstream. The “Sports Time Bank” of TNB and Nirvana Sports takes blockchain as a new

driving force for the high-quality development of the fitness industry. It not only deals with the problem of heavy asset attribute and high operating cost of traditional fitness industry, but also develops a new profit model to provide effective sports service supply centering on the diversified and personalized fitness consumption demand of sports consumers, so as to realize the effective connection between supply and demand of fitness industry. Secondly, take “sports time bank” as the entry point, improve the innovative application of blockchain technology and fitness and leisure industry, cultivate new formats and models of sports consumption, promote the transformation of data value, and empower the fitness and leisure industry. The “Sports Time Bank” of TNB and Nirvana Sports analyzes and processes users’ fitness exercise data by facilitating block chain technology, thus providing sports consumers with more accurate private fitness course appointment, sports goods purchase, fitness venue allocation, and other industry services. It is beneficial for industrial supply to match with the user’s demand so as to enhance the user experience, reduce the cost of user fitness consumption, and extend the corresponding industrial chain.

4.3. Application of Internet Technology in Stadium Service Industry

4.3.1. *Technique Features.* In recent years, the growth rate of stadiums and gymnasiums in China is obvious (Table 2), and the service industry of stadiums and gymnasiums has also made great progress. However, stadiums, especially large stadiums, have been plagued by problems such as poor operation, low utilization rate, and lack of sustainable development motivation, which not only restrict the healthy development of stadium services, but also weaken its basic role in the development of sports in China.

With the development of Internet technology, “Internet + stadium” has gradually become a new form of stadium service [21]. “Internet + Sports Venue” integrates the mode and thinking concept of “Internet+” with sports venue services. It aims to promote the development of diversified

TABLE 1: Application of blockchain underlying technology in various levels of functions of Wildebeest App.

Network level	Functional description	Function
Network layer	Accurate and efficient information processing	Achieve accurate transmission and sharing of information through efficient processing of data. Ensure the real-time interaction between private tutors and students and realize the timely correction and Q&A of students' wrong actions.
Data layer	Rigorous and reliable data storage	User personal accounts and courses. Orders are stamped with time stamps in the form of data blocks to form data chains for distributed storage to ensure information security and immutability and improve App credit.
Consensus layer	Efficient consensus matching is optimal	Through this consensus algorithm, all nodes of students and private tutors in the system can reach consensus and consensus efficiently in a decentralized environment. Ensure optimal matching.
Incentive layer	The agreement guarantees rewards, penalties, and incentives	Encourage users to comply with transaction rules and network protocols through credit accounting rewards to jointly maintain platform security; those who break the trading environment will be punished with official titles to maintain the benign operation of the system and set up points deduction preferential activities and expand the use of the platform.
Contract layer	Smart contract automatically responds	The smart contract is stored in this layer and marked by the unique address of the whole network. When the trigger conditions are met, the contract will automatically respond to the platform for automatic deduction of fees, membership management, and membership renewal.
Application layer	Kaiyuan share real-time upgrade	With the flexible script code provided by blockchain, researchers can independently write all kinds of applications to achieve lesson booking, teaching, and after-class real-time feedback, providing users with the best services.

TABLE 2: Overall changes of large stadiums and gymnasiums in China (2013–2019).

Time	Stadium (Pcs)	Stadium (Pcs)	Natatorium, diving pavilion (Pcs)	Total (Pcs)
At the end of 2013	292	721	80	1093
At the end of 2019	386	962	149	1497
Growth rate (%)	32.19	33.43	86.25	33.96

formats of stadiums and gymnasiums, innovate the operation mode of stadiums and gymnasiums, broaden the field of sports services, improve the operation and service supply capacity of stadiums and gymnasiums, and meet the growing demand of the people for sports services by strengthening the construction of stadiums and gymnasiums with data, information, and intelligence [22]. Under the background of “Internet+” era, the combination of Internet and stadium can improve the informatization degree of existing site resources and improve the utilization rate of existing site resources to a certain extent, which is also a symbolic product of the transformation and upgrading of stadium service industry in the era of “Internet+” (Figure 5).

4.3.2. Advantage Analysis. The main purpose of “Internet + Sports venues” is to reduce the problem of asymmetric information between the supply of stadiums and venues by the government or social forces, so as to solve the pain point of opaque venue information when the masses are enthusiastic about fitness. Its value orientation is to meet the sports needs of the masses. The advantages of Internet + stadiums are embodied in the following aspects: ① Realize the function of stadium booking. With stadiums resources scattered in all corners of the city, real-time update of venue booking App can provide users with mapping navigation and get the latest venue information, online booking, member services, ticketing service, customer service,

payment evaluation activities, sports information, recommendations, and integral variety of online services, such as effective time management, to help users avoid invalid waiting. ② Establish social platform for venues. By using the advantages of the platform to establish connections between users and venues, users and coaches, and users and other users, we can more effectively help users to make appointments for competitions, venues, coaches, fitness courses, etc. ③ Build regional venue information alliance. The Internet has become the main way for the public to access sports information. By establishing venue information alliance, the competent authorities can obtain statistics of passenger flow and event activity data to strengthen supervision and guidance of venue services, especially supervision of public welfare free and low charge opening, so as to avoid “free rates” of venues. Use Internet thinking to promote modern marketing methods such as service marketing, experience marketing, relationship marketing, and difference marketing in all member stadiums of the alliance and improve the overall operation level of regional stadiums and gymnasiums.

4.3.3. Practical Cases. Since the first World Internet Conference was held in Zhejiang in 2014, Zhejiang province has introduced a series of policies and measures to build the economic development model of Zhejiang with digital economy as the core. Zhejiang Provincial Bureau of Sports

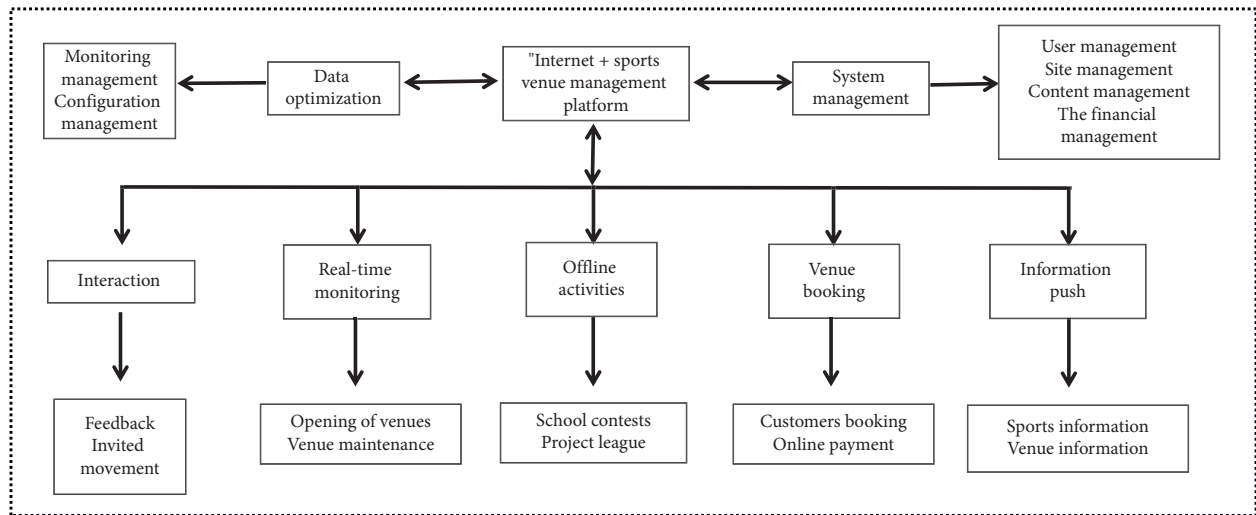


FIGURE 5: Construction diagram of “Internet+” stadium information platform.

actively implements and promotes the construction of digital sports and holds hands with excellent sports Internet enterprises represented by Zhejiang Huanglong Hula Network Technology Co., LTD. To actively promote the digital transformation of Zhejiang sports in the way of government-enterprise cooperation, focus on creating the “Huanglong model”. Huanglong sports center in Zhejiang province was started in 2017 on “Internet + sports venues” mode of innovative technology, from the digital sports training to the intelligent construction, from the data elements applied to motion analysis, etc., making full use of Internet technology to promote the development of digital sports services. It has higher application and popularization value and achieved good results in this way [23]. The characteristics of the digital transformation and upgrading of the stadium service of Huanglong Sports Center are as follows: ① Establish a public service platform for National Fitness in Zhejiang Province, led by the Provincial Sports Bureau. Huanglong Center operates integrated venue online reservation, national fitness monitoring reservation, registration of activities and events, scientific fitness guidance, national fitness facilities GIS, and other system functions. This has formed a national fitness public information service system that integrates “official service management, fitness guidance, data statistics, and decision-making assistance” and combines management and services. ② The Sports Bureau of Zhejiang Province integrates the whole province’s sports resources into the “one network” to realize the “online operation” and “handheld operation” of sports public services, so as to deepen the reform of “running at most once” in the field of sports. Take the lead in realizing intelligent transformation of online selection, reservation, and payment. ③ Strengthen supply-side structural reform in venue services with public sports demand as the supply orientation. For example, a big data cloud platform for healthy consumption can be formed by collecting basic information of users. Obtain various health indicators of the user’s body through the data analysis, and then professional health managers can provide professional personalized exercise, diet evaluation, and other

lifestyle suggestions according to the health indicators, so as to provide help for sports fans to manage their own health scientifically. ④ With the help of venue operation brand and information technology, implement information output management for some venues in the province. Guide grassroots stadiums and gymnasiums to take the road of market-oriented and information-based operation through entrusted operation, chain operation, and cooperative operation. At present, Huanglong’s “Internet + stadium” model has been successfully copied to Huzhou Sports Center and other sports centers.

5. The Promotion Strategy of High-Quality Development of Sports Service Industry Empowered by Digital Technology

5.1. Macro Level: Strengthen Top-Level Design Led by Government. New technology brings new driving force, and the new generation of digital technology brings opportunities for the development of sports service industry. In the face of new opportunities, the government should plan ahead, do a good job in top-level design, give full play to the promotion role of macrocontrol on sports service industry, timely issue relevant guidance opinions, administrative regulations, management norms, and other systems for the integrated development of digital technology and sports service industry, and clarify the value and significance of digital technology to promote the development of sports service industry. Firstly, establish an integrated development mechanism for digital technology and sports service industry. There are many subdivided fields in sports service industry, and there are certain differences in the forms and specific development paths of digital technology integration in different fields. Therefore, it is extremely urgent to establish a mechanism for the coordinated development of digital technology and sports service industry. Secondly, formulate a plan for the integrated development of digital technology and sports service industry. It is necessary to

speed up the research on the development goals, key points and difficulties, and development paths and guarantee mechanisms of promoting the digitalization of sports service industry. Promote the digitalization of sports service industry according to plan, step by step and by key points. Thirdly, introduce incentive policies to promote and guide. Promote the related fields of digital technology in sports service industry vigorously and encourage the transformation and upgrading of sports service industry with digital technology. Support scientific research institutions, high-tech enterprises, and venture capital companies to make full use of big data platforms to provide platform support for sports service industry such as leisure fitness and competition performance and drive the wide application of new technologies in sports service industry. Finally, increase capital input. Make use of fiscal and tax policies to increase financial investment in the digital construction of sports service industry. Strengthen the opening of the sports service market, set up special funds for the digital development of sports service industry, and guide the digital transformation of related industries.

5.2. Middle Level: Establish a Diversified Collaborative Mechanism with Industry as the Main Body. As digitalization has been incorporated into the national top-level design and promoted as the national development strategy, it has become an important theme to promote the diversified and coordinated development of sports service industry by using digital technology. The government, enterprises, industry associations, and the public should cooperate and take the initiative to give full play to their respective advantages, so as to promote the healthy development of sports service industry towards the direction of digitalization and share technological dividends in the process of cooperation. Firstly, sports service industry should play the characteristics of strong integration and constantly form connections with other industries under the role of market resource allocation, through the integration of various resources to promote internal growth and then constantly promote the development of relevant industries, secondly, to fully stimulate leisure and fitness, competition performances, venue services, and other consumer hot spots, so as to gather more resources, through effective sports service industry integration of external resources, from the government, market, and consumers and the participation of the supply situation. Thirdly, the sports service industry should fully promote the digital transformation of sports resources to drive the cooperation between sports enterprises and digital enterprises, for online fitness training, sports goods marketing, smart venue construction, and sports information dissemination and other aspects of in-depth cooperation, leading digital enterprises and sports service-related industries to develop together. Fourth, under the guidance of policies, sports service resources should be integrated; information and data sharing platforms should be established. Promote big data sharing and lower digital barriers, so as to form a diversified and collaborative pattern of common promotion, common maintenance, common governance, and common sharing.

5.3. Micro Level: Improve the Professional Talent Cultivation System Oriented by Market Demand. With the rapid development of digital technology, the demand for professional talents is greatly increasing, and the structure of talent demand is also changing. At present, the shortage of digital talents in sports service industry in China has become an important factor restricting the development of digitalization of sports service industry. Sports service industry should be led by digitalization and oriented to meet market demand to accelerate the improvement of the training system of digital talents in sports service industry, so as to allocate necessary human resources for the digital development of sports service industry. Firstly, it is necessary to implement the strategy of building a strong body of talents, actively introduce talent incentive policies, and attract more high-quality digital talents to enter the field of sports service industry. Local sports administrative departments should perfect the talent service system, set up the digital talent database of sports service industry, and build the service and docking platform of digital talent resource of sports service industry. Secondly, we should reform and optimize the talent training system of colleges and universities and scientific research institutes based on market demand, take digital sports talents as the training direction, and integrate big data, cloud computing, artificial intelligence, and other digital technologies into the curriculum system of sports industry-related majors. Thirdly, sports service professionals who are proficient in digital technology should be systematically cultivated from the perspective of industry, university, and research institutes. The transformation effect of achievements of colleges and universities and scientific research institutions should be fully brought into play to establish the collaborative innovation mechanism between universities and enterprises. At the same time, educate the existing sports service industry practitioners trained based on digital technology to improve their digital literacy and skills. Finally, it is necessary to establish talent introduction mechanism, formulate preferential policies for talent introduction, and attract talents in digital sports industry with international vision and cutting-edge technology to jointly tackle core technologies in key fields.

6. Conclusion

As a green and sunrise industry, sports service industry is an important symbol to measure the level of regional economic development and the maturity of sports industry. The rich application scenarios and successful practice cases of the new generation of digital technology in the field of sports service industry fully demonstrate the important value of digital technology to boost the high-quality development of sports service industry. The rich application scenarios and successful practice cases of the new generation of digital technology in the field of sports service industry fully demonstrate the important value of digital technology to boost the high-quality development of sports service industry. The new generation of digital technologies represented by 5G, blockchain, and the Internet of Things can enable the high-quality development of modern sports

service industry. Overall promotion strategies are supposed to be formulated based on macro, medium, and micro levels. The top-level design led by government should be strengthened at the macro level, and multiple collaborative mechanisms with industry as the main body should be established at the medium level. At the micro level, we should perfect the professional talent cultivation system oriented by market demand.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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