



# Analysis on the Technology Composition and Construction Path of Smart Sports Industry

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**Abstract.** Intelligent technology gives new vitality to the sports industry. The innovative use of new technologies such as big data, blockchain, Internet of Things, cloud computing and artificial intelligence in the Asian Games has not only improved the efficiency of event operations, provided quality services, enriched the presentation and dissemination of events, and created an interactive viewing experience. It also promotes the innovative mode of Hangzhou's smart sports industry to respond more quickly and flexibly to people's more personalised and diversified sports needs. This paper uses literature research, case studies and fieldwork to comprehensively analyse the current situation of the mode of Hangzhou's smart sports industry, analyse the problems that exist, and explore the transformation and upgrading of Hangzhou's sports industry mode model as a new engine in the context of the Asian Games. It also provides theoretical reference and experience for the mode of smart sports industry in other cities, and ultimately promotes the improvement of China's overall sports industry and contributes to a strong sports nation.

**Keywords:** Smart Sports Industry · Cloud Computing · Big Data · Internet+ · Artificial Intelligence Technology

## 1 Introduction

### 1.1 The Concept and Characteristics of Intelligent Sports Industry

#### 1) Overview of the Smart Sports Industry

It is a systematic project to integrate education, culture and other “sports+” resources, and to improve the quality of sports services and promote the transformation and upgrading of the sports industry by constructing digital, networked and intelligent sports spaces, sports models and sports ecologies. The transformation and upgrading of the sports industry will enable it to respond more quickly, flexibly and correctly to people's more personalised and diversified sports needs. Technology to help the sports industry is multi-form, deep and all-round, computer technology, virtual reality technology, somatosensory technology, artificial intelligence and big data will usher in a revolutionary application explosion, becoming a strong driving force to change the way sports are consumed, optimise the supply and demand structure of the sports industry, extend the value chain

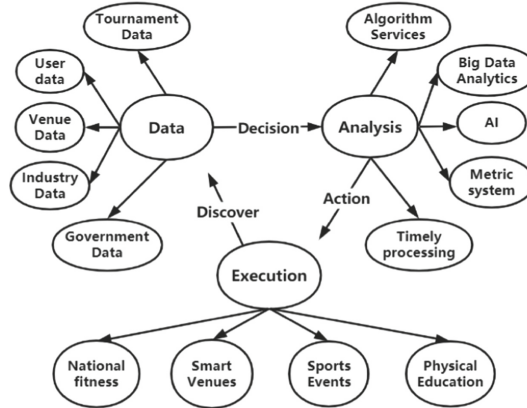


Fig. 1. Smart Sport Operational Framework

of the sports industry and enhance the competitiveness of the sports industry. According to the “Opinions on Accelerating the Mode of Sports Industry and Promoting Sports Consumption” published by the State Council, the total scale of China’s sports industry is planned to exceed 5 trillion yuan by 2025 [1].

## 2) Characteristics of the Smart Sports Industry

The Smart Sports Industry is characterised by three aspects. Firstly, the high quality services of the smart sports industry must closely grasp the real needs of consumers and provide people with high quality services. Secondly, the Smart Sports Industry integrates big data, cloud computing, IoT, AI and other technologies into the traditional sports industry, driving the multi-dimensional mode of the sports industry. Thirdly, technology accelerates the change of the traditional sports industry, bringing consumers a new intelligent sports experience and meeting the convenience needs of the public in modern life.

Born from a smart city, smart sports is an important part of a smart city, a systematic project of smart transportation, smart medical care, smart education, smart energy, smart tourism, smart finance and other urban construction, and is a concrete embodiment of smart city construction in the field of sports (Fig. 1).

## 1.2 Overview of the Internet +, AI and 5G

### 1) The Internet+

The “Internet+” is based on Internet information technology, Internet infrastructure and the degree of Internet usage. It integrates and develops the Internet with industry, optimizes the allocation of resources, brings into play the role of the Internet information economy, and realizes the optimization and upgrading of industrial structure. The “Internet+” has six major characteristics: cross-border integration, innovation-driven, reshaping the structure to respect human nature, open ecology and connecting everything.

## 2) AI

Artificial intelligence is the theory, methods, technologies and application systems that use digital computers or machines controlled by digital computers to simulate, extend and extend human intelligence, perceive the environment, acquire knowledge and use that knowledge to obtain the best possible results. The core idea of artificial intelligence lies in the construction of intelligent artificial systems. Artificial intelligence is a knowledge project that uses machines to imitate humans to perform a range of actions. The core technologies of artificial intelligence include: deep learning, computer vision, natural language processing and data mining. Application segments include: intelligent robots, virtual personal assistants, real-time voice translation, automatic visual recognition, recommendation engines, etc.

## 3) 5G

5G is a new generation of broadband mobile communication technology with high speed, low latency and large connectivity. 5G has three main application scenarios, namely enhanced mobile broadband (eMBB), ultra reliable low latency communication (uRLLC) and massive machine class communication (mMTC). Enhanced Mobile Broadband (eMBB) is aimed at the explosive growth of mobile internet traffic, providing mobile internet users with a more extreme application experience. Ultra High Reliable Low Latency Communication (uRLLC) is aimed at industrial control, telemedicine, autonomous driving and other vertical industry applications with high requirements for latency and reliability. Massive Machine Type Communication (mMTC) is targeted at applications such as smart cities, smart homes, environmental monitoring and other applications where sensing and data collection is the goal [2].

### 1.3 Use of AI, Big Data, Cloud Computing and IoT in Smart Asian Games

The intelligent command platform is the “brain” of the Asian Games. It is a comprehensive command system that uses artificial intelligence, big data, cloud computing, Internet of Things and other technologies to open up information gateways, realise data interoperability between government departments, Asian Games venues, the Asian Games Village, Hangzhou city and sub-regions, and meet the needs of optimising the allocation of resources for the Games, scheduling operations during the Asian Games and improving urban support and supervision.

The use of AI and 5G technology in the Asian Games allows for communication-free competition. A variety of technologies such as automatic translation, speech recognition, speech synthesis and speech conversion are implemented simultaneously through intelligent speech technology and artificial intelligence synergy using exclusive technology for official automatic speech conversion and translation.

In the Smart Asian Games, the AI athlete training assistance system can use a large amount of data for model training, target detection, identification and tracking of competitive sports based on sports sequence prediction. At the same time, AI can be applied to various aspects of post-Asian Games project management, venue operation planning and design, technical command centre construction and maintenance. AI athlete training assistance system can use a large amount of data for model training to make target detection recognition and tracking for competitive sports based on sports sequence prediction.

## **2 Smart Sports Industry Mode Status**

### **2.1 The Scale of the Industry is Growing and the Brand Effect is Remarkable**

At present, Hangzhou's sports industry basically takes "sports goods + manufacturing industry", "sports + fitness and leisure industry" and "sports + competition and performance industry" as the main body, and sports and training, tourism, culture and creation, health and other industries as a new industry. The new industry is complemented by the multi-faceted integration of sports and training, tourism, cultural creation, health and other industries. By the end of 2020, there will be a total of 7,790 sports enterprises, one national sports and leisure township, four provincial sports and leisure townships and five sports and leisure tourism demonstration bases in Hangzhou, and the scale of Hangzhou's sports industry will grow.

### **2.2 Tournament Branding, with Backbone Companies Leading the Way**

International sports brand events are encouraged to enter, and local sports brand events are vigorously cultivated. More than 1,600 sporting events had be held in Hangzhou in 2019, providing a wealth of events for the public and promoting Hangzhou as an international "window for sporting events".

Hangzhou has created 2 national sports industry demonstration units, 5 provincial sports manufacturing demonstration enterprises and 8 provincial sports service industry demonstration enterprises. Continuously improving and broadening the sports industry chain, promoting the synergistic mode of the upstream, midstream and downstream of the sports industry, and facilitating the formation of a sports industry ecosystem.

### **2.3 Digital Empowerment Ushers in Wisdom Enhancement**

In July 2021, the 19th Hangzhou Sports Industry Mode Forum and Digital Sports Forum systematically described the "digital intelligence empowerment" of the sports industry for the first time. There is a comprehensive enhancement of the construction of the information platform of the sports industry through the all-round application of 5G technology, artificial intelligence, cloud computing and mobile wearable devices in the sports industry.

The Work Plan for Promoting the Wisdom of Sports in Hangzhou at a high level states that digital empowerment of sports technology, thinking and cognition needs to be covered in an integrated manner. Digitalisation, integration and modernisation are fully integrated into the sports industry. Use digital technology for social management, empowering stadiums and improving the convenience of physical exercise and the safety of sports consumption for the public.

### **2.4 Major Events and Opportunities for Mode**

During the 14th Five-Year Plan period, a series of major international and domestic events such as the 2022 Asian Games will be held in Hangzhou, which will be an important opportunity for the mode of Hangzhou's sports industry. The hosting of major

international events will bring important opportunities for Hangzhou to speed up the internationalisation process, improve the city's basic public service system, accelerate the construction of a smart city, optimise the facilities and functions of the venues, promote the agglomeration mode of the event economy, cultivate the public's awareness of national fitness and cultivate the sports market, etc. It will also become a powerful driving force for the sports industry to build a modern industrial system and achieve high-quality mode.

### **3 Problems in the Mode of Hangzhou's Smart Sports Industry**

The advent of the new era of the Internet and the opportunity to host the Asian Games in Hangzhou requires that the mode and operation of Hangzhou's stadiums must keep pace with the times and inject big data, Internet of Things, artificial intelligence and other technologies into the mode of smart stadiums, which is of great significance in helping the Asian Games to be held, improving the lives of city residents and enhancing the image of the city.

#### **3.1 Incomplete Chain of Smart Sports Industry**

The Internet promotes the integration of upstream, midstream and downstream resources of Hangzhou's Smart Sports Industry, creating a new Smart Sports Industry chain. However, compared with other cities with developed Smart Sports Industry, the scale mode is slow and the industrial structure is single. The scale and integrity of the industry chain is not high, and it cannot meet the diversified needs of consumers.

#### **3.2 Low Integration of Online and Offline**

The mode of Hangzhou's online Smart Sports Industry is in its infancy. On the one hand, the online sports industry cannot be completely separated from the offline scene and needs to be based on offline sports facilities. However, the allocation of sports resources in Hangzhou is not perfect, and there are problems such as slow renewal of facilities and stagnant construction of sports facilities in public spaces, resulting in low integration of online and offline [3]. On the other hand, the mode of the online sports industry at this stage stays on the online display and sale of products, which has form and concept but lacks practical value.

#### **3.3 Low Level of Informatization and Utilization**

On the one hand, the information resources of the sports industry are fragmented, and there is a lack of platforms for efficient integration of massive information resources, and the data format is not uniform. On the other hand, the content of the public service platform for sports information is not open enough, the means of mode are insufficient, interoperability is not strong, lack of sharing awareness, and updates are not timely [4]. The process of sports informatisation lags far behind the level of mode of the modern sports industry, and a large amount of match information cannot be pushed to interested viewers.

### **3.4 Lack of Expertise and Sizeable Corporate Groups**

The sports industry lacks expertise in digital technology mode and operations. Most Internet companies have only a small part of several businesses covering the sports industry, making it difficult for them to invest their best and brightest to promote mode or come up with practical and innovative technological solutions. The overall scale of Hangzhou's sports enterprises is relatively small, with a low risk resistance and a small position in the overall market, and the sports brands are relatively backward, with a large gap with the big international brands and a relatively low market share. The market penetration rate is not high, and there are no large internationally renowned enterprises or brands to date.

## **4 Exploring the Mode Path of Hangzhou's Smart Sports Industry**

### **4.1 Infusing Big Data, IoT and AI Technologies into the Mode of Smart Stadiums**

The advent of the new era of the Internet and the opportunity to host Smart Asian Games in Hangzhou requires that the mode and operation of Hangzhou's stadiums must keep pace with the times and inject big data, Internet of Things, artificial intelligence and other technologies into the mode of smart stadiums, which is of great significance in helping the 2022 Hangzhou Asian Games to be held, improving the lives of city residents and enhancing the image of the city.

#### **1) 5G helps build smart stadiums for sports**

5G technology has played a huge role in the construction of smart venues. In the 2022 Hangzhou Asian Games, the 5G + Smart Venue Project was launched to provide eight scenarios, including "integrated, event, people and vehicles, energy consumption, equipment, safety, environment and operation", to achieve instant perception, scientific decision-making, proactive service, efficient operation and intelligent supervision. 5G scenes have also been built in the 2022 Beijing Winter Olympic Games venues to achieve full 5G coverage. Real-time data is collected from the venues through technologies such as IoT to provide real-time information on safety, comfort and sustainability, enabling real-time viewing, interactive monitoring and remote command of the venues, making it easier for managers to operate the venues.

#### **2) AI builds 24-h digital intelligent venues**

Creating the nation's leading 24-h unattended venues, each venue is equipped with a variety of modern AI intelligent facilities such as face recognition system, intelligent light control system, intelligent booking reservation system and intelligent front desk, and uses connected and IOT technology to achieve automated and intelligent management. Users can use these software and hardware devices, such as small programs and smart gates, to achieve a number of operations such as booking and prevention and testing of multiple venues such as courts and swimming pools. The platform can automatically determine the number of open venues by monitoring the number of bookings. If a user books a venue at night, the venue lights will automatically turn on before their entry, and 15 min after they leave the venue, the venue lights will automatically turn off, making the whole

process unattended. This greatly saves manpower and operating costs, allowing venues to focus on improving management operations and user services.

Convenient venue booking and admission through mobile internet and IoT technology not only improves customer experience, but also helps to improve the management, operation and service level of the venue through big data to achieve accurate and targeted marketing and service. The normalisation phase of epidemic prevention and control, with the help of intelligent equipment such as face recognition gates, venues will be able to achieve efficient control of the flow of people, and the system's accurate passenger flow statistics will also facilitate real-time flow control by venue staff. It is also possible to analyse and visualise the statistics based on the operation of the venues, providing big data support for the venues and government departments to make scientific fitness decisions at a later stage.

## **4.2 Using Internet Technology to Create a Smart Sports Public Service Platform**

In the context of the Smart Asian Games, the construction of an intelligent, public and digital sports platform can better serve the sports exercise of city residents, meet the individual needs of different people and promote the mode of Hangzhou's Smart Sports Industry [5].

### **1) Use Cloud computing and IT to establish a shared smart sports platform**

The Shared Smart Sports Platform is able to record information on sports resources and citizens' participation in sports programmes in Hangzhou [6]. Combined with cloud computing and Internet technology, it provides citizens with fitness guidance, equipment purchase, venue booking and personalized services. Through the platform, citizens can view their daily training volume, physical function status and calorie intake in real time, and compare their own target data to guide their training volume and daily diet scientifically (Fig. 2).

## **4.3 Yangtze River Delta Digital Intelligence Sports Information Service Platform**

Relying on its geographical location and the mode of digital technology on the Internet, Hangzhou will actively play an exemplary role in building a digital and intelligent information service platform for the Yangtze River delta. Based on the "Integration of the Yangtze River delta Sports Industry" smart platform, it will integrate and gather sports resources in the Yangtze River delta region, and incorporate sports information, stadium booking and ticketing, sports events, sports training services, government procurement cloud service business circle, sports equipment and equipment cloud procurement hall and data formed in the process of sports industry mode in the Yangtze River Delta region. The multi-functional platform incorporates data from all latitudes, provides services for the circulation of sports industry data in the Yangtze River Delta region, and strengthens the trading of sports industry resources.

## **4.4 5G and AI Pioneering Smart Services for Sporting Events**

The "14th Five-Year Plan" for the mode of Hangzhou's sports industry, issued by the Hangzhou Sports Bureau, points out that the holding of major events such as Smart

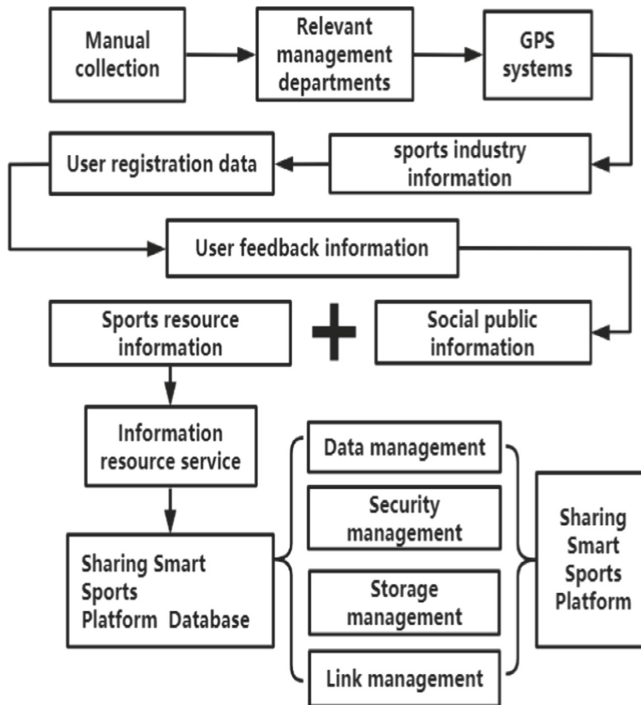


Fig. 2. Platform data acquisition and management process

Asian Games will be an important opportunity for the mode of sports events in the city. The booming digital economy will become an important driving force for the mode of sports events. The mode of Internet+ Sport will be vigorously pursued to support the mode of intelligent sports events, innovate the presentation of sports events, and promote the formation of intelligent sports event platforms and service systems.

### 1) 5G powers the live event viewing experience

With the continuous improvement of 5G technology, the traditional live broadcast of sports events, scene interaction and content operation will usher in new opportunities for reform and transformation. Olympic Winter Games in 2022, with the support of AR virtual technology, the audience can switch at will according to the needs of live broadcasting, which makes people feel like they are in the ice and snow arena. In the FIFA World Cup Qatar 2022, China Mobile Migu opened a virtual interactive space for users with a full range of live events and 5G black technology. Full use of 5G + 4K/8K + XR + AI and other technologies to create a “5G cloud arena” with real-time interaction, immersive experience and other functions, will unlock the user’s sense of presence in the arena with unprecedented interactive experience.

### 2) Intelligent system equipment for the race course

In terms of event preparation training, intelligent training assistance systems are created. For example, the AI-assisted scoring system for pre-competition training and monitoring used by Chinese figure skating at the 2022 Winter Olympics, and the AI



visual scoring system for event officiating. At the FIFA World Cup Qatar 2022, the first semi-automatic offside penalty technology (SAOT) “side judge robot” is used to calculate the exact position of the ball and the player on the pitch using special tracking cameras and ultra-fast transmission frequencies.

### 4.5 AI Will Create a New Model of Intelligent Physical Education

The introduction of AI technology will not only help to solve the pain points in traditional physical education, but will also promote the change of physical education methods and even the whole sports industry [7]. In the process of physical education, artificial intelligence can help students grasp basic sports knowledge and skills more quickly, and will also make sports training more scientific and efficient, helping to visualise and personalise physical education (Fig. 3).

#### 1) Smart Campus Sports Complex

Technology empowers sport, using intelligent physical education products to help physical education teaching innovation and teaching and research reform, for schools and educational institutions, to establish a smart campus complex, to provide scientific solutions for modern physical education teaching, management and assessment on campus, so that teaching programmes are equipped, teaching methods are intelligent, and teaching classes are fun [8]. Artificial intelligence technology and equipment facilitate the automation of all elements of physical education, including practice layout, training supervision, movement standards, skills assessment and growth records. [9].

#### 2) Online fitness smart teaching for national

With the maturity of 5G, VR and AR technologies, “home fitness”, “VR sports” and other smart sports methods will become popular. The establishment of a comprehensive online fitness intelligent teaching system, the launch of AI virtual real coaches,

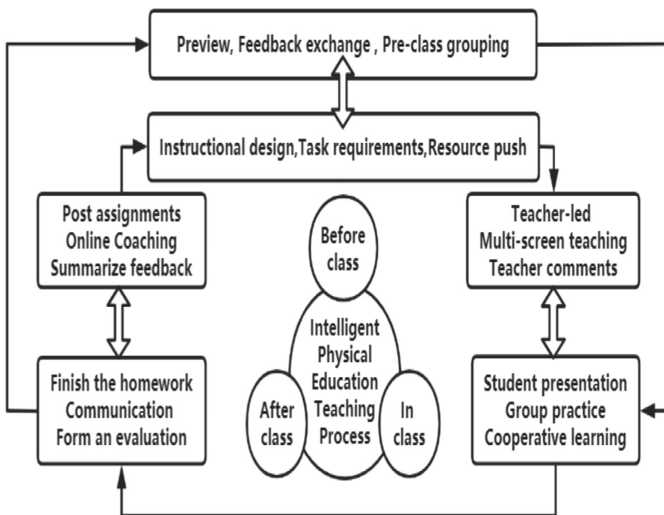
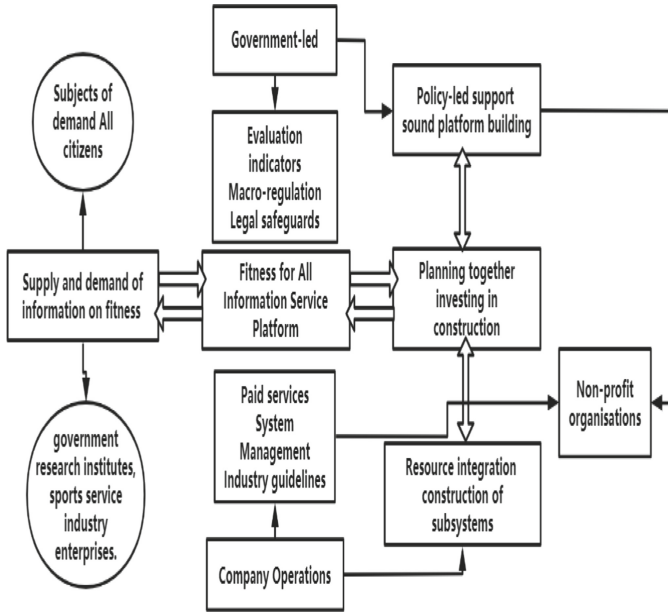


Fig. 3. Constructing Intelligent Physical Education Teaching Mode



**Fig. 4.** National fitness Information Service Platform

standardized output of high-quality teaching services, help users to carry out fitness training, optimize the allocation of fitness education resources, so that all people have equal efficient physical exercise [10] (Fig. 4).

## 5 Mode Countermeasures and Suggestions

### 5.1 The Internet+ Will Unleash the Effects of the Smart Asian Games

Take the 2022 Hangzhou Asian Games as an opportunity to nurture and introduce high-standard, professional venue operating companies and service providers, absorb the experience of diversified events and operation models, encourage venue operating and management organisations to achieve large-scale, professional operation through brand export, management export and capital export, and increase the operational efficiency of venues in the “post-Asian Games” period. To increase the operational efficiency of the venues in the post-Asian Games period. Make full use of Asian Games venues and Asian Games event resources to bid for and organise various national events and high-level professional events, and support the organisation of sports industry fairs, sports culture exchanges and other exhibitions. Promote the mode of local professional sports clubs and promote the construction of sports clubs as home venues.

### 5.2 Improve the Smart Sports Industry Chain and Promote Regional Synergistic Mode

Support enterprises to develop into “platform enterprises”, form a new situation of agglomeration mode, and promote the synergistic and integrated mode of Hangzhou

city and counties, and urban and rural areas. Taking the adjustment of the industrial chain as a grip, it promotes cross-regional integration and sharing of resources among regional organisations, promotes the deep integration of regional sports industries and ultimately realises an integrated regional layout.

### **5.3 Big Data Create a Comprehensive and Optimal Talent Ecology of Training, Citation and Retention**

Use big data and cloud computing create an innovative ecosystem of talents that are well used and can be retained. It will attract more physical education teachers, retired athletes and other sports-related professionals to gather, so that the government can cultivate a team of talents who are qualified to manage and operate large-scale international sports events at a high level. Improve the assessment system and incentive mechanism for sports talents, strengthen international cooperation and exchange in the training of sports industry talents, build a talent service platform, and enhance the matching of talents, innovative and entrepreneurial projects with enterprises.

### **5.4 Encourage Technological Innovation and Cultivate Brand Enterprises**

Strengthen the application of big data on sports, enhance the level of digital innovation in the sports industry, tap into in-depth data on the sports industry, and promote scientific and targeted innovation and mode. Establish Smart Sports Industry clusters to facilitate the rational allocation of industrial relations and maximise regional mode effects, promote the accelerated leap to intelligence in the sports industry, and accelerate the application of various intelligent achievements on the ground. The government needs to guide enterprises to establish a sense of diversified innovation, create a large-scale innovation and research and mode team, and form independent brands with international competitiveness and influence.

## **6 Conclusion**

The epidemic has brought no small shock to Hangzhou's sports industry, but it has also accelerated the pace of smart transformation of the sports industry, and Smart Asian Games will promote the high-quality mode of an Smart Sports Industry system. Through the use of digital technology, the data of sports experience, the dynamisation of sports display and the contextualisation of sports socialisation will be realised. The mode of a mode model that integrates the sports industry online and offline will provide a new dynamic energy for its high-quality mode. However, with the growing multi-level, diversified and all-round demand of consumers, it will bring more challenges to the mode of Hangzhou's sports industry, and many problems will still surface in this mode process, which needs to be continuously summarised and innovated to comprehensively promote the high-speed mode of Smart Sports Industry.

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