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## **Realistic challenges and path options for the high-quality development of smart stadiums in China**

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### **Abstract**

The high-quality development of smart stadiums has become a key concern for the industry and academia. This study uses literature, fieldwork methods and logical analysis to sort out the reality of the development of intelligent stadiums in China and make corresponding recommendations. The study finds that the problems of high-quality construction of smart stadiums in China include: information technology treats the masses as a tame object and a test object for the safety valve, there is a paradox between algorithmic "de-deviation" and "personalised" sports services, and there is a lack of product standards and construction standards for smart stadium facilities. The following recommendations were made: strengthen the functional construction of venues

to promote the "penetration" of sports lifestyle awareness; strengthen the low-carbon construction of venues to improve sustainable development; and implement the new concept of "two developments" to promote the high-quality development of venues.

**Keywords: smart stadiums ; high-quality development ; realistic challenges ; path options ; China**

## **Introduction**

With the advent of the digital era, the iteration of digital technology accelerates the pace of innovation of traditional and sports stadium operations, and under the concept of technological empowerment, sports stadiums are moving towards the development of intelligent Digital technology, the Internet of Things, big data, blockchain and other emerging technologies are integrated into social scenarios to promote rapid and optimal allocation of resources and realize a new digital production and life model. As a product of the deep integration of digital information technology and traditional sports venues, smart sports venues are a new sports space for traditional sports venues integrating emerging technologies such as big data, blockchain, the Internet of Things and artificial intelligence, which is an inevitable choice for social development to crack the problems of poor service effectiveness, poor venue operation and resource allocation Therefore, on the basis of clarifying the important role of smart stadiums, this study analyzes and discusses the reality of smart stadiums in China to provide an important basis for the high-quality development of smart stadiums.

As an emerging product of the times, smart stadiums have received much attention from researchers and scholars in recent years. A literature search reveals that the relevant research results are mainly focused on the construction and intrinsic value of smart stadiums. Among them, scholars in the fields of architecture and kinesiology have conducted multi-dimensional analysis and argumentation. Many experts in architecture have described the impact on the intelligent construction of stadiums from single systems such as electronic display systems (Gan, 2005), media release and timing and scoring systems (Cai , 2009), sound reinforcement systems (Wang, 2010), security systems (Xu, 2011), and gas lighting systems (Xu, 2015) to enhance the scientific and normative nature of intelligent stadiums. Experts in the field of kinesiology conduct academic discussions on the intrinsic value of intelligent stadiums. Relevant scholars argue from the perspective of public management that smart stadiums can integrate multiple resources to the greatest extent ( Zhang,2017 ) , and achieve diversified development of sports venues. Foreign scholars all have different insights into smart stadiums, for example, in enhancing the attendance rate of stadiums and driving the growth of the sports industry(Santomier J P,2008) and

achieving sustainable development of venues and promoting urban governance(Zhang D,2014) etc has its own unique value.Based on understanding the existing research, we seek a path for the high-quality development of smart stadiums in China by drawing on foreign experience.

## **Methods**

This paper adopts the literature method and field survey method to conduct an in-depth study of smart sports venues in selected cities in China. Using the literature method to analyse the development of smart sports venues abroad, it points out that China should learn from the experience of successful countries and apply it to its own construction. The field survey method is used to summarise the characteristics of smart sports venues in selected cities, to diagnose the current situation of smart sports venues in China, and to propose corresponding countermeasures.

## **Results**

### **Information technology treats the masses as tames objects and test objects for safety valves**

Information storage is a necessary part of smart stadium operations, and storing information about exercise crowds can make it easier to provide the desired services to exercisers. However, improper use of information about venue personnel can have adverse effects, such as information leakage and information tampering. Existing technology providers involved in smart cities abroad have largely abandoned the idea of the citizen as a complete 'person' to be negotiated and conversed with, treating them instead as objects to be digitised and tracked, 'lab animals' to test and observe responses, objects to be monitored and objects of surveillance and correction. Some technology companies are developing and experimenting with 'gait recognition systems', which identify individuals by their body shape and walking posture, in the hope of achieving a 'long-range, non-sensitive, full-view, anti-camouflage' recognition rate of 94%, while others are scrambling for heartbeat recognition, microbial cell recognition, odour and even hip-print recognition. With breakthroughs in implantable chips and in vivo information devices, organs can begin to transmit information, tissues can send signals, DNA can be used for storage, and the body can be networked and linked with other out-of-body devices, the "Internet of People" is just around the corner. The epidermis is no longer a barrier to privacy in the body. Immediately following comprehensive observation and monitoring are experiments and corrections. Information technology

certainly brings beneficial technical support for intelligent stadiums, but it goes against the "people-oriented" construction concept. Therefore, the reasonable collection, use, and protection of information is the most important thing for the smooth operation of smart stadiums.

### **The paradox of algorithmic 'de-biasing' and 'personalised' sports services**

There is a paradox between algorithmic 'de-biasing' and 'personalised' sports services. Algorithmic "de-biasing" refers to the collection, storage and analysis of user information and the use of information technology to remove values that deviate from the normal range. The algorithmic society is characterised by weak spatialisation, predictability and differentiation, seemingly creating personalised and exclusive services for individuals, but in essence conquering the world with a single standard code, putting the user's needs into precise code operations and eliminating the largest range of deviations from normal civil practice. Smart stadiums help to reduce the waste of resources by collecting information from users to understand their interests and develop appropriate sports services. However, the algorithm of "de-deviation" can easily overlook those users' interests that deviate from the normal range, resulting in a lack of "personalised services" in the stadium. The original purpose of the construction of smart stadiums is to meet the interests of each user, to create a "personalised" sports service model, algorithmic "de-deviation" is contrary to its purpose, how to reasonably use information technology algorithms is the future of high-quality development of smart stadiums This is a real challenge for the future development of high quality smart stadiums.

### **Lack of product standards and construction standards for smart venue facilities**

Several experts proposed to pay attention to the current problem of lack of standards for smart sports products, safety standards and smart venues. Xue Yuan said that the lack of standards has become a major pain point in the development of smart sports. It is worth further exploring who will set the standards and how they will lead and regulate the industry. Shen Yanfei said that a major bottleneck in the current development of smart sports is the lack of national standards. Mainly involving three major types of standards: one is product standards, currently for sports smart wearable devices and other products, in industrial design, sports data collection and transmission and other aspects have not formed standards, product design is uneven; second is the security standards, sports wearable devices such as privacy data security issues deserve attention; third is the construction of smart venues standards, different cities of sports facilities suppliers vary greatly, the need for relevant The department needs to coordinate the planning(Song,2021). The lack of unified planning for the construction of smart sports venues has resulted in unclear implementation plans and construction models, resulting in a waste of resources. The lack of relevant standards has led to the lack of uniform technical standards and data format standards for the construction of information technology systems. It is easy to cause late system integration and data convergence and sharing difficulties. Therefore, how to unify the safety standards and product quality standards for the construction of smart stadiums is a direct challenge to the high-quality development of smart stadiums.

## **Discussion**

### **Enhancing the functionality of venues and promoting the "infiltration" of sporting lifestyle awareness**

With the continuous development of the economy and society has promoted the modernisation of residents' sports needs, from basic sports facilities to physical health concerns, physical fitness knowledge learning and sports events and activities. A smart stadium with high-quality development to meet the modern needs of residents is the task, and then to achieve the goal of sports life. Smart stadiums rely on the Internet of Things, big data, artificial intelligence and other emerging technologies to create their app, residents through the app operation online, understand the event activities and knowledge and skills learning through blockchain technology to the stadium app and VR equipment as the medium, breaking the dependence on the traditional scene sports, to achieve fitness scene "anytime, anywhere" The technology allows for the transformation of the fitness scene from anywhere to any time. The technology allows for online multi-person participation in events, enabling matches to be played anywhere, anytime, increasing the frequency of participation in exercise and further enabling residents to feel that 'sport is everywhere around them'. The use of the app platform is also an important part of the wisdom of the stadium. To meet the modern needs of residents for sports and fitness knowledge and information on sports events, the use of big data for resource integration, the establishment of a big data resource base for sports exercise guidance, sports event information and sports skills guidance, the sharing of sports exercise guidance information through exchange technology, the establishment of a shared data application platform for sports exercise, and the realisation of a data sharing and exchange system for smart stadiums. Finally, a multi-level, three-dimensional, visualized and intelligent data mining and deep application system are constructed to enhance the wisdom capacity of sports venues (Chai, 2022). Secondly, to enhance the health level of residents as the base point, improve the level of physical health services, sports medical services and national fitness services. In the Notice on Promoting the Free and Low-Charge Opening of Large Sports Complexes, it is proposed that sports complexes should provide free physical fitness testing services for no less than 3,000 people per year. In this context, sports centres in Nanjing and Changzhou in Jiangsu and Qinhuangdao in Hebei have set up physical fitness monitoring service centres to provide physical fitness monitoring services and scientific fitness guidance for residents (Zhang, 2020). Changzhou Olympic Sports Center not only has a physical fitness testing service centre to promote the physical health of residents but also has a sports hospital outpatient clinic to provide residents with portable sports medical services, providing new momentum to accelerate the integration of sports and medicine.

## **Strengthening the low-carbon nature of venues to improve sustainability**

In September 2022, China proposed to achieve "carbon peaking" by 2030 and "carbon neutrality" by 2060, referred to as the "double carbon" goal. The natural environment is a necessary condition and a prerequisite for physical exercise, and the "double carbon" goal is not only a new requirement for the development of sports in the new development stage but also a realistic need for sports to achieve sustainable development. In this context, the high-quality development of smart stadiums should adhere to the development of green buildings and low-carbon consumption and enhance the industry's awareness of green and sustainable development. In the construction process of the stadium, the first choice of environmentally friendly materials, for example, the Water Cube building periphery, uses environmental protection section ETFE (tetrafluoroethylene) membrane material, ETFE material is a lightweight, corrosion-resistant, high temperature and other characteristics of the new environmentally friendly building materials can be recycled. As ETFE has good light transmission, it is not necessary to use a lot of lighting equipment in the daytime, which has the effect of energy saving and emission reduction(Ren,2022).Secondly, the stadium operation process enhances the hardware and software operation aspects to achieve low-carbon environmental protection.Due to the large number of people in the venue, consuming a large number of water and electricity resources, the vast majority of venues do not use solar energy,and the venue's carbon dioxide emissions are large(Chen,2022). Therefore, venues can be set up with various types of IoT sensors and air measuring instruments to facilitate the capture of indoor and outdoor venue operation data and air quality, and thus inhale outdoor air autonomously to keep the venue a healthy and comfortable environment. Low-carbon consumption refers to the conservation of resources and energy consumption in people's daily lives. In terms of low-carbon development in the smart stadium service industry and cultivating low-carbon consumption. Adhering to the concept of low-carbon environmental sustainability, to improve the residents' awareness of green consumption; venues should mainly sell low-carbon environmental protection products to achieve green operation of the venues.

## **Implementing the new concept of "two developments" and promoting the high-quality development of venues**

Promoting high-quality development of sports must adhere to the organic combination of sports development and the development driven and promoted by sports(Bao,2022).Smart stadiums take traditional stadiums as the basis to achieve their transcendence with the technical support brought by information technology. With the transformation of people's contradictions, in order to meet people's diversified sports needs, smart stadiums are moving from a single to a diversified service approach, meeting the public's different needs for sports and creating a characteristic industrial ecological chain. The high-quality development of smart stadiums is based on the original functions,an integrated development with related industries, breaking the single inherent function of stadiums, providing diversified and one-stop sports services, and becoming a sports and leisure life centre for residents. The sports and leisure life centre does not only have the core function of sports exercise but should create a variety of service functions and establish an arena service system that integrates sports, shopping, entertainment, performance and conservation. In the construction of venues, attempts should be made to integrate and communicate with different industries, using the power of sport to promote industrial innovation and economic development through 'sport +' and '+ sport'. When communicating with the relevant

supporting industries, implement a combination of online and offline methods, providing convenient services such as mobile payment, path navigation and self-service ordering online, and providing menu-based and full-service offline to improve the stickiness of consumption; in the process of sports exercise, timely use of the data analysis function of smart stadiums, according to the acquired user information, the interests and needs of users. In the process of sports exercise, the data analysis function of the smart stadium can be used in time to segment and position the interests and needs of the users according to the information obtained, so as to provide personalised solutions and scientific fitness guidance for the sports exercisers, and at the same time develop derivative advertising and planning businesses according to the interests of the users to explore the potential value of the products(Wu,2019). Vigorously promote the combination of the sports industry with other industries, pay attention to market development and industrial diversification, lead the flow with the body, form a synergistic effect, and create a multi-service approach.

## **Conclusion**

As a new model for the future of sports venues, smart stadiums are in full swing at home and abroad to innovate, transform and upgrade sports venues. Nowadays, many traditional stadiums have been successfully transformed, but the development of smart stadiums is challenged by factors such as information security, diversified needs of residents and stadium construction standards. Therefore, at this stage, it is important to establish a new concept of "living sports" and "low carbon sports", to promote the high-quality development of smart stadiums, and to accelerate the construction of smart stadiums with higher quality.

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