J Inf Process Syst, Vol.20, No.3, pp.337~344, June 2024
https://doi.org/10.3745/JIPS.01.0102
ISSN 2092-805X (Electronic)

JOURNAL OF INFORMATION PROCESSING SYSTEMS JIPS

Construction of Sports Event Standard System in the Context of Big Data and Internet of Things

Jin Zha*

Abstract

It is a complex project to construct the standard system of sports events. Sports events standard system covers from the implementation plan to the evaluation work after the smooth implementation of sports events, involving many links. Large-scale sports events have extremely high media value. However, the successful organization and operation of large-scale sports events face many problems to be overcome, especially in terms of event safety. Although the organizers and organizers of large-scale events have invested many resources for the safe holding of sports events, violence similar to "football hooligans" in Europe is endless. At present, compared with Western countries, the standardization of sports events in China is low, and there is a problem of a late start and huge difference with Western developed countries. Knowing the construction of the standardization system's situation in China, we have summarized the data related to 15 sports events held in Chengdu is the last 5 years. By analyzing the problems in the process of holding these 15 events and the reflections of participants on the experience of sports events, the problems in the development of the standard system of sports events are discussed in depth. The final conclusion is that the system structure of China's sports events is not so good and athletes have a poor experience. China's sports event system still has many problems. Finally, we built a sports event standardization model using Internet of Things, and after a practical test we found that it has a good effect. Finally, we combined the current situation of sports event standardization system in China and put forward the following suggestions: laws and regulations related to the standard system of sports events must be formulated at the national level. The implementation level must strengthen the degree of integration of sports events and technology. To improve the quality of human resources in the management of sports events. The article puts forward targeted solutions, which play a great role in promoting the perfection and completeness of China's standard system for sports events. At the same time, it also promotes economic development and improves China's international status.

Keywords

Big Data, Internet of Things, Sports Events, Standardization System Construction

1. Introduction

Big data enables the storage and analysis of massive amounts of data and has a wide range of applications in today's era of data explosion. Clustering and analysis of massive data can increase the value density and improve the usability of the data. The birth of big data comes from the massive data acquired by the Internet of Things (IoT) sensors sensing the outside world, and the normal operation of the IoT must also rely on the ability to store and analyze big data. Big data IoT is complementary in the

Manuscript received February 14, 2023; first revision April 19, 2023; accepted May 4, 2023.
* **Corresponding Author:** Jin Zha (zhajin_edu@outlook.com)
Physical Education College of Zhengzhou University, Zhengzhou, China (zhajin_edu@outlook.com)

application process [1,2]. IoT is the driving force for the development of other industries and the IoT is also widely used in the standardization of sports events [2-4].

Building a standard system for sporting events is a complex project, which covers many aspects from the planning and execution of sporting events to the evaluation of sporting events after their successful execution. Since sports events cover many aspects and participants are complex, it is important to improve the generality of these standards so that they can be adapted to various sports events [5]. Generally speaking, the standard system of sports events includes basic standards, the standards of infrastructure used in the competition, the standards of human resources in the competition process, the standards of supporting services, the evaluation of the competition and the standards of grading.

The construction of a standardized system of sports events can promote the fundamental reform of the management system of sports events [6]. Constructing a sports events standardized system can promote the quality and economic benefits of sports events in China. A standard competition system can promote the comprehensive ability and management level of cities in our country. Combining big data technology and IoT technology to build a scientific sports event standardization system can improve the efficiency of all steps of the event process, make information collection more convenient, event authentication more humane, event evaluation more scientific, and improve the satisfaction of participants with their experience [7,8]. The model constructed in this paper has been verified to effectively improve the athletes' satisfaction with sports events, reduce disputes over the results of the competition, enhance the athletes' experience of participating in the competition, and also enhance the benefits of the organizers.

2. Research Review

2.1 Status of Research on Theory

Compared with western countries, China's sports standardization work started late and is still in the backward stage. Table 1 shows the current development.

Table 1. Display of standardization system of sports events at home and abroad

Project	Stage	Development status	Development goals	Implementation strategy
Abroad	Excellent	Lack of standardized standard system	Green, safe	Professional part certification
Domestic	Initial stage	Perfect system, sound technical standards, product specification.	Lack	China formulated the sports service certification in 2006-2016
Development of International Quality System ISO	Maturity stage	Mature development, widely used in sports services.	Organization, procedure, process, summary	Professional department certification

In the second half of 2009, the standardization of sports events was officially launched under the leadership of the Central Committee of the Party, with the implementation of multi-departmental organizations [9]. Since 2010, under the guidance of this document, the standardization work of sports events in China has shown a slow rise and has achieved initial results so far. Great achievements have been made in event facilities arrangement, event results assessment, event service quality, etc. [10].

The sports event service certification system is formally formed. The sports event certification system is implemented by the state and is going to be mandatory. To sprint. Sports service certification is executed by professionals, and the implementation process is strict. Sports event certification often involves the honor of sports players, etc., is an important part of the standardization of sports events [11].

2.2 The Significance of Developing the Standardization of Sports Events

The sports-related departments in most regions of China lack scientific management experience, reliable reference basis and scientific guidance system for improving the quality of sports events [12]. The construction of the standardization system of sports events can promote the quality as well as economic benefits of sports events in China. Improving the quality of sports events is the ultimate goal of building a standardized system for them [13]. This situation has an important role in promoting the development of our comprehensive capacity as well as the level of urban management. The progress of sports events in a region is made to its health standard, safety management, management capabilities. Sports events are often held as a result of integrated planning by multiple departments and are a reflection of the comprehensive management capabilities of a region [14,15].

3. Experimental Investigation

3.1 Investigation Process

In order to further understand the problems that need to be solved in the standard system of sports events in China, we summarized the data related to 15 sports events held in Chengdu is the last 5 years. By analyzing the problems existing in the process of holding these 15 title events, as well as the reflection of the relevant participants on the sense of experience of sports events to explore in depth the problems, which exists in the development of the standard sports events.

According to the layers of screening, we finally selected five indicators of quality experience, value experience, expectation, impression and loyalty as evaluation criteria. In order to ensure the accuracy of the experimental results, we evaluate the opinions after obtaining the evaluation opinions of the athletes. If the opinions have a lot of subjective factors, we ignore this opinion.

3.2 Findings

We first counted the problems that appeared in 15 sports events held in Chengdu in the past 5 years, and we extracted the items with comments greater than three. Table 2 shows the results of this part.

Table 2. Problem analysis

Problem	Frequency	Total proportion (%)
Post-match sportsmen have questions about assessment results	8	17.39
The physical examination items of athletes are not strict enough	9	19.57
Contest process transparent	7	15.22
Not enough value experience	5	10.87
Greatly different from their expectations	8	17.39
Life supply of athletes is not perfect	9	19.57

Secondly, our team conducted a questionnaire survey of, the athletes who participated in these competitions in recent years, and asked the athletes to rate these 15 competitions through the five evaluation indicators specified above. The specific data are shown in Fig. 1. The x-axis represents 15 athletes, and the y-axis represents the scores of these 15 athletes.

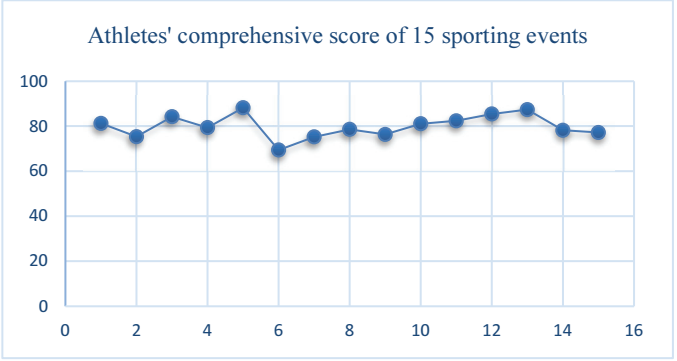

Fig. 1. Athletes' overall ratings of 15 sports events.

From Fig. 1, we can see that most of the athletes' ratings of sports events are concentrated between 70 and 80, which indicates that the athletes are not very satisfied with the process of holding sports events. Therefore, we can conclude that the current satisfaction of sports events in China is not high.

To sum up, through specific investigation and exploration, we have reached the following two conclusions:

(1) The system structure of China's sports events is not so good and athletes have a poor experience.

(2) China's sports event system still has many problems. For example, athletes have doubts about the evaluation results after the competition, the athletes' physical examination items are not strict enough, the competition process is transparent, the value experience is not enough, and their expectations are very different.

3.3 Reliability Analysis and Validity Analysis

Table 3 shows that the Kaiser-Meyer-Olkin (KMO) is 0.736, Table 4 shows that the reliability coefficient is 0.869, the reliability and validity are high, and the questionnaire is reasonable.

Table 3. Validity analysis

Project	F1	F2	F3	F4
EVB	3.196	1.287	2.898	2.999
EVRB (%)	19.62	9.64	10.90	8.97
CVERB (%)	16.61	88.24	67.13	47.08
EVA	3.88	1.35	4.26	2.15
VERA (%)	86.89	66.68	69.22	69.55
CVERA (%)	77.67	76.63	79.99	88.55
KMO		0.736		
BSA		0		

EVB=explained variation before, EVRB=explained variation ratio before, CVERB=cumulative explained variation before, EVA=explained variation after, VERA=variation explained ratio after, CVERA=cumulative explained variation after, BSA=business scenario analysis.

Table 4. Reliability test

Number	Question number	α
200	10	0.869

3.4 Investigation Significance

This experiment adopts the variance analysis method, trying to separate the variance caused by various conditional factors from the variance caused by the experimental error from the difference of the whole test results, and then test whether the influence of various conditional factors on the test results is significant. The variance method is quantitative analysis, which has clear significance and strong comparability, and has a certain effect on the analysis of the content of this paper.

4. Model Construction of Sports Events Standard System using Big Data and IoT

4.1 Introduction of the Model

The data obtained by the IoT sensor is transmitted to the information processing center, and using analyzing technology to get data from IoT sensor. If no anomaly exists, the data content of the point is stored in the database.

4.2 Explanation of Key Nouns

- Microsensors: Microdevices with sensing, processing, and communication capabilities that can collect or monitor data from a specific environment or object using microelectronic technology. Central controller refers to the core component responsible for coordinating and controlling the work of other components in a system, which usually includes a central processing unit (CPU) and some memory and interface circuits.
- KMO: It is a statistic used to evaluate the applicability of factor analysis. It reflects the common variance ratio between variables. The value range is 0 to 1. The closer to 1, the more appropriate the factor analysis is.

4.3 Key Steps

Key Step 1: We first use IoT sensors to obtain a large amount of data as shown in Eq. (1). The prerequisite for big data analysis and screening is to have sufficient data, which are mostly obtained by IoT sensors. As shown in Eq. (1), *B*pr is a series of processing functions for processing different data. *H*ir is the adjustment factor.

$$\sigma_p^2 = \frac{1}{n} B\mathrm{pr} + \alpha - \frac{1}{n} : H\mathrm{ir}. \tag{1}$$

Key Step 2: The sensor obtains the data, the data after the basic analysis, the processing operation is the formula (2). After this operation, we can use clustering algorithms, such as k-means, to perform clustering operations to obtain the deep connotation of the data.

$$\sigma_m^2 = \omega_1 Hir9R_1, R_m: + \omega_2 Hir9R_2, R_m: + \omega_n Hir9R_n, R_m \quad (2)$$

Key Step 3: In formula (3), we standardize the process of processing this data, and after this process, we can obtain a high-dimensional feature matrix for decision support.

$$Cov9R_i, R_m \coloneqq \beta_i \sigma_m^2 \quad (3)$$

Key Step 4: We use the data obtained in Step 3 to make the final decision to determine whether a4 (value or level in the data collected in Step 3) is established. If a4 is established, the respondents are in an abnormal state and need to perform the decision. If a4 is not established, the survey object is in a normal state.

$$\sum_{i=1}^{n} \omega_i \beta_i = 1 \quad (4)$$

4.4 The Test of Model

To noun effectiveness of this model of standard system for sports events our team selected a must-be organization that was conducting a sports event for an in-depth investigation and convinced them to use our model. After the experiment, it was verified that the model has good effect. Through the technical support, the building has improved the satisfaction level of the participating athletes to the sports events, reduced the disputes on the competition results, improved the athletes' experience, and also improved the benefits of the organizers.

5. Suggestions for the Construction of Sports Event Standard System

5.1 Laws and Regulations Related to the Standard System of Sports Events Must Be Formulated at the National Level

One of the reasons why sports events are prone to disputes is the lack of strict definition of some rules, which requires the national level to develop relevant regulations to prevent blocking from the root cause and blocking disputes from the root. At the same time, the national level system also provides a reference basis for event managers.

5.2 Implementation Level Must Strengthen the Degree of Integration of Sports Events and Technology

To change the status quo of backward sports event standard system in China, it is necessary to start from the technical perspective and sports. Use the advantages of modern information technology to gradually overcome the drawbacks of manual management. With the help of technology to promote the reform of the information system of the event.

5.3 Improve the Quality of Human Resources in Sports Event Management

Employees are the executors of the standardization system of sports events and play an important role in the whole process. Therefore, improving the quality of human resources in sports event management is the only way to promote the construction of sports event standardization system.

6. Conclusion

To understand the construction of the standard system's situation in China, we have summarized the data related to 15 sports events held in Chengdu is the last 5 years. By analyzing the problems existing in the process of holding these 15 title events, as well as the reflection of the relevant participants on the sense of experience of sports events to explore in depth the problems existing in the development of the standard system of sports events. The final conclusion is that (1) the system structure of China's sports event is not so good and athletes have a poor experience. (2) China's sports event system still have many problems. Finally we built a sports event standardization model using IoT as well as big data, and after practical test we found that it has good effect. Finally we combined the current situation of sports event standardization system in China and put forward corresponding suggestions. (1) Laws and regulations related to the standard system of sports events must be formulated at the national level. (2) The implementation level must strengthen the degree of integration of sport events and technology. (3) To improve the quality of human resources for sports event management.

Conflict of Interest

The author declare that they have no competing interests.

Funding

This study was supported by 2021 Henan Provincial Universities Young Backbone Teacher Training Program Project, (Project No. 2021GGJS183): Research and practical exploration of the coordinated development mechanism of community sports centers and college sports in China; 2021 Science and Technology Research Project of Henan Provincial Department of Science and Technology (Project No. 20210230927): Research on diversified collaborative governance model of Intelligent community sports center, and 2022 Henan Philosophy and Social Science Planning Project (2022BTY019): Research on Micro governance of China's Community Sports Center in the Smart Field.

References

[1] R. Zhang, X. Lv, and X. Zhou, “Research on the coupling between sports events and the development of cities hosting them: taking Chengdu as an example,” *Sichuan Sports Science*, vol. 41, no, 6, pp. 11-15+65, 2022. https://doi.org/10.13932/j.cnki.sctykx.2022.06.03

[2] Y. Liu, W. Geng, and L. Weng, “Research on the impact of sports event perception on urban construction performance: An empirical study based on Nanjing,” *Sports & Science*, vol. 43, no, 6, pp. 86-95+106, 2022.

[3] C. Zhai and Z Chu, “Research on tennis event brand logo: based on the perspective of semiotics theory” *Journal of Nanjing Institute of Physical Education*, vol. 21, no, 10, pp. 41-47, 2022.

[4] X. Nie, F. Yi, and Y. Qu, “Impact of the epidemic on traditional ethnic sports events and response strategies,” *Contemporary Sports Technology*, vol. 12, no, 30, pp. 146-149, 2022. https://doi.org/10.16655/j.cnki.2095-2813.2205-1579-9188

[5] M, Ma, "Research on the promotion of technology for the development of sports events," *Science & Technology Information*, vol. 20, no, 19, pp. 227-230, 2022. https://doi.org/10.16661/j.cnki.1672-3791.2204-5042-4760

[6] S. Li, S. Liu, and X. Liu, "Rebalancing order and vitality: building a complete sports event supervision system," *Journal of Shanghai Institute of Physical Education*, vol. 46, no. 9, pp. 20-29, 2022. https://doi.org/10.16099/j.sus.2021.10.12.0004

[7] Y. Liang, "Research on the influence of sports events on city image," Ph.D. dissertation, Zhejiang University of Technology, Hangzhou, China, 2022.

[8] J. Liu and W, Tang, "Research on the infringement issues and regulatory paths of sports event short video copyright," *Journal of Tongling University*, vol. 21, no, 4, pp. 62-65, 2022.

[9] Y. Qin and Z. Ren, "Visualization Analysis of Domestic Marathon Events Research Based on CiteSpace," *Sports Science and Technology*, vol. 43, no, 4, pp. 19-23, 2022.

[10] Z. Dai and J. You, "Optimization strategy of evaluation system for organizing large-scale sports events in my country under the background of normalized epidemic prevention and control," *Journal of Nanjing Institute of Physical Education*, vol. 21, no, 7, pp. 9-14, 2022.

[11] H. Zhu, "Research on the formation mechanism and intervention path of pro-environmental behavior of consumers in sports events," *Journal of Tianjin Institute of Physical Education*, vol. 37, no, 4, pp. 418-424, 2022.

[12] J. Gong and Y. Ming, "Comparative analysis and enlightenment of domestic and foreign sports events research based on Netdraw: from 2016 to 2020," *Contemporary Sports Technology*, vol. 12, no, 19, pp. 161-165, 2022. https://doi.org/10.16655/j.cnki.2095-2813.2112-1579-6081

[13] Q. Peng, "Research on human resource management of the 31st universiade: an event based on McKinsey 7S model," Ph.D. dissertation, Xihua University, Chengdu, China, 2022.

[14] J. Zhang, "Research on the construction of the index system for evaluating the operation of mass sports event organizers," Ph.D. dissertation, Shandong University, Jinan, China, 2022.

[15] T. Mu, "Study on the realistic dilemma and optimization path of Lianyungang in hosting large sports events under the urban catalyst theory," Ph.D. dissertation, Nanjing Sports Institute, Nanjing, China, 2022.

Jin Zha **https://orcid.org/0000-0001-8228-6396**

She was born in Luohe, Henan Province, China, in 1982. She received Doctor degree from Wuhan University of technology, and graduate degree from Wuhan University of Technology of Logistics Management. Now, she works in Physical Education College of Zhengzhou University. Her research interests include management, sport management.