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A Model of Enhancing Innovation and Technology and Competition Systems in the Fuzhou Dragon Boat: An Event Management and Service Quality Perspective

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Abstract. Dragon boat racing is a traditional sports event of the Chinese nation, which perfectly embodies the characteristics of Chinese dragon culture. Large-scale dragon boat races not only have a significant sports impact on the development of the dragon boat industry in Fuzhou but also play an essential role in heritage protection, tourism revitalization, and community cohesion. The research revealed that the scale of dragon boat races is commendable; however, the service business of the events is in a state of chaos, and some have questioned the fairness of the competition and the competition environment. Therefore, through literature review, the author found that large-scale sports events usually operate by applying event management theory and service quality theory, and there are many successful cases, such as multiple Olympic Games, World Cups, and marathons. However, these two theories have not been studied and verified in dragon boat races. Therefore, this study uses event management and service quality theory to explore whether service quality and competition systems can effectively improve the management of dragon boat races with the assistance of innovative technologies. A total of 920 valid questionnaires were collected from relevant personnel of large-scale events in Fuzhou. The data were analyzed using descriptive statistical analysis, reliability analysis, and validity analysis for evaluation. The research found that service quality and competition systems have a positive impact on the keyness of event management, and innovative technologies play a mediating role in the event management process.

Keywords: Event management, Service quality, Competition system, Innovative technology.

1. Introduction

Since the new century, dragon boat races have been flourishing in Chinese society, and the dragon boat culture has spread everywhere along with the drumbeats of the dragon boat races. Dragon boat sports have a long history. It perfectly captures the essence of Chinese culture and is one of the best traditional ethnic sports in China. There are many large-scale dragon boat competitions in China, but from the perspective of history, scale, and content, the competitions in Fuzhou are the most representative. The dragon boat competitions in Fuzhou over the past eight years have all become the largest-scale radio and television events broadcast by the country. Large-scale dragon boat competitions attract a large number of tourists and spectators, which contributes to the successful development of Fuzhou's tourism industry, as well as the success of related hotels, restaurants, transportation, and other service sectors. The effect of extensive dragon boat races on the Fuzhou dragon boat industry manifests not only in the economic aspect, but also in multiple areas, including cultural heritage, tourism revitalization, and community cohesion. Therefore, an in-depth analysis of the impact of Chinese dragon boat races on the Fuzhou dragon boat industry is helpful for a more comprehensive understanding of the all-encompassing mechanism by which sports events influence the commercial and cultural aspects of a city. Based on the background, purpose and subjects of this study, the competitive outcome of the dragon boat races is the worthiest of attention. The supporters of the events, the operation of the events, and the interested groups of the audience in the host location are closely interrelated. Their specific performances play a decisive role and significance in the sustainable holding and development of large-scale dragon boat events. What is closely related to the stakeholders is the quality of the event services and the completeness of the competition system, as well as whether the latest technologies are applied during the competition. Therefore, the purpose of this study is to explore the impact of the service quality and competition system of the dragon boat races in Fuzhou on the key aspects of event management, and also to investigate the mediating effect of innovative technologies, in order to deeply investigate the influence of event management on the effectiveness of the dragon boat races in Fuzhou.

2. Theoretical Foundation and Hypotheses

2.1. Theoretical foundation

(1) Event Management Theory

The theory of event management has been applied in many important international sports events to ensure the seamless operation of the events, improve the experience of participants, and promote the success of the events. Event management theory is a theoretical framework that examines and employs numerous management concepts and strategies, covering all aspects of the event lifecycle, to ensure the success of the event and achieve its goals in an orderly and scientific manner. Mccartney and Osti (2007) pointed out that an increasing number of destinations incorporate cultural events into their marketing and promotion strategies to enhance their appeal. For instance, the Dragon Boat Festival, which originated as a traditional Taoist ritual in a Chinese fishing community, has evolved into an international competition held annually in several major cities. However, the growing popularity of cultural events presents a paradox: the authenticity of the event may be compromised by excessive "super-evolution". This study explores the motivations and perceptions of participants in the International Dragon Boat Festival held in Macau (the cultural birthplace of the event) and Melbourne (where dragon boat racing has been successfully integrated into the local culture). However, participants' views vary depending on their cultural background. Therefore, given that the historical and ritual traditions of the Dragon Boat Festival are its unique marketing highlights, these changes have significant implications for the cultural viability of the event as a tourist destination. Pytharoulakis and Zouni (2020), in their study of the relationship between destination image, event image, and tourist satisfaction in the 34th Athens Marathon in Greece, also emphasized the crucial role of marketing in sports events. Tourists'

perceptions of the destination and the event, as well as their level of happiness, significantly influence their willingness to return. Thus, it is evident that the management efficiency of an event does indeed affect tourists' desire to revisit. Chutiphongdech and Vongsaroj (2022), in their investigation of the key success factors of sports events based on the Resource-Based View (RBV) theory, used a systematic review method to evaluate the key success variables in sports event management and found that the most important factors influencing the effectiveness of sports event management are organizational resources and reputation resources. This research provides a conceptual framework for the critical success criteria derived from the RBV theory. Also, it indicates that a successful sports event depends on many factors, including event planning, venue infrastructure, marketing effectiveness, interaction between the audience and the venue, and the cleanliness of the equipment, among others.

(2) Service Quality Theory

The well-known service quality gap analysis model PZB was established by American marketers Parasurama A, Zeithaml V.A., and Berry L.L. in 1985. The gap analysis model understands how the service quality environment is formed from the perspective of gaps. Through the accumulation of four gaps, it conducts an in-depth analysis of the service system, discusses the perceived actual gap, and the expected value of service quality. The service expectation maintains a five-point distance from the customer service perception, addressing the matching issues of relevant gaps and service quality during the delivery process. Enterprises should strive to narrow these four gaps to narrow the fifth gap and improve service quality. By using this model, we can identify the causes of quality problems and assist business managers in taking actions to enhance services.

Based on the connotation of service quality, the athlete's experience during the service process is compared with their pre-expected outcome, and ultimately, the athlete's perceived service quality is formed. This leads to the problem of matching between the athlete's expected value of service and the experience value. The service quality gap analysis model is very intuitive and effective for measuring this matching value. It can identify the gap between the provided service and the athlete's expectations, thereby guiding the event operation organization to promptly discover the causes of service errors and seek appropriate measures to make up for them. This will enable athletes to give higher evaluations of the event. Thus, it can enhance athletes' satisfaction with the service and their loyalty to the event (Parasuraman et al., 1988).

According to the "Major Event Quality for Spectator Sports" (MEQSS) framework constructed by Koenig-Lewis et al. (2018) for large-scale on-site sports events, event management (such as error handling, audience guidance, and security incident response) is an essential component of SEQSS. Its performance has a significant impact on the overall service quality score and satisfaction. Service quality has a high degree of correlation with audience satisfaction and loyalty behavior. Biscaia et al. (2023) conducted a meta-analysis that also verified this view. Although "event management" was not explicitly named as a variable, the meta-analysis included a large number of research segments involving emergency incident handling, service recovery, and audience complaint response. Thus, it can be concluded that there is a high correlation between service quality and event management, and scholars have analyzed it from different perspectives.

Based on previous studies on event management theory and service quality theory, four correlations can be summarized: 1) Event management is a key sub-dimension in the composition of service quality, whether in process management, complaint response, traffic control, or volunteer and security coordination, the event management mechanism directly affects the audience's perception of service quality; 2) Response speed and reliability are the core elements of event management and service quality, frequently appearing in meta-analyses and model studies; 3) Technologically supported event management provides new ideas, achieving efficient event response and traffic control through data-driven methods, thereby enhancing the service experience; 4) Cross-cultural and cross-national studies (such as Taiwan, Greece, Malaysia) show that the correlation between event management and service

quality is universal, but it is also affected by cultural and venue type differences.

2.2. Research Hypothesis

(1) The relationship between service quality, competition system and innovative technology

Service quality theory is a theoretical framework that studies and analyzes all aspects of service quality, including theories on how to evaluate, manage, and improve service quality. Parasuraman et al. (1988) pointed out that the five components of service quality are type, guarantee, responsiveness, empathy, and reliability. To improve the service quality of sports events, it is necessary to narrow the gap between audience expectations and their perception. Establishing an overall service quality concept, improving the management of event service personnel, improving the management of audience expectations and behavior guidance, improving the management of key points of event service, and paying attention to the reasonable use of service recovery in case of service errors, are all ways to enhance event management and the audience's perception of service quality. Enhancing service quality and setting the competition format to incorporate innovative concepts and technologies, promoting innovation and technology in event management. Therefore, this study proposes the following hypotheses:

H1: The quality of service positively influences the innovation and technology of the competition

H2: The completeness of the competition system positively influences the innovation and technology of the competition

(2) The crucial relationship between innovative technologies and key of event management

Hoff et al. (2022) proposed an overall framework for "sports event innovation", emphasizing the importance of technological advancement in promoting innovation in event management processes (such as process innovation, organizational system innovation, technological innovation, etc.), providing a theoretical basis for subsequent empirical research. The application of technology in the process of sports event management is diverse. Jha et al. (2022) emphasized that in top-level football events, IOT can be applied to video analysis for real-time monitoring of athlete and audience behaviors, event identification, safety hazard warnings, and optimization of competition operation management. Technology can also enhance organizational management in the event management field. Hoff et al. (2024) adopted an organizational innovation perspective, focusing on the innovative automated management, knowledge sharing mechanism, technical application obstacles, and strategies of the organizing committee in responding to large-scale sports events, revealing the key role of technology in event organization and management. After entering the "Internet +" era, more innovations and technologies have been integrated into the management process of sports events. The content of sports exhibitions has been widely disseminated, positively influencing the attendance rate of people at sports events and promoting the management of various events. Li (2025) emphasized the application mechanism of AI in the entire life cycle of sports event management (event preparation, security decision-making assistance, audience interaction, referee support, etc.), highlighting how the event management process has been transformed through intelligentization and dataization, and emphasizing the management transformation path of real-time response and personalized services. Through literature review, the relationship between innovative technologies and key aspects of sports event management can be summarized as follows: 1) AI and video analysis technology have increasingly integrated into the event identification, safety management, and process scheduling of sports events; 2) IoT and distributed computing, support, real-time data collection and monitoring provide pre-warning capabilities for event response; 3) Intelligent platforms and organizational innovation structures (Olympic Organizing Committee's technical strategies, venue digital management systems) are the key to promoting the modernization of event management processes; 4) Deep action detection technology (accurate event location, action recognition) has wide practicality in event decision-making, referee assistance, and emergency response; 5) Theoretical construction and concept research (event innovation conceptualization) provide framework support for building empirical research, and integrating

innovative technologies into the event management structure becomes the future research trend. Therefore, the following hypotheses are proposed:

H3: The integration of innovation and technology is positively influencing the key aspects of event management

(3) The crucial relationships between service quality, competition system and key of event management

Srisiri (2022) constructed a model of service quality, satisfaction, and expenditure. The study found that in the sports competition system, the quality of the event itself, the quality of the staff, and the quality of the venue facilities significantly influenced the satisfaction of participants, and thereby affected their expenditure behavior. This study highlights the critical role of system design in event management, particularly in terms of service quality perception; however, it lacks comprehensive coverage. Thus, it can be seen that services run through every stage of the event, both before and after the event. In the era of the service economy, the demands of live-streaming viewers are also constantly changing and developing. During this dynamic process, understanding the needs of viewers, improving the quality of event services, and satisfying them have become key challenges for event management organizations. Ho Voon et al. (2014) developed the SSQ (Sports Service Quality) scale applicable to comprehensive sports event venues. The five dimensions include core services, peripheral services, reliability, responsiveness, and value perception. The research shows that SSQ has a positive impact on emotional experience and user satisfaction, and emotional experience plays a mediating role between SSQ and satisfaction, reflecting the relationship between service quality and system operation management. The lack of a complete competition system mechanism seriously affected event organization management activities. A successful sports event depends on multiple factors, including the planning of the event, the infrastructure of the venue, the effectiveness of marketing, the interaction between the audience and the venue, and the cleanliness of the equipment (Chutiphongdech & Kampitak, 2022). Reviewing the relationships among the three, the design of the sports competition system serves as the foundational structure for the construction of service quality, encompassing elements such as venue layout, process arrangement, volunteer scheduling, safety guarantee, and information dissemination, which directly determine the perception of service quality; the multi-dimensional model of service quality (core service, reliability, responsiveness, empathy) is widely applicable and is commonly manifested in the interaction mechanism between services and the competition system in different event environments; the event management mechanism has a strong positive correlation with service quality. Whether it is complaint handling, event response process, safety management, or volunteer scheduling mechanism, they all directly affect the satisfaction and loyalty intentions of participants; emotional experience has an intermediary or regulatory role; emotional experience is the critical path connecting service quality and user satisfaction; digital technology supports the optimization of the event system, indirectly improving service quality, especially the improvement of the 5G platform system and information transmission mechanism, providing technical support for the systematization of service quality. Therefore, based on the above, this study makes the following reasonable assumptions:

H4: The quality of service has a positive impact on the key of event management

H5: The completeness of the competition system positively affects the key of event management

(4) The mediating role of innovation and technology

The application of innovative technologies in the Longzhou race in Fuzhou has significantly enhanced the entertainment value and participation of the event. By leveraging augmented reality (AR) and virtual reality (VR) technologies, spectators can experience the excitement of dragon boat racing. Drone aerial photography and live streaming for e-commerce also break geographical barriers, allowing more people to watch the event in real time. The use of interactive platforms and social media has increased audience engagement and expanded the impact of the event. Artificial intelligence (AI) and big data analysis technologies have improved scheduling and victory determination in event planning and management,

enhancing the fairness and efficiency of the event. Berber and Mollaoğulları (2020) proposed that the optimization of service quality relies on AI-driven facility management systems (such as intelligent ticket checking and crowd flow monitoring), and demonstrated through empirical research the impact of these systems on the satisfaction of participants. The integration of innovation and technology plays a mediating role. For instance, Kim et al. (2023) have verified that the performance expectations of technology have a mediating effect between technological functions and service service quality/experience; that is, the perception of technological utility influences the audience's evaluation of event management. Scholars often study the innovation technology dimension as a mediating variable. Al Mannai et al. (2025) have verified that the attitude towards the acceptance of innovative technology plays a mediating role between cultural background and technology adoption. Although it focuses on cultural factors, such systems are typical representatives of the mediating mechanism of technology management in large-scale events. Berber and Mollaoğulları (2020) explored the innovative narrative techniques (the interaction between the virtual host and the audience) in cultural festival live broadcasts to enhance the emotional dissemination effect of the event. The application of innovative technologies can also be seen in campus sports events or simulation competitions, which can strengthen sports consumption behavior by improving the experience and symbolic value, and indirectly drive participation intentions and satisfaction (Zhong et al., 2025). Thus, it can be seen that in the process of event management, the integration of innovation and technology can enable the relevant participants of the event to feel an improvement in service quality and the completeness of the competition system. The mediating role of innovative technologies in major sports events can be summarized as follows: referee technology, real-time tracking systems, interactive live streaming platforms, and intelligent venue configuration. All these technologies are the core mediating links along the path of "system/management→audience/participant experience→behavioral output"; the mediating role of technology usually depends on the perceived value, ease of use, participation sense, and emotional connection of the participants; such mechanisms apply to various large-scale sports event environments, including football, table tennis, marathons, and campus interactive competitions, etc. Therefore, this study proposes the following hypotheses:

H6: Innovation and technology play a mediating role between service quality and the key of event management

H7: Innovation and technology play a mediating role between the competition system and the key of event management

Based on the results of the aforementioned preliminary research and in combination with the event management research in the dragon boat race field, this paper selects five dimensions: Reliability, Assurance, Tangibles, Empathy and Responsiveness to measure the service quality of the event, and selects five dimensions: Event planning, Infrastructure, recreational activities, Competition equipment, Enforcement rules to measure the competition system of the event. A theoretical model is constructed with service quality and competition system as independent variables, innovation and technology as mediating variables, and event management key as the dependent variable. The specific model is shown in Figure 1.

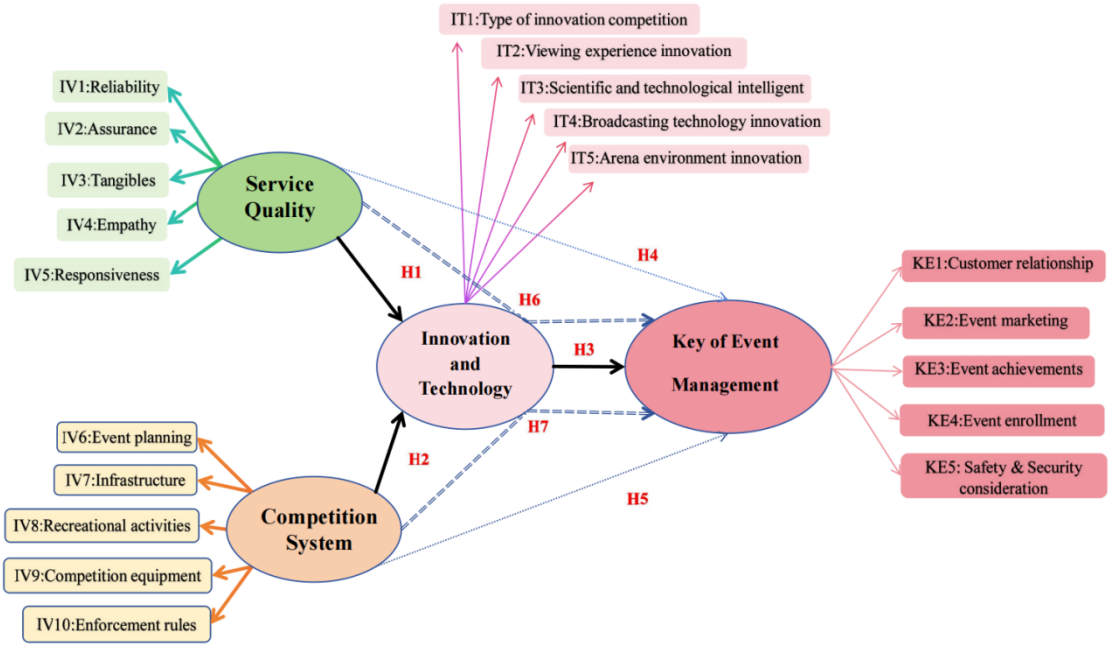

Fig. 1: Conceptual framework

3. Research Methodology

3.1. Sample and data collection

This study mainly collected the original data through questionnaire surveys. The population scope of the questionnaire survey was primarily divided into three parts. The first part consisted of the competition teams, including team leaders, coaches, and team athletes; the second part comprised the on-site staff, including referees, volunteers, and receptionists; the third part was the audience. After conducting field research on the Fuzhou Cultural Festival and Tourism Bureau, it was found that the number of participants in the 2024 Fuzhou International Dragon Boat Race reached over 150,000. Therefore, this study followed Israel (1992)'s suggestion, that is, the total number of questionnaires distributed should be at least 900.

In the variable design phase of this study, a qualitative research approach was used to determine the feasibility of each variable. This was followed by multiple rounds of expert scoring for variable validity (the IOC phase) to ensure that the scale was suitable for the survey in the Chinese context. Eventually, the questionnaire was determined. Finally, using the random stratified sampling method, questionnaires were distributed in advance to the leader groups, coach groups, athlete groups, Longzhou fan groups, and nearby residents' communities through emails and WeChat messages for the survey. A total of 1,008 questionnaires were sent out, and all 1,008 were returned. The collected questionnaire results were screened one by one, excluding some incomplete or duplicate questionnaires. Eventually, 920 valid questionnaires were obtained, with an effective questionnaire rate of 91.27%.

3.2. Measurement of variables

In this study, the variable measurements utilized the Likert 5-point scale. The scale regarding service quality was based on the scale developed by Parasuraman et al. (1988), consisting of five dimensions: Reliability, Assurance, Tangibles, Empathy, and Responsiveness, with a total of 25 items. The measurement of the competition system was based on the research by Chutiphongdech and Kampitak (2022), including five dimensions: Event planning, Infrastructure, Recreational activities, Competition

equipment, and Enforcement rules, with a total of 15 items. Innovation and technology are referred to in the research by Kumpe and Bolwijn (1994), which includes a total of 5 items. Event management key points, combined with the research by Prahalad and Ramaswamy (2004), also include a total of 5 items. This study collected data through a questionnaire survey. The first part of the questionnaire collected basic information about the respondents (including gender, age, role, etc.), while the second part focused on the variables. The questionnaire was compiled based on the English references.

This study used specific numbers to replace the corresponding variables. Service quality was IV1 - IV5, the competition system was IV6 - IV10, innovation and technology were IT1 - IT5, and event management key points were KE1 - KE5.

3.3. Data analysis methods and procedures

This study mainly employs quantitative research methods, using statistical software SPSS 26.0 and Amos 26.0 to analyse the key factors influencing the management of dragon boat races. The specific analysis is as follows: Firstly, a descriptive analysis was conducted to investigate the demographic characteristics of the respondents, including gender, age, educational background, annual salary, and professional title. Secondly, reliability and validity analyses were carried out. The reliability test used Cronbach's coefficient, which is a method for evaluating internal consistency. The value range is from 0 (no internal consistency) to 1 (complete consistency), and a value between 0.8 and 0.95 can be considered a high reliability level for the questionnaire. At the same time, validity analysis was conducted. Confirmatory Factor Analysis (CFA) was performed on the scales of each variable to verify the validity of the scale structure. Firstly, the test results of chi-square degrees of freedom ratio, RMSEA, IFI, TLI, CFI, and AGFI were used to verify the model's fit. Then, the values of AVE and CR of the scale were further tested to determine the convergent validity and discriminant validity of the scale dimensions, thereby judging the validity of the scale. Secondly, Pearson correlation analysis was used to explore the relationships between multiple variables to test whether they are correlated. Finally, the structural equation model was used to test the proposed hypotheses. Firstly, the structural equation model between variables was tested for good fit, and then the path relationships were tested.

4. Data Analysis and Research Results

4.1. Descriptive statistical analysis

For the collected data, this study conducted a preliminary analysis using the statistical software SPSS26.0. According to Table 1, all 920 participants had either participated in or witnessed the 2024 Fuzhou International Dragon Boat Race, indicating that our survey subjects were highly targeted. In terms of gender, 59.5% were male and 40.5% were female. Regarding the place of residence, the respondents were mostly local people in Fuzhou, accounting for 69.6%. In terms of age, the number of people under 40 was higher, reaching 85.5%, which also matched the survey topic, as young people mostly favored dragon boat races. Regarding the role of the dragon boat competition, the scope of the survey subjects was also broad, facilitating the collection of opinions from different audiences with different survey themes. The largest group was the audience, accounting for 45.3%, which was consistent with the distribution of the sampling group. The second largest group was the athletes, accounting for 21%, and they were also the most intuitive subjects for evaluating the service quality, competition system, innovative technology, and key aspects of event management. The proportions of volunteers, managers, coaches, referees, staff, and other on-site personnel were 12.2%, 7.7%, 5.8%, 5.2%, and 2.8% respectively. For the 2024 Fuzhou International Dragon Boat Championship, 42.83% had participated, 10.43% had not formed a team, and 46.74% had not joined a dragon boat team, indicating that the survey took into account various aspects such as service quality, competition system, innovative technology, and key elements of event management.

Table 1. Descriptive Statistical Analysis of Population Variables

Demographic variable	Option	Frequency	Proportion
Have you attended or watched the 2024 Fuzhou International Dragon Boat Race	Yes	920	100%
	No	0	0%
Gender	Male	547	59.5%
	Female	373	40.5%
Hometown do you live in	Fuzhou locals	643	69.9%
	Foreigners who have lived in Fuzhou for less than six months	63	6.8%
	Out-of-towners who have lived in Fuzhou for more than six months	214	23.3%
Your age	Under 18 years old	133	14.5%
	18 to 25	270	29.3%
	26 to 30	260	28.3%
	31 to 40	123	13.4%
	41 to 50	64	7%
	51 to 60	30	3.3%
	60 or more	40	4.3%
What is your role in the 2024 Fuzhou International Dragon Boat Race	Referees	53	5.8%
	Manager and Coach	71	7.7%
	Athletes	193	21%
	Volunteers	112	12.2%
	Audience	417	45.3%
	Staff	48	5.2%
	Other on-site personnel	26	2.8%
Is your dragon boat team participating in the 2024 Fuzhou International Dragon Boat Tournament	Participated	394	42.83%
	Team, not participating	96	10.43%
	Did not join the dragon boat team	430	46.74%

Furthermore, to ensure the accuracy of the data, multiple types of descriptive analyses should be conducted on the samples, including mean, median, standard deviation, skewness, kurtosis, etc. Therefore, the descriptive statistical analysis of the sample data is an essential prerequisite for determining whether to proceed with further research, and also determines the correctness of the statistical analysis results.

Table 2 presents the descriptive statistical analysis and normality test results of the factors used in this study. The results show that the mean scores of each dimension and variable are between 4 and 5, with a median of 4 and relatively small standard deviations, indicating that the sample data is relatively concentrated. Moreover, the scale scoring method ranges from 1 to 5, indicating that the target population of this study has an understanding of service quality (reliability, assurance, tangibles, empathy, responsiveness), competition system (event planning, infrastructure, recreational activities, competition equipment, enforcement rules), innovation and technology, and key of event management at a medium or above level. Additionally, the overall mean of each variable is above 4, indicating that the sample data scores are high and the research subjects have a positive understanding of the

questionnaire. The overall standard deviation of each variable is slight, indicating that the values in the surveyed data set are relatively close, which can help to predict and estimate the overall parameters more accurately. The absolute values of skewness and kurtosis coefficients are less than 3 and 8, respectively, conforming to an approximately normal distribution.

Table 2. Descriptive Statistics of Each Dimension and Results of Normality Test of Measurement Items

Dimension	Measurement item	Mean	Median	Standard deviation	Skewness	Kurtosis	Population mean	Population standard deviation
Reliability	RB1	4.31	4	0.698	-0.699	0.031	4.3583	0.49713
	RB2	4.34	4	0.625	-0.67	0.78		
	RB3	4.38	4	0.605	-0.71	1.058		
	RB4	4.41	4	0.62	-0.87	1.309		
	RB5	4.36	4	0.642	-0.787	0.908		
Assurance	AS1	4.32	4	0.627	-0.602	0.576	4.2326	0.48082
	AS2	4.18	4	0.64	-0.583	1.078		
	AS3	4.24	4	0.606	-0.501	1.044		
	AS4	4.27	4	0.662	-0.653	0.593		
	AS5	4.15	4	0.63	-0.595	1.385		
Tangibles	TB1	4.21	4	0.728	-0.654	0.134	4.2052	0.52991
	TB2	4.2	4	0.689	-0.617	0.478		
	TB3	4.21	4	0.67	-0.57	0.486		
	TB4	4.24	4	0.699	-0.767	0.782		
	TB5	4.18	4	0.708	-0.651	0.491		
Empathy	ET1	4.05	4	0.7207	-0.449	0.064	4.1109	0.56125
	ET2	4.11	4	0.7	-0.533	0.373		
	ET3	4.08	4	0.7003	-0.487	0.301		
	ET4	4.16	4	0.7397	-0.682	0.364		
	ET5	4.16	4	0.7465	-0.752	0.555		
Responsiveness	RS1	4.16	4	0.7397	-0.66	0.298	4.1391	0.64123
	RS2	4.1	4	0.7093	-0.581	0.479		
	RS3	4.19	4	0.7251	-0.693	0.436		
	RS4	4.13	4	0.851	-0.802	0.065		
	RS5	4.13	4	0.8582	-0.787	-0.015		
Event planning	EP1	4.19	4	0.6976	-0.637	0.508	4.1551	0.61702
	EP2	4.18	4	0.7029	-0.701	0.721		
	EP3	4.1	4	0.7376	-0.615	0.339		
Infrastructure	IS1	4.18	4	0.7178	-0.735	0.706	4.1855	0.61821
	IS2	4.19	4	0.7256	-0.712	0.499		
	IS3	4.19	4	0.7432	-0.79	0.598		
Recreational activities	RA1	4.18	4	0.7066	-0.633	0.44	4.1746	0.62641
	RA2	4.16	4	0.7338	-0.705	0.499		
	RA3	4.19	4	0.7734	-0.794	0.366		
Competition equipment	CE1	4.12	4	0.7145	-0.543	0.225	4.1054	0.6915
	CE2	4.09	4	0.7657	-0.628	0.176		
	CE3	4.1	4	0.758	-0.587	0.092		

Enforcement rules	ER1	4.18	4	0.7183	-0.63	0.301	4.1638	0.67459
	ER2	4.15	4	0.7821	-0.742	0.247		
	ER3	4.16	4	0.8381	-0.808	0.072		
Innovation and Technology	IT1	4.3	4	0.6951	-0.787	0.57	4.2622	0.50689
	IT2	4.26	4	0.6543	-0.718	1.1		
	IT3	4.29	4	0.6317	-0.485	0.108		
	IT4	4.28	4	0.65	-0.728	1.1		
	IT5	4.19	4	0.7104	-0.688	0.562		
Key of Event Management	KE1	4.29	4	0.6947	-0.773	0.556	4.2617	0.50513
	KE2	4.24	4	0.6514	-0.697	1.117		
	KE3	4.29	4	0.6265	-0.474	0.147		
	KE4	4.28	4	0.6504	-0.731	1.097		
	KE5	4.2	4	0.7124	-0.713	0.576		

4.2. Reliability and Validity

Since the main elements of this study were tested using questionnaires, checking the data quality of the measurement results is the crucial first step in ensuring the significance of further analysis. Most studies recommend using the Cronbach's Alpha coefficient (Molloy, 2005) to assess reliability. The value of Cronbach's alpha coefficient ranges from 0 to 1. Reliability increases as the value of the test result coefficient rises. Table 3 shows that the Cronbach's alpha coefficients of all variables are above 0.8, indicating that the data is highly reliable. Additionally, the total validity of all variables is 0.899, which is close to the highly reliable standard. The results indicate that the scale used in this study has been tested and has acceptable internal consistency and reliability.

Since the scales used in this study contain both self-compiled and modified components, exploratory and confirmatory factor analyses are necessary conditions for validity analysis. According to previous research, we expected that the measurement of the variables could be decomposed into 12 elements. Therefore, exploratory factor analysis is needed to examine the internal structure of each variable, to determine the number of factors influencing the observed variables and the degree of correlation between each factor and each observed variable. As shown in Table 4, the KMO value is 0.864, which is higher than 0.6, indicating that the questionnaire scale is very suitable for factor analysis. Secondly, significance tests with a 1% significance level prove that this scale is applicable for validity investigation. The approximate chi-square is 27,255.96, the degrees of freedom are 1225, and the significance is 0, which is less than 0.001.

Table 3. Reliability Analysis Table of Each Variable

Variables		Cronbach's Alpha	Number of terms
IV1	Reliability	0.837	5
IV2	Assurance	0.816	5
IV3	Tangibles	0.815	5
IV4	Empathy	0.837	5
IV5	Responsiveness	0.881	5
Service Quality		0.895	25
IV6	Event planning	0.832	3
IV7	Infrastructure	0.805	3
IV8	Recreational activities	0.805	3
IV9	Competition equipment	0.917	3
IV10	Enforcement rules	0.830	3
Competition System		0.804	15

Innovation and Technology	0.815	5
Key of Event Management	0.813	5
Total	0.899	50

Table 4. KMO and Bartlett's Test

Sample the Kaiser-Meyer-Olkin measure of adequacy.		0.864
Bartlett's sphericity test	Approximate chi-square	27255.963
	df	1225
	Sig.	0

Further exploratory analysis of the sample and principal component analysis to extract factors resulted in a cumulative variance contribution rate of 69.081%, exceeding 60%. This indicates that the original data has been adequately reflected. Using the orthogonal rotation method, a total of 12 standard components were finally reconstructed. The composition of each factor is consistent with the prediction results of the model, suggesting that this model has strong construct validity.

Next, confirmatory factor analysis was conducted. The first step was to perform a model fit test, and the result showed that CMIN/DF = 4.831, within the reasonable range of 3-5, and RMSEA=0.044, within the reasonable range of <0.08. In addition, the index values of GFI, IFI, TLI, and CFI are at an excellent level. Therefore, the results of this analysis show that the model has a good fit, which proves that the scale structure is valid.

The second step involves conducting tests for convergent validity and composite validity. The results are shown in Table 6. It can be seen that the AVE and CR values of the dimensions in this validity test exceed 0.5 and 0.7, respectively. This indicates that this dimension has strong composite reliability and convergent validity.

Table 5. Total Variance of Interpretation

Ingredient	Initial eigenvalue			Extract sum of squares and load			Rotate the sum of squares to load		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	10.923	21.847	21.847	10.923	21.847	21.847	6.68	13.36	13.36
2	3.838	7.675	29.522	3.838	7.675	29.522	3.521	7.042	20.403
3	3.044	6.089	35.611	3.044	6.089	35.611	3.294	6.589	26.992
4	2.951	5.903	41.514	2.951	5.903	41.514	2.96	5.92	32.911
5	2.499	4.998	46.512	2.499	4.998	46.512	2.924	5.848	38.759
6	2.294	4.589	51.1	2.294	4.589	51.1	2.921	5.843	44.602
7	1.97	3.94	55.041	1.97	3.94	55.041	2.8	5.6	50.202
8	1.806	3.613	58.654	1.806	3.613	58.654	2.318	4.636	54.838
9	1.704	3.408	62.061	1.704	3.408	62.061	2.219	4.439	59.277
10	1.424	2.848	64.909	1.424	2.848	64.909	2.203	4.405	63.682
11	1.059	2.117	67.026	1.059	2.117	67.026	1.373	2.745	66.427
12	1.027	2.055	69.081	1.027	2.055	69.081	1.327	2.654	69.081
13	0.778	1.556	70.636						
14	0.756	1.511	72.148						
15	0.733	1.466	73.614						

Table 6. Convergence Validity and Combination Reliability Test of Scale Dimension

Path coefficient			Estimate	AVE	CR
IV1	<---	Service Quality	0.845	0.706	0.920
IV2	<---	Service Quality	0.713		
IV3	<---	Service Quality	0.801		
IV4	<---	Service Quality	0.98		

IV5	<---	Service Quality	0.839		
IV6	<---	Competition System	0.979	0.934	0.986
IV7	<---	Competition System	0.994		
IV8	<---	Competition System	0.998		
IV9	<---	Competition System	0.901		
IV10	<---	Competition System	0.957		
IT1	<---	Innovation and Technology	0.769	0.575	0.870
IT2	<---	Innovation and Technology	0.784		
IT3	<---	Innovation and Technology	0.671		
IT4	<---	Innovation and Technology	0.683		
IT5	<---	Innovation and Technology	0.866		
KE1	<---	Key of Event Management	0.849	0.625	0.891
KE2	<---	Key of Event Management	0.98		
KE3	<---	Key of Event Management	0.685		
KE4	<---	Key of Event Management	0.693		
KE5	<---	Key of Event Management	0.702		

The third step involves conducting a validity difference test, as shown in Table 7. Every dimension in this differential validity test has good differential validity, where the standardized correlation coefficients between each dimension are all less than the square root of the AVE value corresponding to the dimension.

Table 7. Differential Validity Test Results of Each Dimension

Variable	Service Quality	Competition System	Innovation and Technology	Key of Event Management
Service Quality	0.706			
Competition System	0.039	0.934		
Innovation and Technology	0.208	0.100	0.575	
Key of Event Management	0.34	0.023	0.327	0.625
Square root of AVE	0.840	0.966	0.758	0.791

4.3. Correlation analysis

It can be seen from Table 8 that service quality, competition system, innovation and technology, and key event management are significantly positively correlated with each other ($p<0.01$). In addition, the maximum correlation coefficient between any two variables is 0.654 (<0.8), indicating no serious collinearity problem between the variables.

Table 8. Pearson correlation analyses

Variable	Service Quality	Competition System	Innovation and Technology	Key of Event Management
Service Quality	1			
Competition System	.654**	1		

Innovation and Technology	.091**	.087**	1	
Key of Event Management	.507**	.042**	.402**	1
** There was a significant correlation at the.01 level (bilateral).				

4.4. Structural equation model (SEM) analysis

The structural equation model analysis will be conducted in two steps. The first step involves the model fitting test, and the result shows that CMIN/DF = 4.81, within the reasonable range of 3-5, and RMSEA=0.064, within the excellent range of <0.08. In addition, the index values of GFI, IFI, TLI, and CFI are all at an exceptional level of 0.9. Therefore, the comprehensive analysis results show that the SEM model of service quality, competition system, innovation and technology, and the key of event management has a good fit, which can indirectly prove the validity of this scale structure.

The second step is the SEM model path test, according to the results in Table 9, in the path hypothesis relationship test of this study, first, service quality significantly positively affects innovation and technology (β=0.404, P<0.001), so hypothesis H1 is accepted; Second, the competition system significantly positively affects key of event management (β=0.093, P<0.01), so H2 is assumed to be accepted; Third, innovation and technology significantly positively affect key of event management (β =0.286, P<0.001), so hypothesis H3 is accepted; Fourth, service quality significantly positively affects key of event management (β=0.062, P<0.05), so hypothesis H4 is accepted; Fifth, the competition system significantly positively affects the event management key (β=0.308, P<0.001), so the hypothesis H5 is accepted.

Additionally, the mediating effect was tested using the stepwise regression method.

(1)A three-step model of service quality - innovation and Technology - the key to event management was established for the test. The results showed that in the first step of the test, the independent variable had a significant influence on the dependent variable ($\beta = 0.217$, $p < 0.001$), indicating that the total effect was valid. In the second step of the test, the independent variable had a significant influence on the mediating variable ($\beta = 0.324$, $p < 0.001$). In the third step of the test, the impact of the independent variable on the dependent variable was not significant ($\beta = 0.007$, $p > 0.05$). Innovation and Technology had a considerable influence on the Key of Event Management ($\beta = 0.646$, $p < 0.001$). Therefore, it was demonstrated that the mediating effect of Innovation and Technology in the model was valid. Thus, H6 was established.

(2) The three-step model of establishing the competition system - innovation and Technology - key to event management was tested. In the first step of the test, the independent variable had a significant influence on the dependent variable ($\beta = 0.113$, $p < 0.01$), indicating that the total effect was valid. In the second step of the test, the independent variable had a significant influence on the mediating variable ($\beta = 0.161$, $p < 0.001$). In the third step of the test, the impact of the independent variable on the dependent variable was not significant ($\beta = 0.009$, $p > 0.05$). Innovation and Technology had a considerable influence on Key of Event Management ($\beta = 0.647$, $p < 0.001$), thus indicating that the mediating role of Innovation and Technology in the model was valid. Therefore, H7 was established.

Table 9. The Result of SEM Model Path Test

Path coefficient			Estimate	S.E.	C.R.	P
Innovation and Technology	<---	Service Quality	0.404	0.039	5.75	***
Innovation and Technology	<---	Competitio n System	0.093	0.028	2.693	**

Key of Event Management	<---	Innovation and Technology	0.286	0.029	8.447	***
Key of Event Management	<---	Service Quality	0.274	0.028	7.706	***
Key of Event Management	<---	Competition System	0.062	0.02	4.512	*

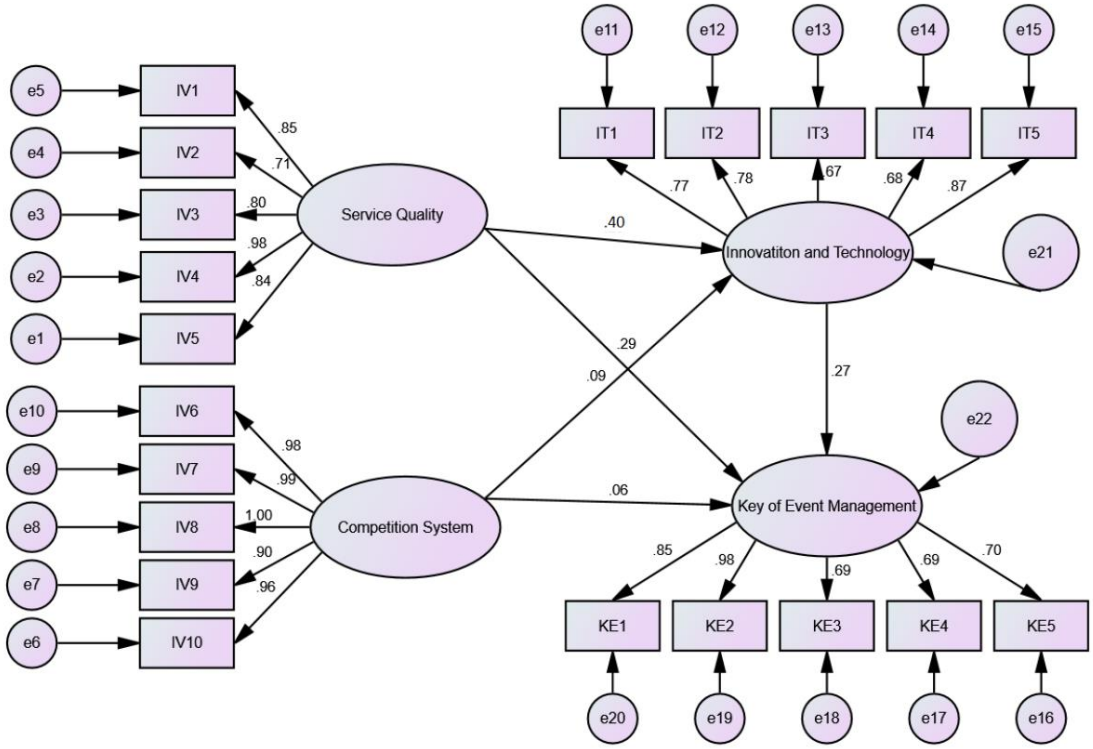

Fig. 2 SEM Model Diagram

5. Discussion

study aims to explore the key influencing factors in the management process of dragon boat racing events. To this end, this study examines the relationships among service quality, competition system, innovation and technology, and key event management aspects. From the results, it can be seen that the core of event management is to establish a "service, system, technology" collaborative driving model. Based on the research results, quality service should be regarded as a touchpoint. H1 confirms that high-quality service not only improves the satisfaction of participants and visitors, but also supports technological innovation, which is consistent with the viewpoint of Biscaia et al. (2021). The event organizers can enhance service efficiency by introducing intelligent service systems such as online registration, real-time information push, and smart navigation (Hoff et al., 2023).

The competition system has a significant positive impact on innovative technologies, as confirmed by H2. This suggests that optimizing the competition system can effectively activate participants' intrinsic motivation and establish innovative incentive policies, such as supporting the incubation of

technological patents (Ho Voon et al., 2014). A scientific competition system can stimulate the enthusiasm of participants and organizers, encouraging them to innovate in technology and strategies. By establishing a technological innovation reward mechanism or introducing a multi-level competition model, it is encouraged for participants to develop more advanced technologies and methods, thereby enhancing the overall technical level of dragon boat races (Xu et al., 2025). Therefore, with the addition of innovation and technology, the management of dragon boat events has been improved. H3 is acceptable, that is, innovation and technology have a significant positive impact on event management.

The research results indicate that the improvement of service quality can effectively enhance the management of the event. This supports H4. This suggests that the event participants enjoyed satisfactory services during the event process, which is more conducive to the dissemination and management of the event. This is consistent with Kim et al. (2023)'s conclusion that when event participants have higher scores in safety, empathy, reliability, responsiveness, and tangibility, they have a higher level of service quality, which effectively promotes the organization and management of sports events. A well-designed competition system is a key success factor in sports event management (Chutiphongdech & Vongsaroj, 2022). Furthermore, H5 supports the notion that competition system factors, including event planning, infrastructure, entertainment activities, competition equipment, and enforcement rules, significantly impact the management of sports events.

The research results indicate that the improvement of service quality and the assistance of innovative technologies have a positive impact on event management. H6 is supported. This is also demonstrated in Li (2025)'s study, where it was proved that service quality indirectly enhances the core elements of event management by promoting the application of innovative technologies. An efficient and accurate registration system and real-time information push services (service quality) are based on advanced innovative technologies. The application of these technologies further optimizes the event management process (core elements), and innovation and technology play an intermediary role. H7 is also supported, that is, innovative technologies play an intermediary role between the competition system and the key aspects of event management. The competition system indirectly optimizes the core elements of event management by promoting technological innovation. This is consistent with the viewpoint proposed by Günel and Duyan (2020), that is, by integrating more innovative technologies into sports events, more scientific evaluations of athletes' performance can be achieved. At the same time, fair competition rules and incentive mechanisms (competition system) encourage participants to adopt new technologies (innovative technologies), and the application of these technologies further improves the efficiency and quality of event management (core elements).

5.1. Theoretical Implications

This study enriches the connotations of service quality theory and event management theory, deepening the academic understanding of the influence relationships among service quality, competition systems, innovation and technology, as well as event management key factors. At the same time, this study also provides important theoretical support for further in-depth exploration of the constraints in the process of sports event management.

5.2. Practical Implications

The dragon boat race event, as a sports activity that combines traditional cultural connotations with modern competitive spirit, the improvement of its management quality and competition system is of great significance for promoting local cultural tourism integration, enhancing cultural identity, and promoting the development of the sports industry. Based on empirical analysis, this study explores the role of service quality and competition system in the management of dragon boat races. It focuses on the dynamic mediating effect of innovation and technology. It provides the following specific suggestions for relevant practitioners: Organizers should establish standardized service processes, such

as improving operational efficiency through digital registration systems, intelligent timing technology, and real-time data feedback. At the same time, AR/VR technology can be introduced to enhance the interactive experience for spectators, or big data analysis can be used to optimize race course design and crowd management. However, it is necessary to note that the application of technology should be combined with local actual conditions to avoid neglecting the creation of a traditional cultural atmosphere due to excessive reliance on technology. Cultural managers can draw on the "dynamic scoring system" or "graded event system" proposed in this study to balance competitiveness and public participation. In addition, it is recommended to strengthen cultural attributes through supporting activities such as intangible cultural heritage exhibitions and folk performances, but be cautious of the dilution of traditional rituals due to commercialization. It is necessary to retain core cultural symbols in innovation. Empirical data show that the service quality of the event is significantly positively correlated with local tourism revenue. The tourism department can incorporate dragon boat races into regional tourism routes, develop "events + study tours" and "events + eco-tourism" composite products, and use social media for precise marketing. Sponsors can choose cooperation points related to technological upgrades or cultural dissemination based on the research conclusions (such as sponsorship of intelligent equipment, co-branding with intangible cultural heritage IPs). At the same time, local governments need to provide support at the policy level. The suggestions of this study are based on specific samples (such as event data from a particular region), and their universality needs to be verified in combination with cultural differences and resource endowments in different regions. In addition, technological innovation may face cost or talent barriers. It is recommended to implement it in stages and pay attention to the balance between traditional management and modern tools. Future research can further explore differentiated strategies for different-sized events or longitudinally track the long-term effects of technological intervention.

6. Conclusion

This research investigation revealed numerous problems in the organization, planning, and management of Fuzhou City's large-scale dragon boat races. The main problems were concentrated in areas such as event safety, fairness of the event, poor infrastructure of the venues, and low quality of the service provided to the athletes. The following conclusions were drawn: Firstly, service quality is one of the key factors for the success of large-scale sports events. High-quality services not only increase the satisfaction of athletes and spectators, but also play a positive role in promoting technological innovation in the events. Secondly, a scientific and fair competition system can stimulate the innovative potential of participants and organizers. Thirdly, innovative technology is the bridge connecting service quality, competition mechanisms, and the core elements of event management. Big data analysis technology can optimize event scheduling. The application of artificial intelligence technology can improve the accuracy of refereeing work and even the audience's direct experience. Additionally, the Internet of Things technology can monitor event equipment status in real-time.

Through empirical research, this study has drawn some valuable conclusions. However, due to factors such as the research subjects and sample size, there are still certain limitations that need to be further improved. Firstly, the "process-oriented" tendency in event management theory tends to overlook the event experience of dragon boat culture. This requires the adjustment of mutually compatible models through multiple event management processes. Secondly, the "standardization" indicators of the service quality theory only survey the event itself. The experience level of dragon boat culture cannot be summarized through theoretical standardization. Of course, cultural experience is not the central part of this study. Moreover, respondents may be influenced by emotional orientation due to the competition results when answering the questionnaire. The victory or defeat of the supporting team may affect the quality of the data. Therefore, in future sports event research, it is advisable to complete the answers to some non-result-oriented questions before the start of the competition.

At the same time, we also provide suggestions to the stakeholders: The implementation of the new competition system relies on the deep collaboration of multiple parties. The regulatory side needs to establish an exceptional technical team, apply big data based on previous competition experiences to optimize the schedule, ensure the fairness of the registration of participating teams and the fairness of the competition process, and gain higher recognition from the competitions; the operational level, sponsors can set AR interactive devices on the track to provide each participating team's perspective for the audience to have an AI-level experience during non-competition time, effectively eliminating the experience gap during the intermission period. The "second live" metaverse can realize the switching of audience perspectives; the fairness of the participating teams needs to be ensured through the joint establishment of a database with universities, strictly controlling the team's group setting and the review of athletes' qualifications to prevent the competition from losing credibility due to inadequate work; in addition, it is recommended that operators introduce more university science and technology projects into the competitions, including the application of new technology materials in competition equipment, the process-based development of the competition system, and VR live dissemination methods, allowing viewers to choose their perspectives to watch the competition. Promote the modernization transformation of sports symbols through technological empowerment.

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