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AI-DRIVEN SERVICE INNOVATION IN THE CREATIVE ECONOMY: INSIGHTS FROM KUMBH 2025

Chetna[1] Priyanshi Agarwal[2]

[1],[2] Scholars, Department of Economics, Dayalbagh Educational Institute, Agra, Uttar Pradesh, India

Resham Chopra[3]

[3] Assistant Professor, Department of Economics, Dayalbagh Educational Institute, Agra, Uttar Pradesh, India

ABSTRACT

The paper explores the integration of Artificial Intelligence (AI) into the management and service innovations of the mass events, with a focus on Mahakumbh Mela 2025. Using secondary data, the study analyses this intervention across SERVQUAL dimensions - tangibles, reliability, responsiveness, assurance, empathy and communication to assess their influence on the service delivery and its operational efficiency. Further, the study examines the role of government in managing Kumbh 2025 through a PESTLE framework, elaborating the political, economic, social, technological, legal, and environmental implications of AI adoption. By positioning Kumbh as both a cultural mass event and a driver of local creative industry, this paper shows how AI-led interventions blend with traditional practices, to contribute to digital infrastructure, inclusive growth and sustainable development. The findings offer insights into how AI can redefine event management, ensuring a seamless balance between cultural traditions and modern technological demands.

Keywords: Creative Industry, Service Innovation, SERVQUAL Kumbh 2025, Artificial Intelligence (AI),.

1. INTRODUCTION

India is a land of extraordinary cultural diversity and values, with a blend of traditions, rituals, and artistic expressions that have developed over the years (Singh, 2024). The country's large events, such as religious festivals, yatras, and cultural fairs, exemplify these traditions. Heritage mass events, like the Kumbh Mela in India, the Hajj in Saudi Arabia, and the Pushkar Fair in Rajasthan are a part of cultural, religious and historic traditions. These events attract millions of people from different parts of the the world, fostering a sense of belongingness and tend to transmit cultural values through generations (Rutagand, 2024). Their impact goes beyond spiritual and cultural significance; serving as sources of cultural wealth and catalysts for economic activity (Herrero, 2002). India's creative industries make a significant contribution to the national economy and are valued at $30 billion (PIB, 2024). Additionally, creative exports have increased by 20% since last year and employ nearly 8% of the workforce, highlighting the economic influence of cultural mass events.

Mass events in India showcase a blend of traditions, rituals, and community identity. Among these, Kumbh Mela is one of the largest religious gatherings, attracting millions of pilgrims and tourists from around the world to experience its sacred rituals for a once-in-a-lifetime event (Khamitkar, 2025). It is a spiritual event that takes place every 12 years in India at four different sacred Hindu pilgrimage sites namely- Prayagraj, Haridwar, Nashik, and Ujjain (Kanaujiya and Tiwari,2025). In 2017, UNESCO recognized the Kumbh Mela as an Intangible Cultural Heritage of Humanity, highlighting its spiritual, social and cultural

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importance (UNESCO, n.d.). Such massive gatherings are important for the host countries, since they generate revenue through tourism and also strengthen international relations (Kanaujiya and Tiwari, 2022). The Kumbh Mela presents a microscopic view of India's diverse population from different demographic and cultural backgrounds, each with different expectations and needs. Due to its large scale, it faces the most complex challenges in organizing the event. Events attracting millions of visitors demand careful and systematic planning across multiple government departments, local authorities and modern tech firms (Kumar et al., 2025) for crowd management, sanitation, transportation and communication. In the past, event management required a considerable amount of human effort (Srivastava, 2025), relying on experience and local knowledge. With limited technology integration, managing large-scale events becomes challenging. The quality of the event tends to decline as the number of attendees increase, demonstrating an inverse relationship between the crowd size and event coordination efficiency. As a result, service innovation becomes essential for the seamless and efficient management of such mass gatherings (Thomas, 2025). Given the vast scale and cultural depth of the Kumbh Mela, it can be said that it represents not only a religious congregation but also showcases creative expression of cultural industries. In this context Servqual becomes a useful tool to assess the quality of services offered to millions of pilgrims and visitors during such events.

The SERVQUAL model was initially propounded by Parasuraman et al. (1988) and it outlines essential dimensions of service quality and its assessment. Each of these is necessary in shaping visitors' perception of services provided at the Kumbh Mela and how improvement in any of its dimensions could greatly improve the overall experience. At this point it becomes imperative to mention that use of Artificial Intelligence in supporting the innovative service delivery quality at Kumbh is expected to enhance operational efficiency, visitor satisfaction and real time decision making. The most disruptive changes in public service delivery were brought in by the usage of Artificial Intelligence, where efficiency and effectiveness play a key role for effective governance and citizen satisfaction (Kulal et al., 2024). Artificial Intelligence is transforming event management, particularly for huge gatherings, by strengthening safety and improving services (Kumar and Ratten, 2025). AI technologies such as facial recognition, crowd monitoring, predictive analytics and automated chatbots have demonstrated the ability to streamline the management. This technology assists not only in planning but also in the post-event evaluation. In the context of Maha Kumbh, such technologies have been employed to improve such events.

The sustainability of these AI-led initiatives cannot be made possible without the consideration of several macro-economic factors. To examine the government's contribution in efficiently organising Kumbh 2025, the PESTLE framework was used. This framework uses six broad dimensions - Political, Economic, Social, Technological, Legal and Environmental (Team FME, 2013). It enables a structured assessment of the government's role in supporting sustainable management of Kumbh 2025 and in institutionalising AI to harmonise cultural preservation, technological innovation and sustainability.

As technology continues to evolve, several studies have endorsed the fact that Ai integration does lead to better management and experience overall in large scale events (Halim et al., 2023). However, there is a dearth of research initiatives on the usage of AI-enabled technology in mega events like Kumbh, which blends culture and modern technology. Thus the study helps in filling this gap by investigating the role of AI-enabled technology in service innovation at Kumbh 2025. The study explores the ability of AI tools in enhancing service quality across six dimensions of SERVQUAL. Further the study intends to assess the similar large scale events where organizers use AI to improve services and enhance safety.

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2. RESEARCH METHODOLOGY

The current study adopts a qualitative research approach to examine the role of AI-led service innovation at Kumbh 2025, with a focus on its implications for India's Viksit Bharat 2047 vision. The research is primarily based on secondary data and uses case study method for the fulfilment of the research objective. Existing literature and government reports, such as those from the Ministry of Electronics and Information Technology (MeitY) and the Ministry of Culture are also used for analysis.

2.1 Theoretical Framework

The SERVQUAL model, created by Parasuraman et al. (1988), is the primary framework for analysing the impact of AI on public services, especially in the context of mass gatherings. AI's contributions across several dimensions with reference to Kumbh are listed below :

1. Tangibles: It refers to infrastructure and resources required in organising Kumbh using AI.
2. Reliability: It refers to consistency and accuracy of the delivery of public services using AI.
3. Responsiveness: It refers to addressing of real-time challenges using A and how well the user expectations are met.
4. Assurance: It refers to how well we assure pilgrims regarding management of public services with safety.
5. Empathy: It refers to how solutions can be provided adhering to the needs and experiences of pilgrims using AI.
6. Communication: It refers to how digital applications facilitate seamless interactions using AI.

Using the above dimensions, the study examines how the application of AI enhances service innovation in large scale events like Kumbh

2.2 Objectives:

The present study aims to explore the role of Artificial Intelligence (AI) in enhancing service innovation at large-scale heritage events, with a specific focus on Kumbh 2025. The objectives are as follows:

- To identify the key areas of AI-led intervention for service innovation at Kumbh 2025
- To examine Kumbh 2025 using the PESTLE framework for managing heritage mass events in the light of AI-led service innovation.

3. DATA ANALYSIS AND DISCUSSIONS

3.1 Objective 1:

The SERVQUAL (Parasuraman et al. 1988), is a framework for evaluating service quality by measuring gaps between customer expectations and perceived service delivery. The original identified factors are: tangibles, reliability, responsiveness, assurance, communication and empathy. The study uses these determinants to examine how AI-driven technology intervenes in mass events and how it improves the quality of services offered at large-scale events with special reference to Maha Kumbh 2025.

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In Servqual framework *"Tangibles"* refer to the physical facilities like buildings, rooms along with equipment employed in delivering the services used to provide them. In the context of large-scale events like Maha Kumbh 2025, AI-enabled service innovations phenomenally improved the quality of tangible aspects thereby providing a seamless experience to the pilgrims. For instance AI-driven intelligent traffic management systems improved urban efficiency and helped in facilitating a well-structured event (L&T Technology Services, 2025). Additionally, the ICCC Prayagraj used AI-powered services (including video surveillance and sensor-based systems) to monitor sanitation across temporary housing tents, rest areas, and public restrooms (Institute of Land and Disaster Management, 2025). Another key intervention was the deployment of a centralized AI-based digital volunteer management system. This system tracked the attendance, assigned duties, and standardized volunteer appearance using RFID-tagged ID cards and dress code monitoring (NIC, 2025). It helped in enhancing security measures. The Kumbh Rail Sewa App and AI chatbots further improved the pilgrim experience by providing real-time information about parking, food courts, and nearby hospitals. AI significantly increased visitor experience (PIB, 2025). The essence of this is that AI-driven measures enhanced the tangible aspects of the event ranging from smart infrastructure and real-time monitoring to sanitation and volunteer coordination thereby creating a well-coordinated and efficient system for pilgrims.

The second dimension is reliability which states the ability to consistently deliver the service without error. AI integration played a crucial role in enhancing reliability of services provided at Maha Kumbh 2025, ensuring seamless operations across various aspects of the event. Public transport and shuttle services, crucial for managing pilgrim movement, utilized AI-enabled navigation apps to provide real-time updates on routes, facilities, and event schedules (Sogeti Labs, 2025). Moreover government facilitated transportation by running more than 1,000 special trains, while Uttar Pradesh State Road Transport Corporation added more than 10,000 daily bus trips. AI was used to integrate rail, road and river transport systems, for ensuring the reliability and efficiency of transportation systems (Banga, 2025). The resultant effect of AI enabled systems was smooth flow of traffic and intra-city mobility due to AI-enabled systems, as well as real-time dashboards. Artificial intelligence increased the dependability of urgent care and security forces as well. This ensured swift response times with coordination, which were critical in large-scale events like Kumbh. AI integration enabled reliable logistic support, consistent service, and dependability, significantly improving the experience for both pilgrims and organizers.

The third dimension ,responsiveness, refers to the willingness and readiness of the service providers to give prompt service and assistance to the customers. It emphasizes on the provider's ability to respond efficiently and timely to customer demands. During Maha Kumbh 2025, AI-powered portals like kumbh.gov.in and kumbhlostandfound.in remained active in assisted pilgrims when needed. Since these portals offered real-time updates for services and schedules, the accutate information was always available, enabling pilgrims management smoothly (National Informatics Centre, 2025). Additionally, AI-assisted helplines and information centers became more effective in resolving queries and in providing timely responses to urgent needs. The "Khoya Paaya Kendra" (lost-and-found center) was a prominent AI application in this regard. Facial recognition technology was used there to reunite missing individuals with their families. AI system digitized the

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details of missing persons and shared this information through social media platforms such as Facebook and X, which made the search process faster. It ensured a reliable resolution (Hindus for Human Rights, 2025). Thus, AI-driven interventions significantly enhanced the reliability of Kumbh 2025's by providing a plethora of services.

Having discussed how responsiveness ensures timely and effective support, it becomes important to discuss about assurance which played a vital role in instilling confidence that these services will be delivered with professionalism and expertise. AI interventions at Maha Kumbh 2025 significantly transformed the Assurance dimension of SERVQUAL by improving the key aspects of safety, trust, and competence, which directly affect the quality of services. By integrating AI technologies, the event organizers were able to provide improved security measures, timely medical response, and effective disaster management strategies which led to a greater sense of trust and confidence among pilgrims.

Underwater drones were also deployed for the first time. Additionally, cyber security professionals from NIC and CERT joined hands to prevent the misuse of digital platforms. Social media was monitored electronically to identify potential threats. (National Informatics Centre, 2025). Furthermore, AI predictive analytics identified potential dangers such as weather disruptions and resource shortages and ensured sensing of risk well in advance. This allowed event management to prepare and reduce these challenges before they impacted the pilgrims. Safety management improved, ensuring smooth operations and reinforcing pilgrims' trust in the safety and quality of the services provided (TransformingUP, n.d.). Maha Kumbh Mela 2025 demonstrated that AI can enhance service delivery, attendee experience, and overall quality through these AI interventions.

The next aspect of the pilgrim experience is the personalized care and attention which they received. Understanding needs and emotions defines empathy at large-scale events like Maha Kumbh 2025. Here the study discusses the empathetic dimension of Servqual framework. By recognizing the diverse needs of millions of attendees, AI intervention ensured that volunteers and officials were empathetic and responsive to pilgrims' concerns. One notable initiative in this regard was the distribution of Number Rakshak bracelets, which particularly targeted children, the elderly, and women. These bracelets were engraved with family contact information, enabling quick reunification of lost individuals even without a mobile phone (ImpactonNet, 2025). Another innovative campaign implemented during Kumbh was Kaala Teeka by Pidilite, inspired by the culture, a black dot, practiced in India. Children received a Teeka Id with a QR code connecting their identification details so that if lost, safe reunions with their families can be made (Pidilite,2025). The integration of AI addressed this problem by adhering to practical needs and cultural values.

Where empathy makes sure that organizers understand the individual's needs, another aspect of Servqual - communication - ensured that this understanding was shared with the visitors with clarity, accuracy, and timely updates. One of the AI applications was the introduction of the Kumbh Sah 'AI' yak app. It was an AI-powered, multilingual, voice-enabled chatbot which helped in providing real-time updates and assistance to the large number of people visiting. (PIB,2025). BHASHINI'S, a language translation chatbot supported eleven languages to ensure seamless communication across large demographics. This helped in improving the on-

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ground coordination with the real-time updates. Pilgrims navigated the complex logistics easily with the help of Google Maps. They could find the key landmarks, including ghats, temples, and *akhadas* easily, which enhanced their experience (NIC,2025). Moreover, the digital platform developed by NIC served as a global window to this mega event, offering a user-friendly interface. People could easily access the different information needed regarding rituals, schedules, transportation, and accommodation all in one place. The AI intervention not only improved the communication process but also played an important role in effectively managing one of the largest cultural events worldwide.

To further critically evaluate the implementation of Artificial Intelligence, a SWOT (Strengths, Weaknesses, Opportunities and Threats) was done. The SWOT provides a structured analysis of the external influences and internal capabilities that affect AI integration in large-scale mass events like religious gatherings, music festivals etc.

Figure 1 SWOT Analysis

STRENGTHS

The strengths of the AI integration at Kumbh 2025 are largely derived on the basis of secondary studies stating the improvement in service quality indicators and visitor management. AI intervention significantly enhanced the operational efficiency and coordination of the 66.6crore gathered for the holy baths. For rapid responses to crowd management and infrastructural needs, real-time decision-making tools such as predictive analytics and computer vision facilitated proactive risk mitigation (Surya Narayanan et al. 2025). For improved accessibility and pilgrim experience, especially those foreign to the experience, AI chatbots, navigation apps and multilingual voice/visual tools like Bhashini by MeitY, enhanced inclusivity for diverse groups, including the visually impaired (UNESCO, 2023; PIB, 2025). Facial recognition and object detection expedited real-time lost-and-found exercise; through initiatives like Kala Teeka by Pidelite. Continuous data collection optimized service quality through apps like Kumbh Sah'AI'yak (PIB,2025). This streamlined data powered AI surveillance to help in predictive modelling for preventing risks and boosting security. For timely medical assistance and ensuring sanitation, Smart health kiosks and environmental sensors were in place (PIB, 2025). Further, AI's scalability and automation potential proved vital for uninterrupted streamlining of such a large- scale event;

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surging expectation and probable benefits for future mass gatherings (PIB, 2025)

WEAKNESS

Kumbh 2025, despite being one of the most celebrated major mass-events of the country, faced certain limitations, especially in the implementation of AI. There was a high implementation and maintenance cost of infrastructure for provisions like the surveillance systems, cloud-based analytics and IoT sensors. This high cost is a significant barrier for replication in smaller or less-funded events or states that lack digital capabilities (World Bank, 2025). Other infrastructural challenges include inconsistent power supply and compromised network bandwidth which further strain AI systems and their reliance on real-time video, sensor integration and automated alerts (NIUA, 2025). Digital literacy among pilgrims is also a pressing concern. Strained digital literacy, especially among the rural population, limits the widespread adoption of AI-enabled services (IAMAI, 2025). Furthermore, there is concern over heightened technical dependency and its vulnerabilities in case of system malfunctioning, cyberattacks or hardware failures (CERT-In 2025).

OPPORTUNITIES

AI intervention at Kumbh 2025 provides a significant opportunity for further replication and innovation. It provides a benchmark for future smart events - integrating AI in mass gatherings and spiritual tourism worldwide. This could lead to possible collaborations between government and tech start-ups for the creation of innovation-driven, cost-efficient, context-specific AI solutions for heritage tourism through public-private partnerships (FICCI, 2024). Strengthening tourism and international branding, Kumbh 2025 also leverages India's position as a tech-driven cultural destination (Ministry of Tourism, 2025). This intervention also leads to future scalable AI models piloted for other mega events nationally, like Amarnath Yatra, Rath Yatra, CharDham Yatra, and global replication in events like the Hajj, the Rio Carnival or Tomorrowland. AI integration can also be leveraged to enhance policy development promoting the use of behavioural insights and strengthened data-backed capabilities (UNDP, 2023). These innovations also align with and empower national objectives like Digital India and VIksit Bharat @2047 vision.

THREATS

AI integration at Kumbh 2025, while offering substantial benefits, also presents significant critical challenges which need to be addressed. Data privacy concerns, especially in the absence of a robust regulatory mechanism, are existent with extensive use of biometric surveillance technologies like facial recognition and localised data collection. Additionally, AI-enabled infrastructure is susceptible to infrastructural lapses like cybersecurity breaches, security mismanagement, and other adversarial attacks. This could lead to abrupt disruption of essential crowd management, communication, and security measures during such mass events (Nott, 2025). With heavy involvement of AI services, the risk of exclusion of the elderly, illiterate, differently abled or other technologically marginalised groups has increased significantly, especially if inclusive design principles are not enforced (UNESCO, 2022). With unemployment being a pressing concern, job displacement among manual workers due to automation could lead to potential resistance from cultural leaders and traditional stakeholders (ILO,2023; ORF, 2023). The over-commercialisation of sacred practices and spiritual spaces can be perceived as intrusive. Excessive dependence on foreign AI technologies may raise sovereignty concerns and further provoke public scrutiny.

3.2 Objective 2: The objective is to employ PESTLE framework for the puepose of systematically analysing the influence of AI driven service innovations on the management of

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Kumbh 2025, a large scale heritage event.

The Kumbh Mela is one of the largest religious mass gatherings in the world, serving as both a cultural and spiritual spectacle and a complex logistical challenge. Integrating AI presents a transformative opportunity to address these challenges while improving the overall experience for millions of devotees and visitors. This segment of the study examines Kumbh 2025 using the PESTLE framework. Further it explores how a number of factors like technology, governance, economic, and societal factors in combination facilitate the AI-driven service innovation in organizing heritage events. The following table explores key focus areas of each factor and highlight their implications for better analysis.

Factor	**Focus Area**	**AI-led Innovation Illustrations From Kumbh 2025**	**Implications**
Political	Government Policy	Govt. approval for AI-enabled Integrated Command & Control Centres (ICCCs)	Strengthened governance credibility in handling mega-events.
	Security	AI-based crowd prediction and surveillance systems	Balanced the need for public safety with concerns about civil rights and privacy.
	National Branding	Multilingual chatbot *Kumbh Sah'AI'yak* integrated with *Bhashini*	Strengthened India's global branding as a technological cultural leader
	Coordination	Centre–state coordination committees supported by AI dashboards (PIB, 2025)	Improved inter-governmental efficiency and real-time decision-making
Economic	Growth & Tourism	Development of 4,000 hectares into a temporary smart city.	Boosted tourism revenue by improving visitor experience
	Jobs	ICCC operations creating skilled tech-support roles	Generated employment and built local digital capacity
	Cost Efficiency	Predictive sanitation using AI sensors	Economised operational costs and optimized resource allocation
	Infrastructure	AI-assisted planning of 150,000 tents and 20 pontoon bridges AI chatbots are improving the foreign tourist experience.	Expanded infrastructure and created a replicable smart-event economic models for smart event logistics Fostered innovation in local business by using AI technology to tailor offerings to attendees' needs.
	Demographics & Safety	Distribution of "Rakshak" bracelets for child/elderly safety.	Protected vulnerable groups and built family trust

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Social	Inclusivity	Women-led security units and anti-Romeo squads ensuring inclusivity (TOI, 2025)	Promoted gender-sensitive and inclusive event management
	Cultural Values	AI apps offering ritual guidance in multiple languages	Preserved cultural authenticity while easing participation
	Literacy	QR-coded Kaala Teeka IDs linked to AI lost & found systems	Required awareness campaigns and digital literacy drives were addressed for public resistance.
Technological	Artificial Intelligence	Real-time AI dashboards for crowd & weather forecasting	Enabled predictive decision-making and risk reduction
	IoT	IoT-enabled smart waste bins; AI facial recognition at lost & found centres (Raja, 2025)	Enhanced efficiency in resource management
	Drones	Approximately 2000 drones were used for river monitoring and water quality assessment.	Supported environmental protection and surveillance
	Cybersecurity	Encrypted AI platforms for pilgrim registration	Protected user data and prevented service disruptions
	Infrastructure	ICCC integrating 2,700+ AI-powered CCTV cameras	Set a global benchmark for smart-event management in India.
Legal	Data Protection	Compliance with Digital Personal Data Protection Act (2023)	Safeguarded pilgrims' rights and digital privacy
	Liability	AI Vendor accountability frameworks for technology implementation.	Clarified responsibility in case of system failures and data misuse.
	Consumer Rights	AI-monitored price regulation of food and lodging	Prevented exploitation and ensured fair access. Sets legal precedents for AI use in mass gatherings
	Heritage Norms	UNESCO heritage safeguards ensuring cultural rituals and spaces were preserved. (MoEIT, 2025)	Preserved cultural heritage while enabling modernization
	Waste Management	Use of sensor-based waste bins for efficient garbage collection.	Reduced overflow and improved cleanliness

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Environmental	Energy Use	Solar-powered AI-based ICCCs	Promoted renewable energy in temporary setups
	Eco-Practices	Biodegradable plates monitored by AI supply systems Temporary eco-friendly sanitation setups (AP News, 2025)	Minimized ecological footprint and supported Swachh Bharat Projects India as a leader in green heritage event management
	Water Conservation	AI sensors monitoring Ganga water quality	Ensured river sustainability and aligned with UN SDGs

The integration of advanced technology provided a significant opportunity to reshape the management of mass heritage events. PESTLE framework examined the implementation of AI not only to address logistical challenges faced by such large-scale events but also instigates positive changes in governance, economic growth, social inclusion, technological progress, legal frameworks, and environmental sustainability. Kumbh 2025 intends to serve as a benchmark model for AI-driven innovative service management and to balance innovation with the conservation of cultural values and societal norms. The insights from this study can serve as a guide for future heritage mass gatherings, showing how AI can enhance safety, efficiency and inclusivity of such events while supporting sustainability and economic growth.

5.0 CONCLUSION AND FUTURE DIRECTIONS

AI has greatly transformed how public services are provided during Maha Kumbh 2025, setting a benchmark for managing large gatherings through smart governance, predictive planning, and integrated services. Using a SERVQUAL model, the study highlights how incorporating AI in various areas has improved the event. The success of AI at Kumbh 2025 shows its potential and hints at the scalability aspect with respect to other international events like Hajj, global concerts, climate summits etc boosting safety, operational efficiency, and cultural sensitivity.

The insights gained from the Kumbh serve as a blueprint for upcoming global events. Future research can focus on deeper AI integration into heritage festivals, ensuring operational efficiency and safety. AI's role can be extended beyond enhancing event services to creating long-term benefits for local communities and infrastructure. Implementing such advanced technologies in public services can generate ongoing economic opportunities for host cities after the events. Moreover, promoting international cooperation on AI standards can help more countries connect and share solutions for managing large-scale events.

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