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Enhancing the experience economy, marketing and sustainability in tourism event stages through smart technologies

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Abstract

Purpose – This study aims to examine how smart technologies (e.g. artificial intelligence, Internet of Things and virtual reality) can be adopted across the phases in an event lifecycle, presenting a holistic framework for event managers and future research.

Design/methodology/approach – Using the PRISMA method, a systematic literature review identifies key smart technologies and research themes across the event lifecycle. It analyses their intersections with event phases and proposes a comprehensive framework to map these relationships.

Findings – The results are structured into systematic-quantitative analysis, which explores publication trends, technology types, event categories and key academic contributions; and framework development, which aligns smart technologies with event phases.

Originality/value – This study integrates key event literature themes into a unified framework. By addressing these themes collectively, it introduces the novel 6Ss of the event lifecycle framework, enhancing technology's role in event planning and management.

Keywords Information and communication technologies (ICT), PRISMA, Smart technologies, Event lifecycle, Tourism events

Paper type Research paper

自然与城市：通过智慧技术提升旅游活动阶段中的体验经济、营销与可持续性

摘要

研究目的 – 本研究探讨如何在活动生命周期的各个阶段应用智慧技术（如人工智能、物联网、虚拟现实等），并提出一个整体性框架，为活动管理者与未来研究提供指导。

研究方法 – 本研究采用PRISMA方法进行系统性文献回顾，识别出贯穿活动生命周期的关键智慧技术与研究主题，分析其在不同阶段的交叉关系，并提出综合框架以呈现这些关联。

研究发现 – 研究结果分为两部分：系统定量分析：探讨研究发表趋势、技术类型、活动类别及主要学术贡献；框架构建：将智慧技术与活动生命周期阶段相对应，形成系统化的结构。

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研究创新 – 本研究首次将活动管理领域的核心主题整合进统一框架，提出了创新性的“活动生命周期6S框架”（6Ss of the Event Lifecycle Framework），以促进智慧技术在活动策划与管理中的应用与发展。
关键词 旅游活动, 活动生命周期, 信息与通信技术（ict）, 智慧技术, PRISMA

文章类型 研究型论文

Introduction

Advancing research in tourism events requires the integration of technological innovations to align with the dynamic and rapidly evolving global landscape (Backman, 2018; Ryan *et al.*, 2020; Unson *et al.*, 2023). The sector has been shaped by both rapid technological advancements, including artificial intelligence (AI), augmented reality/virtual reality (AR/VR) and metaverse platforms (Choi *et al.*, 2023) and global disruptions, such as the COVID-19 pandemic (An *et al.*, 2025; Unson *et al.*, 2023), which together highlight the limitations of traditional approaches and the need for an integrated, forward-thinking framework. As the industry evolves, innovation, digitalisation and smart technologies have become central to academic discourse (Aktepe and Demirci, 2024; Revilla *et al.*, 2023).

Within this transformation, three domains, the experience economy, marketing and sustainability (EEMS), have emerged as critical yet often siloed foci. Personalised experiences and knowledge exchange enhance the experience economy (Pine and Gilmore, 1999; Sharma *et al.*, 2024), while digital communication reshapes marketing and brand engagement (Bilgihan and Ricci, 2023; Harb *et al.*, 2019; Pascucci *et al.*, 2023). Since the 2020s, leading tourism, hospitality and events (THE) journals have positioned sustainability as integral, extending focus beyond economic outcomes to include social and cultural dimensions (Mair and Smith, 2021). In this context, smart technologies play a dual role: enhancing event phases and mediating tensions across the EEMS. However, how these contributions integrate across the entire event lifecycle remains underexplored.

Parallel to the Figure 1 technology timeline, a recent study by Aktepe and Demirci (2024) identified 16 emerging technologies in the event industry, including AR, VR, robotics and AI, demonstrating the sector’s growing adoption of innovative tools in events and festivals. Similarly, Strickland *et al.* (2024) noted major gaps in AI and advanced technology research in festivals. Choi *et al.* (2023) argued that in spite of the growing importance of the metaverse for businesses and personal lives, it remains underexplored in event research. Unson *et al.* (2023) further highlighted the overall scarcity of focusing exclusively on innovation and technology in events. Additionally, Lee *et al.* (2022) conducted a systematic literature review (SLR) on VR in festivals, finding research largely centred on attendee experiences, leaving other components of the event life cycle underexamined.

The existing literature remains fragmented, favouring narrow analyses over holistic integration (Sigala *et al.*, 2025). While recent reviews explore individual smart technologies or specific event types (Ariza-Montes *et al.*, 2023; Choi *et al.*, 2023; Filimonau *et al.*, 2024; Gursoy *et al.*, 2023), no comprehensive lifecycle-wide perspective exists. This study bridges that gap by proposing a conceptual framework aligning smart technologies with each phase of the tourism event lifecycle. By unifying technological integration across core events, the framework provides a foundation for future research and practice.

Thus, the study seeks answers to two questions:

RO1. What are the key smart technologies currently adopted in tourism events, festivals and meetings?

RO2. How can the phased integration of intelligent technologies serve as a methodological framework to unify core tourism event research domains?

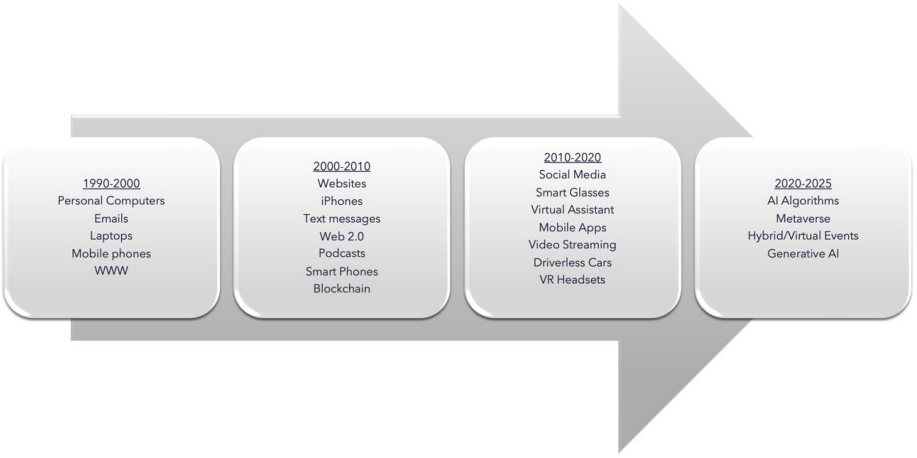

Figure 1. Technology timeline
Source: Adapted from Gössling (2021, p. 736)

The next section reviews existing research on events and technology related to EEMS, outlines the PRISMA-based SLR method and presents findings forming the basis of the Six Ss of the event lifecycle framework. The framework is then discussed with implications for tourism event phases and directions for future research.

Background

This research identifies a critical gap in the literature: the fragmented application of three foundational theoretical domains – the EEMS. Although these domains are frequently referenced across various stages of event delivery, they are often addressed piecemeal, without integration or a cohesive analytical approach, as revealed in this study's systematic review (Lei and Ngan, 2023; Lopes *et al.*, 2025). Yet, these three backbones are not only interdependent in practice but also collectively shape the value proposition of modern events.

Sustainability addresses long-term environmental and social responsibility; marketing drives visibility, stakeholder engagement and attendance; and the experience economy ensures emotional and sensory resonance with attendees. Failing to integrate these dimensions overlooks their synergy, such as how sustainable practices enhance brand reputation (marketing) and deepen attendee satisfaction (experience), or how immersive experiences promote pro-environmental behaviours.

In our SLR, while over half of the technology-focused event studies examined at least one EEMS component (Alghamdi *et al.*, 2023; Alsahafi *et al.*, 2023; Hur *et al.*, 2022; Olya *et al.*, 2020; Wreford *et al.*, 2019), only a marginal proportion explored interactions between two, and none addressed the triadic intersection. This analytical disconnect limits the field's ability to generate comprehensive insights and best practices. By mapping smart technologies to event phases through an integrated EEMS lens, this study not only exposes these silos and but also argues that converging EEMS enables a more meaningful, measurable and future-ready approach to event design and evaluation. Each domain is now examined in turn.

The experience economy

The experience economy has gained significant traction in event studies, highlighting the importance of delivering memorable experiences that drive attendee satisfaction, loyalty and revisit intentions (Pine and Gilmore, 1999; M and P, 2024). Advanced digital systems are transforming event experiences through customised and reciprocal engagement opportunities. For example, AR enhances both cognitive and emotional engagement, leading to positive word-of-mouth and a greater likelihood of return visits (Lei and Ngan, 2023).

In addition to AR, the digital landscape (spanning information and communication technologies [ICTs] and social media) offers new ways to personalise event experiences and optimise costs (Bustard *et al.*, 2019; Choi *et al.*, 2023; Sharma *et al.*, 2022). Research shows digital platforms foster more interactive, participatory environments and strengthen audience connections (Bustard *et al.*, 2019). Moreover, ICT-based event management systems improve operational efficiency and provide long-term stakeholder benefits, enhancing overall attendee experience and success (Cimbaljević *et al.*, 2021). By integrating multiple technologies, ICT enables seamless information flow, transforming event spaces into smart, interconnected and synchronised environments (Cimbaljević *et al.*, 2021; Lopes *et al.*, 2025).

Technological innovations in festival settings play a key role in shaping attendees' experiential perceptions and influencing engagement and brand loyalty (Zheng and Chi, 2024). For example, AR and VR enhance satisfaction and memory formation, highlighting technology's role in elevating experiences (Olya *et al.*, 2020). As immersive and hybrid experiences become integral to event delivery (Bustard *et al.*, 2019; Sharma *et al.*, 2022), a growing share of budgets is allocated to technological adoption (Kim *et al.*, 2023; Tiew *et al.*, 2021). Positive engagement with tech-driven practices consistently drives event success (M and P, 2024; Zheng and Chi, 2024).

Marketing

The evolving role of technology in marketing has transformed event promotion and audience engagement (Setiawan *et al.*, 2022; Sharma *et al.*, 2024). Networked communication, social media strategies and advanced digital applications enhance branding, sales and customer interactions (Lin *et al.*, 2024; Revilla *et al.*, 2023). Festival content marketing through cloud-based live streaming, vlogs and platforms such as Instagram and TikTok has proven effective in strengthening events' reputations and increasing visitor familiarity (Zheng and Chi, 2024). These digital engagement strategies reflect a shift towards personalised, transformative marketing (Bustard *et al.*, 2019; Fesenmaier and Xiang, 2014; M and P, 2024; Revilla *et al.*, 2023).

Interactive and immersive technologies expedite event marketing by creating unique, participatory experiences. Gamification elements, such as branded app experiences and game design, serve as powerful tools for increasing attendee engagement and fostering repeat attendance (Lee, 2023). Additionally, the integration of e-commerce capabilities into event-related websites enhances attendee experience, operational efficiency and financial performance, particularly during crisis or disruption times (Soifer *et al.*, 2021).

Furthermore, from a broader perspective, ICTs form the backbone of marketing innovation (An *et al.*, 2025; Arora and Siddhey, 2024; Mo *et al.*, 2015). Integrating these digital resources improves stakeholder communication, facilitating seamless exchanges that optimise marketing performance (Unson *et al.*, 2023), while creating new avenues for green event promotion (Sharma *et al.*, 2022). For example, Expo 2020 officials and travel agents relied on digital marketing as their primary communication channel, illustrating the dominance of digital over traditional methods (Haneef and Ansari, 2019). Experiential marketing suggests that innovative engagements foster durable memories, as seen in AR's capacity to create blended reality encounters that amplify brand resonance and attendee

commitment (Ngan and Lei, 2025). As digital marketing strategies become more immersive and interactive, they also present opportunities to align promotional practices with sustainable event principles, paving the way for greener, more responsible audience engagement.

Sustainability

Sustainability is increasingly theorised as integral to the experience economy and marketing, functioning as both a structural precondition and a transformative force. Sustainability in tourism events is commonly examined using the triple bottom line framework, encompassing economic, social and environmental aspects (Getz, 2009; Thelen and Kim, 2024). Integrating intelligent technologies strengthens sustainability initiatives with tools such as AR, VR and hybrid formats, reducing carbon emissions through energy efficiency and lower resource use (Loureiro *et al.*, 2019; White *et al.*, 2025). These technologies also provide resilience against challenges, sustaining events during crises (Cimbaljević *et al.*, 2021; Unson *et al.*, 2023). Additionally, big data analytics enable participatory monitoring, engaging diverse stakeholders and improving sustainable event management (Cortese *et al.*, 2019). Finally, gamification in sustainable tourism has been identified as a tool for enhancing tourist engagement, improving HR management and fostering community support (Lee, 2023; Liu *et al.*, 2019).

A major focus in sustainability research is fostering positive event and festival images (Kshetri, 2022). Beyond short-term attendance, digital platforms support long-term engagement, now seen as a critical success measure (Ryan *et al.*, 2020). Cortese *et al.* (2019) illustrate how ICT-driven monitoring promotes circular processes that deliver economic, social and environmental equity. Their case study showed tangible outcomes: hotel occupancy reached 85%, taxi and bus usage doubled and tripled, over 30,000 ATM withdrawals occurred, staffing demand rose by 50% and 1,150 volunteers contributed unpaid labour across a five-day exhibition. These metrics show how ICT can boost engagement and reduce costs while advancing sustainability goals.

Event research, particularly studies of AR/VR, gamification and robotics, has predominantly aligned with EEMS. While these studies acknowledge the transformative potential of technology within event practices, the domains often remain conceptually fragmented, focusing on one event or type, one technological innovation or one phase of the event life cycle. Further research is needed to examine how intelligent technologies collectively enrich the experience economy, amplify marketing effectiveness, enhance sustainability across distinct event stages and empower organisers to harness technology's full potential.

Methodology

This study uses an SLR to examine the evolving body of knowledge on technological innovations in tourism events. Guided by the PRISMA protocol (Moher *et al.*, 2009), the review captures how smart technologies intersect with EEMS across event phases, drawing from tourism, hospitality and technology databases.

The review process began by selecting major academic databases and developing search terms based on Figure 1 and detailed in Figure 2. Search term and database choices were further guided by contemporary literature and prior studies (Aktepe and Demirci, 2024; Celuch, 2021; Ivanov *et al.*, 2025) to capture a broad range of ICTs relevant to tourism events. The final search yielded 1,067 studies, with database contributions as follows: Web of Science (337), Scopus (663) and EBSCO Host Business Source Complete (68). Search terms ensured comprehensive coverage, combining technological and innovation-driven advancements within the field as:

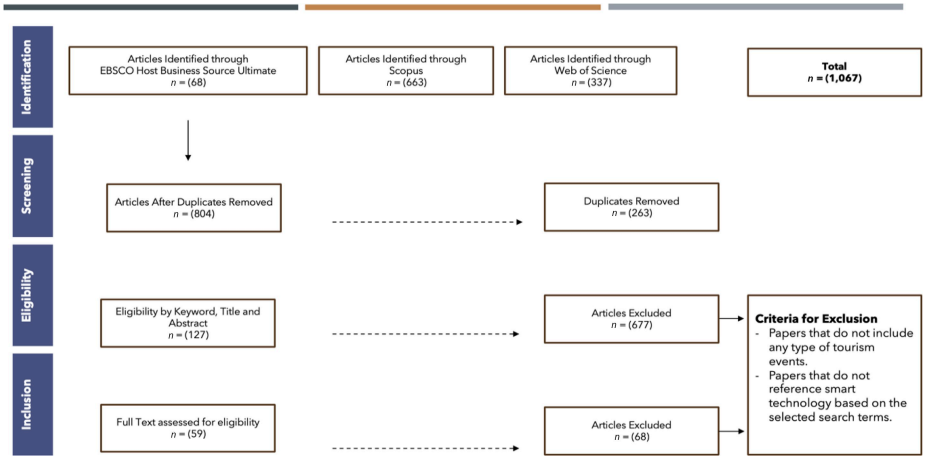

Figure 2. PRISMA diagram

("big data" OR "robot*" OR "intelligen*" OR "virtual reality" OR "augmented reality" OR "text mining" OR "data mining" OR "smart" OR "mobile" OR "machine learning" OR "internet of things" OR "IoT" OR "streaming" OR "artificial intelligence" OR "gamification" OR "innovat*" OR "advanced technolog*" OR "humanoid" OR "metaverse" OR "AR" OR "VR" OR "industry 4" OR "chatbot" OR "GPT" OR "open AI" OR "ICT" OR "automation") **AND** ("event" OR "conference" OR "festival") **AND** ("tourism").

The final database search was conducted on 4 November 2024. The next step involved applying the inclusion criteria to refine the data set.

To capture the evolution of smart event technologies and avoid temporal bias, the review included all relevant literature regardless of publication date, enabling longitudinal trend analysis. However, the search was limited to English-language, peer-reviewed publications to ensure conciseness and reliability (Björk and Solomon, 2013). All retrieved data were imported into EndNote, duplicates removed and 804 papers screened for eligibility. Papers were then assessed against inclusion criteria, leading to the exclusion of 1,008 papers and a final selection of 59 studies.

This process was systematically evaluated using a star rating system, structured as in Figure 3.

Results

The analysis proceeds in two parts:

(1) a systematic overview of research trends and

(2) thematic synthesis towards framework development.

Systematic literature review

Following inclusion and exclusion criteria, 59 English-language peer-reviewed studies were retained. The earliest contribution addressing immersive technologies in events dates to 2013 (Mair and Whitford, 2013), with publication numbers showing a clear upward trend in subsequent years.

Rating	No. of Papers	Description	Inclusion Decision
☆☆☆☆☆	30	Fully aligned with all search terms; directly relevant to EEMS and technology themes.	**High / Included** Meets all theoretical and contextual criteria.
☆☆☆☆	29	Lacks one key element but strongly addresses at least two EEMS domains.	**High / Included** Partial misalignment offset by depth in other areas.
☆☆☆	36	Missing two key elements (e.g., no EEMS focus and vague tech linkage).	**Medium / Excluded but cited** Useful for background; not suitable for framework development.
☆☆	32	Only one relevant element (e.g., generic tourism tech without EEMS ties).	**Medium / Excluded but cited** Minimal contribution; cited only if methodology overlaps.
☆	677	Irrelevant topic (e.g., healthcare IoT or unrelated disciplines).	**Low / Excluded** Fails all screening criteria.

Figure 3. Inclusion/exclusion criteria

According to Hur *et al.* (2022), Ryan *et al.* (2020) and Sharma *et al.* (2022), ICTs such as AI, VR, AR and the Internet of Things (IoT) are reshaping the industry. This increase resulted from the unprecedented shock COVID-19 imposed on THE, sectors that never envisioned functioning in an automated manner (Dubinsky, 2023; Ivanov *et al.*, 2025). This growth remains strong, driven by smart technology advancements and their deeper integration into events (Figure 4).

Figure 5 categorises technologies studied across the 59 papers, highlighting those appearing in over 5% of studies. Among these, three key AI-focused studies stand out: Neuhofer *et al.* (2021), Zhang (2023) and Wang and Uysal (2024). Two explored AI broadly without a specific event context, while one focused on the Meetings, Incentives, Conferences and Exhibitions (MICE) industry. Neuhofer *et al.* (2021) examined AI as a non-human actor in business events, Zhang (2023) investigated AI integration in exhibition tourism and Wang and Uysal (2024) explored AI-assisted mindfulness in tourism and hospitality.

Gamification-focused studies accounted for 7% of the 59 papers reviewed (Liu *et al.*, 2019; Chernbumroong *et al.*, 2022; Sisson and Whalen, 2022; Lee, 2023). The 2019 and 2023 studies specifically examined festival gamification, while Chernbumroong *et al.* (2022) analysed the exhibition context in Thailand, focusing on attractiveness, engagement and learning behaviours.

Sisson and Whalen (2022) proposed a conceptual model linking pre-event game communication to attendees' perceived value, willingness to participate, word-of-mouth intentions and emotional commitment, confirming gamification's positive influence on attendee behaviour. Lee (2023) explored the relationship between the experience economy

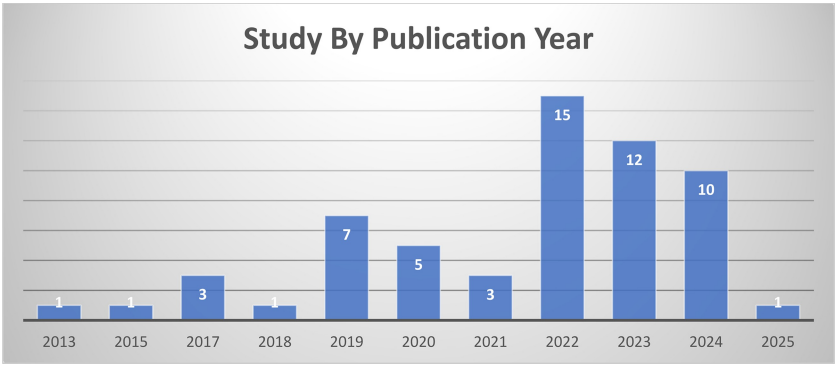

Figure 4. Publication trends by year

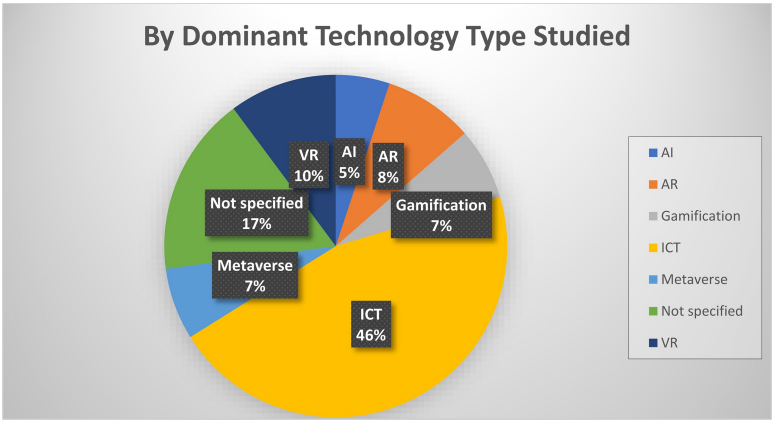

Figure 5. Technology type distribution

and re-patronage intentions at the Taiwan Lantern Festival, showing that festival gamification enhances attendee experience and memorability.

Finally, Liu *et al.* (2019) developed a five-dimensional, 16-item Festival Gamification Scale using literature review, in-depth interviews and survey data from cycling, marathon and religious festivals to assess gamification's role in boosting tourist engagement. Consequently, gamification is gaining strategic importance as a mechanism for enhancing engagement and memorability across diverse festival and event contexts (Lee, 2023).

Metaverse-related studies accounted for 7% of the 59 papers reviewed. The metaverse has attracted scholarly interest as it extends the physical world into digital space through simulations (Gursoy *et al.*, 2023), positioning it as a transformative arena for events (Bustard *et al.*, 2019; Choi *et al.*, 2023). In this context, three studies were conducted in 2023 and one in 2024, primarily focusing on MICE and entertainment events.

Gursoy *et al.* (2023) explored how metaverse applications create ecosystems for virtual events by influencing real and meta entities. Wang and Uysal (2024) examined user experiences at a tourism-related event (Guangfu Temple Fair) linking metaverse engagement to satisfaction and electronic word-of-mouth. Additionally, Choi *et al.* (2023) analysed psychological mechanisms, highlighting immersion, escapism and playfulness, while Ariza-Montes *et al.* (2023) identified predictors of metaverse adoption in conferences, including performance expectancy, social influence and low anxiety.

Studies on AR, VR and hybrid technologies comprised 18% of the reviewed papers. AR overlays computer-generated 3D content onto the user's real-world surroundings, enriching images and enabling mesmerising interactions, while VR fully replaces reality. This supports constructivist learning through immersive experiences (Lau *et al.*, 2019). Most studies focused on participant satisfaction, memorability, engagement, technology adoption and perceived value. The earliest study dates to 2018, with most literature addressing post-COVID-19 challenges and trends.

Almost half of all studies fell under the ICT category (25 of 59 papers). These were evenly split between festivals (36%), MICE events (36%) and sports events (16%). ICT studies focused on social media and applications for specific event types (Lin *et al.*, 2024). The ICT category covered a wide range of digital and online tools previously outlined, reflecting their central role in technology-driven event innovation (Revilla *et al.*, 2023).

Finally, the Not-Specified category accounts for 17% of the papers, comprising referrals broadly labelled as technology or innovation, or where the study did not focus on a specific technological type, making classification difficult. For example, Jiménez-Andres (2024) discusses Dubai Expo 2020's smart innovation initiatives, while Wang and Uysal (2024) explore advanced technology's effect on the experience economy and festivalgoer satisfaction. Eleven studies were classified here because of their generalised technological scope.

Next, the papers were categorised using Getz and Page's (2016) event typology, which classifies events into four categories: MICE, Sports, Entertainment and Festivals and Cultural Celebrations. As illustrated in Figure 6, MICE events were the most frequently investigated, leading in technological integration, followed by festivals, which show increasing innovation in adopting emerging technologies. Studies on MICE spanned 2012–2024 and demonstrated notable geographic diversity, led by contributions from the USA. Within this category, conferences and meetings accounted for 53%, exhibitions and conventions 35%, while two studies examined MICE events more broadly without specifying subtypes.

Festival-related research was the second most studied event type, with 16 of 59 publications covering music, art, science, gastronomy and horticulture. Most festival studies fell under ICT, with smaller subsets exploring AR/VR and gamification. While four studies were conducted in Taiwan, the rest showed no significant geographic clustering.

The entertainment category includes concerts, fairs and small-scale food and beverage events. Sports events accounted for 17% of publications (10 studies), with six focusing on mega-events. Research here primarily examined COVID-19 impacts, with a strong geographic concentration in China, South Korea and Japan.

The geographical distribution of studies shows most first authors were based in Asia (28 papers), led by China (8), South Korea (5) and Taiwan (4). Europe followed with 18 studies, led by the UK (7) and Spain (3), with other countries contributing one each (Figure 7).

The prominence of China and the UK likely reflects the concentration of well-resourced universities, research funding and advanced technological infrastructure that enable more publications in these contexts. In contrast, representation from the Global South is limited. This is not because of the absence of large-scale events, but rather because only a handful since 2013, such as Brazil's 2014 FIFA World Cup and 2016 Rio Olympics, Argentina's 2018 G20 Summit and Indonesia's 2022 G20 Summit, have incorporated significant technological innovations. These sporadic cases have not generated a sustained research stream, highlighting disparities in academic output between technologically advanced regions and emerging event hosts. This imbalance underscores a need for future research to examine whether such disparities stem primarily from the underdevelopment of economic

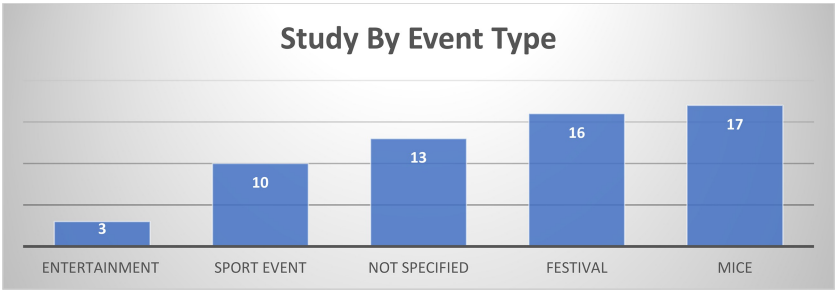

Figure 6. Articles published by event type
Source: Adapted from Getz and Page (2016, p. 594)

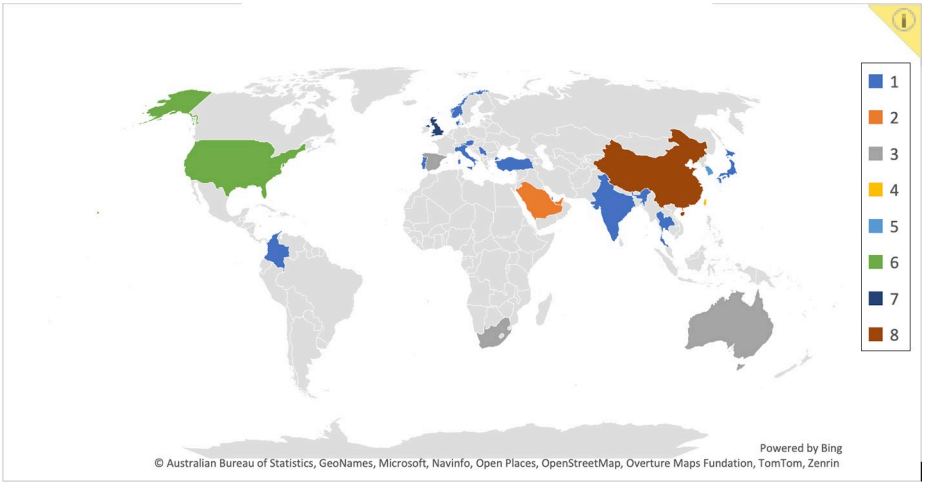

Figure 7. Number of study distribution map

and educational institutionalisation, gaps in the production of peer-reviewed English-language publications or the comparatively lower density of mega-events that typically stimulate investment in advanced technologies and improvements across event phases.

In summary, the SLR focuses on the intersection of smart technology and event types, with emphasis on sustainability, attendee psychology, flow and satisfaction, aligning with the experience economy and marketing. This provides a benchmark for future research, highlighting the growing significance of smart technologies in tourism events and their expanding role in shaping the industry. The next section introduces the developed framework.

Six Ss of the event lifecycle framework

This study examines how integrating smart technologies across various stages of tourism events can generate synergies among three core theoretical themes of EEMS, offering a holistic perspective for future research and practice. Building on these foundations, this study develops a conceptual 6S event lifecycle framework (Figure 8) that aligns smart technologies with event stages.

To ensure conceptual rigour, the framework draws on the established EMBOK model (Bowdin *et al.*, 2023; Silvers *et al.*, 2005) and O'Toole's project management phases (Bowdin *et al.*, 2023). EMBOK outlines five key phases: initiation, planning, implementation, event and closure, which were adapted to reflect the dynamic role of technology across the event lifecycle. Rather than operating in isolation, the EEMS domains interact fluidly throughout these stages, their significance shifting as events progress. Additionally, while EMBOK provides five operational phases – initiation, planning, implementation, event and closure – the 6S framework reframes these for a smart-technology and EEMS context. The 6Ss of the event lifecycle framework consolidates early strategic choices into *Scope* (drawing from initiation/planning); elevates *stakeholder*, *space* and *safety* from tasks typically embedded in planning/implementation to stand-alone phases where technology materially changes decisions; equates EMBOK's *event* with *Scene* (live delivery); and renames *closure* as *Success* to foreground measurement, feedback and legacy.

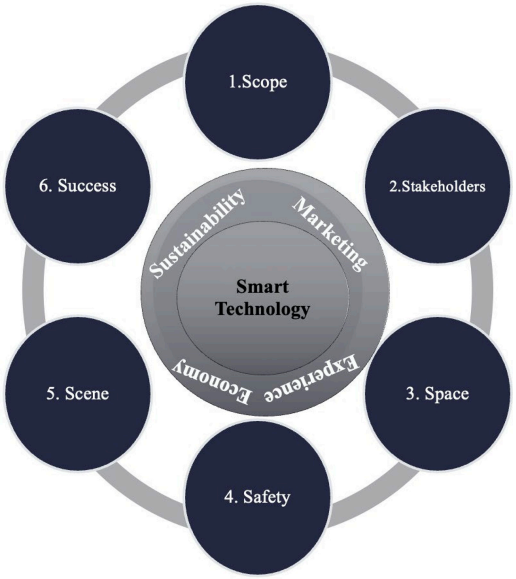

Figure 8. 6Ss of the event lifecycle framework

This reconceptualisation creates a feedback-driven model in which data from *Success* loops back into *Scope*.

In spite of growing scholarly interest, research remains fragmented, either focusing narrowly on individual technologies or specific event phases, limiting opportunities to compare outcomes or trace cross-stage impacts. The 6S framework addresses this gap by systematically mapping smart technologies across six phases: scope, stakeholder, space, safety, scene and success. By aligning these phases with the EEMS domains, it provides both an analytical lens and a practical roadmap for understanding how technology reshapes the tourism event lifecycle.

Scope

The scope phase establishes the strategic foundation of an event by defining purposes, objectives and operational boundaries. Smart technologies are reshaping this stage by integrating sustainability, marketing and experiential considerations into a single decision-making process. AI-powered market research combines real-time sentiment with sustainability benchmarking (Anderson *et al.*, 2024), ensuring that participant expectations are considered alongside ecological targets. Similarly, big data analytics merge attendee sentiment with IoT sustainability metrics, such as energy use per capita, enabling organisers to balance personalised design with eco-efficiency (White *et al.*, 2025). These applications transform scoping into a data-driven process that moves beyond logistics, allowing early decisions to optimise outreach, sustainability performance (Duffy and Mair, 2021) and experiential design (Zheng and Chi, 2024).

By fusing these technologies, scope decisions can advance sustainability, strengthen marketing visibility and create memorable experiences, demonstrating how EEMS outcomes are reinforcing one another. Insights captured at this stage form the evidence base for

downstream phases such as stakeholder engagement and spatial design, ensuring that technology-enabled decisions cascade through the entire event lifecycle.

Stakeholder

The stakeholder phase identifies who participates in an event, spanning organisers, sponsors, local authorities, service providers, communities and attendees (Tiew *et al.*, 2021). Technology now enriches these relationships by shifting them from transactional to co-creative. AI-driven social listening provides live insights into expectations, while VR, AR and gamification tools foster engagement and encourage pro-environmental behaviours (An *et al.*, 2025; Liu *et al.*, 2019). Digital platforms like event apps and social media extend interaction across groups (Lopes *et al.*, 2025), offering marketing advantages while aligning with sustainability values (Bilgihan and Ricci, 2023). Collectively, these tools recalibrate stakeholder engagement by fostering inclusivity, transparency and trust through consistent interactions, where stakeholders see their input reflected and experience seamless engagement, reinforcing events as collaborative ecosystems.

When used synergistically, these technologies allow marketing-driven visibility, sustainability-oriented practices and experience-enhancing interactions to converge, amplifying engagement while embedding shared values across groups. Moreover, insights gathered through stakeholder interactions flow directly into the spatial design phase, informing venue choices and technological configurations that reflect collective needs and expectations.

Space

Decisions about space link venue design to ecological performance, experiential quality and brand positioning (Mair and Smith, 2021). Smart technologies elevate this phase by transforming physical sites into digitally enhanced environments. Virtual prototyping enables organisers to test layouts, crowd flows and energy consumption before implementation, reducing costs and emissions (Filimonau *et al.*, 2024). Smart destination systems benchmark accessibility and resource efficiency (Toubes *et al.*, 2024), embedding sustainability into planning from the outset. These tools not only optimise logistics but also create immersive experiences that shape perceptions of innovation and comfort. While in-person gatherings support local economies yet increase travel-related emissions, hybrid and virtual formats reduce ecological costs but risk excluding digitally marginalised groups. (Mair and Smith, 2021). Hence, space decisions involve balancing trade-offs that influence sustainability, inclusivity and branding simultaneously.

Taken together, these technologies illustrate how spatial design can simultaneously drive sustainability outcomes, strengthen marketing through brand positioning and heighten the attendee experience, underscoring the interconnected potential of EEMS within a single decision space. Furthermore, the data generated from spatial technologies, such as energy usage, crowd flows and accessibility metrics, feeds into the safety phase, where it supports proactive risk management and enhances both operational security and attendee confidence.

Safety

Safety is no longer confined to operational risk management but has become a visible aspect of event value creation. AI-powered monitoring and blockchain-based ticketing strengthen both security and trust, while 3D venue modelling and VR simulations allow proactive risk mitigation with reduced environmental costs compared to traditional drills (Filimonau *et al.*, 2024; Lu *et al.*, 2024). Wearables and mobile apps offering real-time safety protocols enhance confidence, improving attendee experience as well as organisational reputation (Jakar *et al.*, 2024). Glastonbury's 2023 drone initiative illustrates how eco-friendly

monitoring can signal sustainability leadership. However, reliance on surveillance raises privacy concerns, and unequal access to advanced systems risks widening divides in perceived event quality (Hutton *et al.*, 2025). Effective adoption, therefore, requires balancing innovation with fairness and accountability.

Holistically, safety technologies link sustainability, marketing and attendee experience: eco-friendly monitoring supports green practices, enhanced security builds trust and brand reputation and visible safety measures foster confidence and care. Data captured here also feeds into the scene phase, supporting dynamic, real-time responses during live event delivery.

Scene

The scene phase marks live delivery, where technologies converge to shape atmosphere, engagement and outcomes. High-speed connectivity, interactive visuals, gamified platforms, streaming services and service robots transform events into immersive environments (Aktepe and Demirci, 2024; Toubes *et al.*, 2024). These tools deepen engagement, extend marketing reach and provide sponsors with heightened visibility. Hybrid participation and live streaming also help reduce travel emissions, while gamification nudges pro-environmental behaviours during the event (Sisson and Whalen, 2022). Robots not only reduce labour needs but also generate data for sustainability monitoring.

Yet, digital participation depends on equitable access: while advanced immersive tools can heighten engagement, they may exclude groups with limited resources. Ensuring inclusivity is therefore a core challenge for aligning innovation with sustainability and marketing goals (Holmes *et al.*, 2015; Mair and Smith, 2021).

Collectively, these technologies show how EEMS domains interlock in real time: immersive tools enhance experiences, sustainable features reduce impact and digital channels expand marketing value. Their combined use elevates the scene beyond entertainment into a multidimensional platform of value creation. Performance data and behavioural insights from this phase then flow into the success phase, supporting systematic evaluation and continuous improvement.

Success

The success phase closes the lifecycle by evaluating outcomes and guiding the measurement of each EEMS objective. AI-driven sentiment analysis, automated surveys, RFID wristbands and mobile applications deliver multidimensional insights into attendee satisfaction, sponsor value and environmental outcomes (Bustard *et al.*, 2019; Choi *et al.*, 2023). For well-funded events, sophisticated analytics create opportunities to demonstrate accountability and enhance reputation. However, smaller organisers, limited to basic tools, face constraints (Meier *et al.*, 2025). The lack of shared standards hinders comparison across events, weakening the cumulative value of evaluation. Accessible and standardised frameworks are thus needed to position success measurement as both a benchmarking tool and a driver of continuous improvement in event engagement.

In concert, these tools ensure sustainability, marketing and experiential metrics are assessed together, providing a comprehensive account of event value. The insights loop back into the scope phase, informing future design and completing the technology-enabled lifecycle. The 6S framework thus links individual phases into a continuous cycle.

Discussion and implications

Across all six phases, a recurring challenge is the uneven capacity of organisers to adopt and benefit from smart technologies. Mega-events such as the Tokyo 2020 Olympic Games

exemplify the integrated potential of robotics, AI, blockchain, IoT and big data to optimise the entire lifecycle, from scoping through to evaluation (Russo *et al.*, 2022). In contrast, smaller organisers often rely on inexpensive applications or open-source systems, which, while functional, risk reinforcing disparities in inclusivity, quality and innovation. Addressing these divides requires adaptable solutions and shared standards that make technology accessible across scales. To consolidate these insights, Table 1 synthesises how smart technologies operate within the 6S framework, aligning tools with their primary functions and highlighting synergies with the EEMS. Rather than duplicating detail, it provides a comparative lens that complements the narrative analysis, offering both scholars and practitioners a concise reference for understanding where and how digital innovations create value across the event lifecycle.

The implications of this study are anchored in the 6S framework, ensuring they remain tethered to empirical insights rather than abstract generalisations. By tracing how smart technologies shape scope, stakeholder engagement, space, safety, scene and success, the findings demonstrate that transformative outcomes are not limited to live delivery but extend across the entire lifecycle (Aktepe and Demirci, 2024; Frank, 2021; Toubes *et al.*, 2024). For practice, this means that even modest interventions, such as low-cost AI social listening in scoping or open-source digital twins for space design, can meaningfully advance EMMS reach and outcomes. For policymakers, the evidence underscores the need to establish accessible standards and incentivise equitable adoption so that technological progress does not widen divides between resource-rich and resource-poor organisers. More broadly, embedding accountability and inclusivity into each phase positions smart technologies as enablers of fairness as much as efficiency, reinforcing their societal value. In this way, the study not only consolidates the framework's utility for researchers but also translates it into actionable strategies that guide decision-making in a rapidly evolving event landscape.

Conclusion

This study demonstrates that smart technologies fundamentally redefine how interdependencies between the EEMS are managed across event lifecycles, transcending phase-specific enhancements. Through an SLR, the proposed 6Ss of the event lifecycle framework synthesise fragmented research, providing a structured analytical lens to examine technological impacts on event scoping, stakeholder engagement, spatial design, safety protocols, live delivery and post-event evaluation. By mapping key technologies (RO1) and their phased integration (RO2), the framework reveals critical EEMS convergence points and dynamic cross-stage interactions, advancing both theoretical discourse and practical implementation strategies.

The analysis identifies recurring tensions: reconciling cost-efficiency with sustainability objectives, balancing high-tech innovation with accessibility and aligning ambitious societal goals with operational realities. While large-scale organisers leverage advanced solutions such as blockchain ticketing or metaverse-enabled co-creation, resource-constrained counterparts can achieve parallel EEMS outcomes through scaled alternatives, community-driven digital tools or hybrid manual–digital systems. Existing policy frameworks (e.g. ISO 20121) provide scaffolding to standardise these adaptations across contexts. This spectrum-based approach, ranging from low-cost tools to data-intensive systems, ensures viability for diverse organisational capacities while maintaining fidelity to sustainability, marketing and experiential imperatives.

Notwithstanding these contributions, the study faces several limitations that shape the scope and applicability of its insights. Limitations acknowledge the inherent volatility of technology-focused research, including rapid obsolescence and a literature bias that over-represents technologically advanced regions and large-scale events, thereby obscuring

Table 1. Smart technologies across the event lifecycle: functions and EEMS intersections

Event phase	Key technologies	Primary functions	EEMS intersections and impacts
Scope (strategic foundation)	AI-powered market research	Define purposes and objectives	Experience: embeds participant expectations into design
	Big data analytics	Integrate sustainability benchmarking with real-time sentiment analysis	Marketing: optimises outreach and positioning
	IoT sensors	Balance personalised design with eco-efficiency metrics (e.g. energy per capita)	Sustainability: embeds ecological targets into objectives
Stakeholder (co-creation and engagement)	AI social listening	Shift relationships from transactional to co-creative	Marketing: generates buzz and extends brand interaction
	VR/AR	Foster engagement and sustainable behaviours	Sustainability: nudges sustainable behaviour; reduces waste
	Gamification	Improve accessibility and visibility	Experience: builds inclusive participation and trust
	Event apps and digital platforms		
Space (venue and format design)	Virtual prototyping (digital twins)	Test layouts, flows and energy digitally	Sustainability: reduces travel emissions
	Smart destination systems	Benchmark accessibility and resource efficiency	Experience: improves comfort, accessibility and innovation
		Enable hybrid/virtual participation	Marketing: enhances branding with virtual tours
Safety (risk and value management)	AI video monitoring	Proactively mitigate risks	Experience: ensures attendee well-being
	Blockchain ticketing	Verify identities and strengthen security	Marketing: builds trust and professional reputation
	3D VR Simulations	Deliver real-time safety protocols	Sustainability: cuts environmental cost of drills
	Wearables and apps		

(*continued*)

Table 1. Continued

Event phase	Key technologies	Primary functions	EEMS intersections and impacts
Scene (live delivery and atmosphere)	5G connectivity Interactive visuals and AR Gamified platforms Service robots Live streaming	Create immersive environments Heighten engagement and interaction Reduce labour intensity and monitor ops	Experience: transforms engagement Marketing: boosts sponsor visibility and reach Sustainability: cuts travel emissions and material waste
Success (evaluation and learning)	AI sentiment analysis (NLP) RFID wristbands Automated feedback tools	Deliver multidimensional insights. Gather real-time satisfaction, value and ecological impact	Marketing: measures ROI and sentiment Experience: demonstrates attendee feedback is valued Sustainability: reports carbon footprint and metrics

insights from developing markets and resource-constrained settings. As an SLR, its findings are contingent on the scope and quality of these existing publications. The emphasis in current research on emerging tools such as robotics, blockchain and metaverse applications also reflects a hype bias, as many of these technologies remain experimental rather than widely adopted (Kılıçarslan *et al.*, 2025). Furthermore, while the proposed 6S framework consolidates fragmented insights into a coherent structure, it remains a conceptual model requiring empirical validation across varied cultural and organisational contexts. Practical barriers such as legacy system integration, workforce upskilling and the absence of standardised cross-phase metrics further constrain immediate applicability. Finally, the study acknowledges that the pursuit of synergies across EEMS domains can, in practice, involve complex trade-offs that are not exhaustively explored here. Acknowledging these limitations reinforces the need for complementary empirical studies that test, refine and contextualise the framework to ensure it remains both theoretically robust and operationally viable.

These limitations also signal critical opportunities for future research. Future studies must consolidate the 6S framework by empirically testing how smart technologies generate integrated outcomes across experiential, sustainable and market-oriented (EEMS) domains. Rather than analysing each stage in isolation, research should adopt holistic designs that capture cross-phase dynamics, for instance, tracking how AI-enabled scoping tools influence downstream safety planning or how immersive live technologies generate data for long-term evaluation. A critical priority is comparative research across scales, from mega-events to community festivals, to determine whether low-cost solutions (e.g. open-source digital twins) can deliver outcomes comparable to advanced systems. To enable this, the development of standardised metrics is essential, ensuring insights are transferable and actionable. By embedding inclusivity and accessibility directly into these measures, scholars can ensure that innovation reduces, rather than reinforces, adoption disparities. Ultimately, this body of work should demonstrate how smart technologies can be positioned as a public good, providing an accountable pathway for the event industry to achieve experiential richness, marketing effectiveness and the broader goals of sustainable development.

As intelligent technologies evolve, the 6S framework provides a foundation for ongoing innovation, equipping scholars to theorise emergent trends and guiding practitioners in navigating implementation complexities. It serves as both a shared language for researchers and a strategic roadmap for practitioners to plan, implement and evaluate technology integration, ensuring investments create simultaneous value across experience, marketing and sustainability.

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