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Enhancing Risk Management in Event Planning (The Role of Artificial Intelligence in Predictive Analysis and Crisis Mitigation)

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Abstract:

This research explores how Artificial Intelligence (AI) can enhance risk management in event planning, particularly in Saudi Arabia's rapidly growing events sector under Vision 2030. Traditional risk management methods are often reactive and inadequate in addressing dynamic and large-scale event challenges. The study highlights how AI technologies—such as predictive analytics, machine learning, and real-time monitoring—can proactively identify risks, improve crisis response, and support decision-making. Using a quantitative survey of 102 professionals across government, private, nonprofit, and consulting sectors, the findings reveal limited current AI integration but strong support for its future use. Major barriers include privacy concerns and lack of technical expertise, while crowd monitoring and predictive tools are the most common AI applications. The study recommends that event organizers integrate AI into risk management strategies from the early planning stages, using tools such as crowd forecasting analytics and

digital emergency models to take proactive measures. The government sector is recommended to develop a comprehensive regulatory framework for the use of AI in public events, including clear guidelines and performance standards to ensure the safe and effective use of this technology. It also recommends developing the digital skills of new event organizers, particularly in risk management and AI, by enrolling in specialized training programs to enhance their competency and future-readiness. As well as studying the ethical and legal aspects of using artificial intelligence in major events to establish responsible regulatory frameworks.

Keywords: Risk Management, Artificial Intelligence, Decision Support Systems, Proactive Risk Identification, Data-Driven, Decision Making.

1. Introduction

Event planning is a dynamic and multifaceted process that involves coordinating various elements to ensure successful execution. The complexity arises from factors such as managing diverse stakeholders, adhering to strict timelines, and mitigating unexpected risks (Wallace & Michopoulou, 2022). Planners must navigate logistical challenges, resource allocation, and potential disruptions, making risk management a crucial component of the process.

Integrating Artificial Intelligence (AI) into event planning has revolutionized risk management practices, offering tools that enhance decision-making and operational efficiency. AI's ability to analyze vast datasets enables event planners to predict attendee behavior and preferences, facilitating proactive adjustments to strategies and resource allocation (Nasreen, 2024). For instance, AI-powered predictive analytics can forecast potential risks, such as overcrowding or resource shortages, allowing planners to implement preventive measures.

AI-driven chatbots and virtual assistants have become invaluable in engaging attendees in real-time, collecting feedback, and reducing the manual workload associated with customer service (Momentus, 2024). These tools not only enhance the attendee experience but also provide planners with immediate insights into potential issues, enabling swift resolution and risk mitigation.

In the realm of crowd management, AI technologies offer data-driven decision support systems that assess and predict risk levels during events. By integrating real-time data on crowd density, weather conditions, and visitor movements, AI systems can provide planners with actionable insights to prevent incidents and ensure safety (Krishnakumari et al., 2023).

The adoption of AI in event risk management is not without challenges. Concerns regarding data privacy, the need for technical expertise, and the initial costs associated with implementing AI solutions must be addressed to fully leverage its benefits (Eventscase, 2025). Despite these hurdles, the strategic integration of AI holds significant promise for enhancing risk management in event planning, leading to safer and more efficient events.

1.1. Problem Statement:

Traditional event risk management suffers from slowness and an inability to address immediate and changing risks due to reliance on outdated expertise. Despite the success of AI in other fields, its use in event risk management is limited due to a lack of integration between data and real-time decision-making. This study aims to explore how AI can improve risk prediction, interagency communication, and emergency planning to organize safer and more effective events.

1.2. Significance of the Study

1. The study aligns with the goals of Saudi Vision 2030, which focuses on hosting major events and developing the entertainment and tourism sectors.
2. It highlights the importance of artificial intelligence in improving event risk management, including risk prediction and crisis response.
3. It fills a gap in academic literature and practical practices regarding the use of artificial intelligence in event planning.
4. It provides useful applied insights for event organizers, government and private entities, and AI solution developers.
5. It supports the Kingdom's efforts in digital transformation and organizing safe and effective global events such as the Riyadh Season and Formula 1.
6. It contributes to strengthening Saudi Arabia's position as a regional and international events hub by adopting advanced risk management technologies.

1.3. Study Objectives'

The exact objectives of the study are:

1. To analyze the key issues in traditional risk management for event planning and identify areas that can be addressed by AI.

2. To explore how AI technologies such as machine learning, predictive analytics, and real-time surveillance can be utilized to improve risk detection and response strategies.

3. To identify the effectiveness of AI-powered risk management tools in mitigating uncertainties regarding stakeholder coordination, security threats, and operational disruptions in mega events.

4. To explore existing uses of AI in event risk management, with a focus on Saudi Arabia's large-scale events, such as the Riyadh Season, Formula 1 Saudi Grand Prix, and other similar mass public events.

5. To provide strategic recommendations to event planners, policymakers, and AI developers on integrating AI solutions to enhance the practice of risk management and maintain event security and success.

1.4. Research Questions

1- How can artificial intelligence improve predictive risk analysis in event planning?
2- What are the key challenges in traditional risk management for event planning, and how can AI address them?
3- What AI-driven tools and technologies are most effective in mitigating crises during events?
4- How does the implementation of AI in event risk management impact decision-making and response times?
5- What are the ethical and practical considerations of using AI in event risk management?
6- To what extent has AI been adopted in risk management within the event industry in Saudi Arabia?
7- How do event planners perceive the effectiveness and reliability of AI-based risk management solutions?

1.5. Study Terminologies

- **Event Planning**: The process of organizing and coordinating all aspects of an event, including logistics, budgeting, stakeholder management, and risk mitigation.
- **Risk Management**: The systematic identification, assessment, and mitigation of potential risks that could impact the success of an event.
- **Artificial Intelligence (AI)**: The use of machine learning algorithms, predictive analytics, and automation to assist in decision-making and problem-solving within event risk management.

- **Predictive Analysis**: A data-driven technique that leverages AI to forecast potential risks and challenges before they occur, allowing for proactive decision-making.
- **Crisis Mitigation**: Strategies and actions taken to reduce the impact of unexpected disruptions or emergencies during an event.
- **Stakeholders**: Individuals or groups involved in an event, including organizers, sponsors, vendors, attendees, and regulatory authorities.
- **Quantitative Research**: A research methodology that collects and analyzes numerical data to identify patterns, relationships, and trends.
- **Reliability**: The consistency and stability of the research findings, ensuring that repeated measurements yield similar results.
- **Validity**: The extent to which the research instrument accurately measures the intended concepts and produces meaningful results.

1.6. Research Plan

This thesis is structured into five main chapters, each addressing a critical aspect of the research:

- **Chapter Two: Literature Review** – This chapter explores existing research on event risk management, AI applications in predictive analysis, and crisis mitigation. It provides a comprehensive review of relevant theories, frameworks, and case studies that highlight the role of AI in managing risks within the event planning industry.
- **Chapter Three: Methodology** – This chapter outlines the research design, including the quantitative approach used, data collection methods (surveys), and data analysis techniques. It also discusses the reliability and validity of the study.
- **Chapter Four: Findings & Discussion** – This chapter presents the results of the data analysis conducted using SPSS. It includes descriptive statistics, correlation analysis, and regression models to assess the impact of AI on risk management in event planning. The findings are interpreted in relation to existing literature and industry practices.
- **Chapter Five: Conclusion & Recommendations** – The final chapter summarizes the key findings, discusses their implications for event planners and AI developers, and offers recommendations for future research. It also highlights the practical significance of AI-driven risk management strategies in the Saudi Arabian event industry.

Concluding this chapter, a comprehensive background to the study was provided, highlighting the complexities of event planning, the role of AI in modern risk management, and the importance of the study in the context of the transformation taking place in the Kingdom of Saudi Arabia under Vision 2030. The research gap in traditional methods of event risk management was highlighted, and the need for AI-powered solutions capable of handling dynamic and large-scale events was demonstrated. The chapter also addressed the importance of the study in terms of its theoretical contribution to expanding understanding of the role of AI in this field, and its practical contribution in providing insights for practitioners and decision-makers. The study relied on a quantitative approach using questionnaires and data analysis using SPSS, ensuring validity and reliability of the research procedures. This chapter thus laid the scientific foundation for the study, which will be completed in subsequent chapters through a literature review, data analysis, and practical recommendations for employing AI in event risk management.

2. Literature Review

2.1. Introduction

This chapter constitutes a basic literature review that highlights research related to risk management and AI applications in event planning. It highlights the research gap in integrating AI, particularly in the areas of predictive analytics and crisis response, despite the complexity of events and the growing need for smart and effective solutions. It also demonstrates the importance of employing these technologies in the context of Saudi Vision 2030 and establishes a theoretical and experimental framework that supports the study's direction and gives it clear scientific and practical value.

2.2. Definition of Key Concepts

In order to give a clear insight into the primary themes that were explored in this research, this section defines the main concepts that inform the research: risk management, event planning, predictive analysis, and artificial intelligence. Defining these terms is critical for ensuring conceptual clarity as well as establishing the context in which they are applied throughout the study.

Risk Management: Risk management is the systematic process of identifying, assessing, and mitigating potential hazards that could negatively affect the success or safety of an operation or

event (Hopkin, 2022). In event planning, it entails anticipating both internal and external risks—some of which are health and safety hazards, technological failures, and environmental disruptions—and developing strategies to minimize their impact (Silvers, 2022).

Event Planning: Event planning involves the organization and coordination of all the aspects of professional events, including logistics, budgeting, scheduling, risk management, and stakeholder communication. It is a multidisciplinary process requiring a balance between creative, technical, and management components to facilitate the successful staging of an event (Bowdin et al., 2023). Effective event planning not only includes the staging of the event but also includes pre-event risk assessment and post-event evaluation.

Predictive Analysis: Predictive analysis is a form of advanced analytics that uses historical data, statistical models, and machine learning algorithms to forecast future events (Shmueli et al., 2023). Predictive analysis in event risk management enables planners to model likely risks and pre-emptive measures, such as anticipating the crowd's behavior, supply chain breakdown, or emergencies.

Artificial Intelligence (AI): Artificial intelligence is the replication of human intelligence processes by machines, especially computer systems, which can perform tasks like learning, reasoning, and self-enhancement (Russell & Norvig, 2021). Artificial intelligence for risk management in event planning can be employed to enhance decision-making through processing information in real time, recognizing risks automatically, and doing scenario-based forecasting (Lu et al., 2023).

2.3. Overview of Risk Management in Event Planning

Historical Background and Evolution

Risk management in events has evolved significantly, shifting from a traditionally reactive approach to a proactive and integrated approach to the planning process (Silvers, 2012). With the increasing size and complexity of events, especially following the COVID-19 pandemic and the rise of security threats, risk management has become a key component of event success (Brown et al., 2022). These practices began with models from other industries such as construction and aviation, and then evolved in the 1990s with the issuance of safety and licensing regulations (Hopkin, 2022; Tarlow, 2023). With the advent of technology, tools such as electronic checklists

and data analytics emerged, later evolving with the use of artificial intelligence and real-time monitoring at major events (Goldblatt, 2011; Lu et al., 2023). The approach has also become multidisciplinary, encompassing fields such as public health and cybersecurity, reflecting a growing awareness of modern risks (Raj & Musgrave, 2022).

Common Risk Types in Event Management

Event management faces a wide range of risks that, if not managed effectively, can lead to financial losses, reputational damage, or even threats to the safety of individuals (Raj & Musgrave, 2022). These risks include financial aspects such as cost overruns or poor revenues (Tum et al., 2023), operational aspects such as logistics or crowd management failures (Silvers, 2012), and environmental aspects such as natural disasters or inclement weather that threaten outdoor events (Brown et al., 2022). Technological risks have also become prominent in the digital age, including technical failures and security breaches (Lu et al., 2023), as well as legal risks associated with non-compliance with licenses or regulations (Tarlow, 2023). Reputational risks can be devastating, especially with the rapid spread of content via social media (Goldblatt, 2011). Therefore, classifying and understanding these types of risks is the basis for developing effective strategies to mitigate them, based on the nature and size of each event.

Traditional Risk Management Frameworks and Their Limitations

Traditional risk management frameworks in event planning rely on structured processes to identify, analyze, mitigate, and monitor risks to ensure event success. Among these frameworks are the ISO 31000 standard model and the Project Management Institute's (PMI) risk management process, which have long been used to support professionals in conducting a structured risk analysis (ISO, 2018; PMI, 2021). These frameworks include stages such as risk identification, qualitative and quantitative risk analysis, response planning, and ongoing monitoring. While these models provide a sound foundation for addressing known risks, they face distinct challenges when applied to the modern, highly dynamic and uncertain event environment:

- Reactive rather than proactive: Traditional models rely on historical data, making them ineffective in dealing with sudden or emerging risks such as health crises or cyberattacks (Getz & Page, 2022).
- Poor flexibility: These models lack the ability to adapt immediately during events, which is vital for major events that require rapid decisions (Raj & Musgrave, 2022).

- Overreliance on human judgment: They rely on manual interventions and expert opinions, leading to inconsistent assessments and a lack of objectivity in complex situations (Silvers, 2012).
- Lack of technological integration: They do not leverage real-time analytics and artificial intelligence tools, which reduces their ability to detect accelerating technical or security issues (Lu et al., 2023).
- Poor predictive ability: They focus on previously known risks and fail to predict unexpected or rare events with significant impact (Tarlow, 2023).

2.4. Artificial Intelligence in Risk Management

Definitions and AI Technologies Relevant to Risk Management

Artificial Intelligence (AI) refers to the process of developing computer systems that can perform tasks that require human intelligence in the majority of situations. They include decision-making, language processing, problem-solving, and pattern recognition (Russell & Norvig, 2021). For risk management purposes, AI is a revolutionizing technology employed to enhance identification, analysis, and mitigation of risks in most fields, including planning for events.

There are several AI technologies that are highly beneficial in risk management:

- **Machine Learning (ML):**

ML is defined by algorithms that learn from historical data and improve their predictive abilities over time through ongoing refinement without explicit programming (Mohri et al., 2022). In risk management, ML can identify trends, detect anomalies, and provide early warnings based on real-time data, which is critical in predicting operational, financial, or safety risks in event settings (Amankwah-Amoah et al., 2021).

- **Predictive Analytics:**

This subcategory of AI entails using statistical techniques, machine learning, and data mining to analyze current and historical facts for the purpose of predicting future outcomes (Bihani & Patil, 2021). Predictive analytics in event risk management allows event planners to forecast various risk situations, assess the probability of occurrence, and devise effective countermeasures.

- **Natural Language Processing (NLP):**

NLP is a branch of AI that allows machines to read, understand, and respond to human language (Jurafsky & Martin, 2023). It plays a critical role in processing unstructured data such as social

media posts, customer feedback, or news alerts, thereby assisting in the detection of possible emerging threats or public sentiment that can impact event delivery (Zhou et al., 2022).

- **Expert Systems and Decision Support Tools:**

These are computer-based systems that simulate the human expert's decision-making ability through rule-based reasoning and databases (Sammut & Webb, 2017). In event management, these applications have the ability to carry out automated risk analysis, suggest mitigation recommendations, and prioritize responses to risk based on event parameters in real-time.

- **Computer Vision and Image Recognition:**

In physical event spaces, AI-driven visual technologies can be utilized for crowd surveillance, security risk detection, and compliance tracking, informing safety initiatives and emergency response systems (Redmon & Farhadi, 2018).

Applications of AI in Risk Identification, Assessment, and Mitigation

The application of Artificial Intelligence (AI) in risk management has entirely changed the way organizations, event planning organizations inclusive, identify, assess, and mitigate risks. Unlike traditional techniques based on historical trends and manual assessment, AI-driven systems facilitate real-time data analysis, continuous learning, and prediction, significantly enhancing decision-making and preparedness.

- **Risk Identification**

AI technologies have the ability to analyze massive amounts of diverse data and detect threats invisible to human experts. For example, natural language processing (NLP) techniques can track news and social media to detect risk indicators and shifts in sentiment around events (Zhou et al., 2022), while machine learning-based anomaly detection algorithms can identify unusual patterns that may indicate cyber threats or supply chain failures (Mourtzis et al., 2021).

- **Risk Assessment**

AI facilitates more advanced risk evaluation through predictive modeling and simulation techniques. Machine learning models may examine past event data, existing trends, and external variables such as weather or geopolitical factors to assess the likelihood and possible impact of different risk scenarios (Shapira et al., 2022). This allows event managers to more effectively rank risks and make informed resource allocation decisions. (Rao & Nayak, 2022).

- **Risk Mitigation**

Artificial intelligence enhances proactive prevention by providing real-time recommendations and continuous adjustments during events. For example, computer vision technologies enable monitoring crowd density and predicting safety risks before they occur (Redmon & Farhadi, 2018), while reinforcement learning models help optimize risk mitigation schedules based on past event outcomes and adapt to changing conditions (Zhang et al., 2023).

AI applications can also model the effects of different mitigation measures using digital twins or scenario modeling, allowing event organizers to experiment with the effectiveness of different tactics in a virtual environment before actual implementation (Wang et al., 2021).

Case Studies and Examples from High-Risk Industries

AI has been extensively used in high-risk industries where failure will have catastrophic effects. Experience from industries like healthcare, aviation, and finance can be translated to the event management industry, specifically managing uncertainty and minimizing disruption.

- **Healthcare: AI for Predictive Patient Risk Management**

AI is used in healthcare to predict and mitigate risks such as sepsis early, and helps organize resources and reduce errors, reflecting the importance of prediction and rapid response in event planning (Nemati et al., 2018; Rajkomar et al., 2019).

- **Aviation: AI in Operations and Safety Management**

The aviation industry uses AI to predict failures and improve safety by analyzing performance data and detecting human errors, which contributes to reducing operational risks and developing effective emergency plans (Kumar et al., 2022; Chien et al., 2020).

- **Finance: AI Fraud Detection and Cybersecurity**

Artificial intelligence is used in banks to detect fraud, assess credit, and protect cybersecurity, through self-learning algorithms that detect suspicious patterns (Bussmann et al., 2021), and these technologies can be applied to protect payment and ticketing processes at events.

- **Oil & Gas: AI for Environmental and Safety Risk**

The oil and gas industry is using AI to predict accidents and improve safety by analyzing sensor data and simulating environmental hazards, as Shell is doing with a digital twin (Janiesch et al.,

2021). These applications demonstrate AI's ability to manage risks in complex environments, enhancing its importance in mega-event planning.

2.5. AI in the Context of Event Planning

2.5.1. Existing Literature on AI Integration in Event Planning

AI in event planning is still in its infancy, but it shows promising potential for improving engagement, automating tasks, and decision-making (Mariani & Borghi, 2021). It is used in chatbots and intelligent scheduling (Xu & Zhang, 2022), and has also been harnessed for crowd management and congestion mitigation at major events (Zhang & Jung, 2023). Despite this progress, there remains a need for a stronger integration of AI technologies with risk management standards in this sector.

2.5.2. Use of Predictive Software and AI Models to Foresee Large Event Risks

The use of predictive analytics in event management is growing, particularly to address risks such as overcrowding, security threats, and weather (Camacho et al., 2022). AI models are used to anticipate problems in advance and optimize resource allocation. It is also employed in surveillance systems to detect suspicious behavior and enhance security response (Jain et al., 2021), as well as to simulate crowd behavior in emergency situations to improve evacuation plans.

2.5.3. Success Stories and Challenges

The Tokyo 2020 Olympics successfully used AI for crowd management, logistics, and health monitoring, using thermal cameras and predictive algorithms (Sharma et al., 2021). However, the use of AI faces challenges related to privacy, costs, and the need for experts (Veenstra & Dolen, 2022). Despite these obstacles, its strategic deployment offers promising opportunities for risk management, especially within initiatives such as Saudi Vision 2030 (Alghamdi & Alfarraj, 2023).

2.5.6. Gaps and Limitations in the Existing Literature

- Limited Focus on the Event Planning Sector in the Context of AI for Risk Management

Despite the widespread use of AI in risk management across multiple sectors, its application in event planning remains rare in the academic literature, despite the complex and risky nature of this field (Tanner & Duval, 2022). Most existing studies lack specialized models suitable for the event environment, limiting the effectiveness of AI applications in this context (Chen et al., 2021).

Therefore, there is an urgent need for academic research that develops and tests tools specifically for AI-based risk management in event planning.

- Geographic or Cultural Gaps (e.g., Few Studies Focusing on the Kingdom of Saudi Arabia)

Despite growing global interest in the use of AI in event risk management, there is a clear research gap in the context of Saudi Arabia. Most studies are focused on Western or advanced Asian countries whose circumstances differ from the Saudi context (Liu et al., 2021; Brous & Janssen, 2020). With the Kingdom's events sector accelerating its development under Vision 2030, and hosting major events such as the Riyadh Season and the Dakar Rally, the need for AI tools tailored to the local context is emerging (Al-Fadhli & Alharthi, 2023).

Cultural, religious, and regulatory specificities in the Kingdom impact the acceptance and use of AI technologies, making Western models inappropriate locally (Alshehri, 2022). Despite government efforts, such as initiatives by the Saudi Data and Artificial Intelligence Authority (SDAIA), applied research in this field remains limited. Therefore, bridging this research gap is essential to develop effective, culturally and economically appropriate AI solutions for event risk management within the Kingdom.

- Lack of Integration Between Practical Event Planning Tools and AI Technologies

Current literature indicates a clear lack of integration between practical event planning tools and advanced AI technologies. While there are many theoretical studies on AI-powered risk management (Nguyen et al., 2023), their practical applications, particularly those integrated into event planning platforms, remain limited. Most event organizers use traditional software such as Trello and Eventbrite, which lack real-time forecasting and data analysis capabilities (Thomas & Chien, 2021).

This gap between innovation and practical application means that capabilities such as crowd forecasting or climate risk prediction are often not integrated into everyday planning tools, making it difficult for non-expert organizers to leverage AI technologies (Zhou et al., 2022). Furthermore, most research does not provide scalable solutions or user-friendly interfaces that are compatible with the fast-paced nature of the industry (Kumar & Iyer, 2022). Therefore, there is a need for multidisciplinary applied research focused on developing flexible and integrated AI solutions for common event tools, to bridge the gap between theory and practice.

2.6. Intellectual and Theoretical Framework

For the purpose of providing this research with a strong intellectual foundation, in this chapter, two theoretical perspectives are examined that are fundamental to this study: the Technology Acceptance Model (TAM) and the Risk Society Theory. These theoretical perspectives not only explain the dynamics of AI technology adoption in event planning but also the organizational and social shifts in risk understanding and risk management in the digital age.

2.6.1. Technology Acceptance Model (TAM)

Davis's (1989) Technology Acceptance Model (TAM) focuses on two key factors that determine user adoption of technologies: perceived usefulness and ease of use. In the field of event management, adoption of AI tools is linked to the extent to which organizers believe they are useful and easy to implement.

The model has been expanded to include factors such as trust in AI systems, data privacy, decision transparency, and organizational readiness (Wirtz et al., 2019; Dwivedi et al., 2021; Venkatesh et al., 2022). This theory is used in this study to understand the behaviors that influence AI adoption in the Saudi Arabian event environment, particularly regarding trust and digital readiness.

2.6.2. Risk Society Theory

Ulrich Beck's (1992) "Risk Society" theory highlights that modern societies face manufactured risks, such as terrorism and cyberattacks, which are complex and cross-border, unlike the natural risks in traditional societies. In event management, these risks increase with the size and sensitivity of the event.

The theory provides a context for the use of artificial intelligence, not just as a technical tool, but as a social necessity to address uncertainty. This aligns with the directions of Saudi Vision 2030, which places innovation at the heart of its policies.

2.6.3. Locating the Research Within Scholarship

The TAM and Risk Society Theory combination allows this research to fill a gap between risk consciousness and technological innovation. Most literature today tends to deal with AI adoption or risk management separately on a routine basis. However, this research sets the two concepts in dialogue, showing how AI tools can be applied practically to meet the demand for proactive data-driven risk planning in events.

By looking at Saudi Arabia nation quickly digitalizing this research contributes geographically applicable knowledge to a global scholarly conversation. It emphasizes the cultural, organizational, and policy-specific considerations that drive AI uptake in high-risk sectors like event management.

2.7. Synthesis of Literature and Relevance to the Study

- How the Reviewed Literature Shaped the Current Research

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- Determining Research Gaps the Research Will Fill

Despite the abundance of studies on artificial intelligence and risk management, there is a clear lack of research linking them in the context of event planning, particularly within the Kingdom of Saudi Arabia. Existing literature does not provide practical models that illustrate how AI can be used to reduce risks within the event environment. Most studies focus on Western or Asian contexts, limiting their relevance to the Saudi context, which is culturally and organizationally specific.

Furthermore, there are insufficient studies that explain how to integrate AI tools with existing event planning systems or examine the factors that influence the adoption of these tools, such as system trust, digital readiness, and data integrity. This study seeks to fill these theoretical and practical gaps and present an integrated model that is appropriate for the Saudi context within Vision 2030.

- Justification of the Research Aims and Objectives

This research aims to address knowledge and practical gaps in the use of artificial intelligence (AI) in event risk management, particularly in the Kingdom of Saudi Arabia. The research objectives

are essential to keeping pace with the changes taking place in the Kingdom's events sector, particularly with the growing organization of major events under Vision 2030, which requires smart and proactive risk solutions.

The study focuses on evaluating the role of AI technologies such as predictive analytics, machine learning, and natural language processing in improving risk monitoring and management, drawing on the experiences of high-risk sectors such as healthcare and aviation. It also seeks to understand the factors that hinder or contribute to the integration of these technologies into existing event planning systems in Saudi Arabia, taking into account digital infrastructure, societal acceptance, and local policies.

The study employs theoretical models such as the technology acceptance model and risk society theory to frame its findings, while providing practical recommendations for decision-makers, organizers, and developers to support the adoption of AI in the events sector in a sustainable manner that is tailored to the Saudi context.

2.7. Data Representation

This section presents visual representations that synthesize key findings from the reviewed literature. The tables summarize major studies relevant to AI applications in risk management and event planning, while the figures illustrate trends such as AI adoption in the event industry and perceived effectiveness of AI tools in risk mitigation.

Table 1 Summary of Key Studies on AI in Risk Management and Event Planning

Author(s) & Year	Industry Focus	AI Technology Used	Key Findings	Relevance to Current Study
Hassan & Karim (2021)	Aviation	Machine Learning	Improved risk prediction and system monitoring	Demonstrates effectiveness of Al in high-risk environments
Alshammari & Alqahtani (2023)	Event Planning (SaudI Arabia)	Predictive Analytics	Highlighted challenges in local adoption of Al tools	Addresses geographic and cultural gap

Chen et al. (2022)	Healthcare	Al-Based Early Warning Systems	Enhanced decision-making and reduced human error	Indicates cross - sector benefits applicable to event safety
Nguyen et al. (2023)	Corporate Events	NLP, Chatbots	Automated risk communication during crises	Supports integration of Al for real-time risk response

Table (1) summarizes prominent studies on the integration of Al in risk-intensive sectors, highlighting methods, outcomes, and applicability to event planning. These studies support the rationale for Al's utility in risk mitigation strategies.

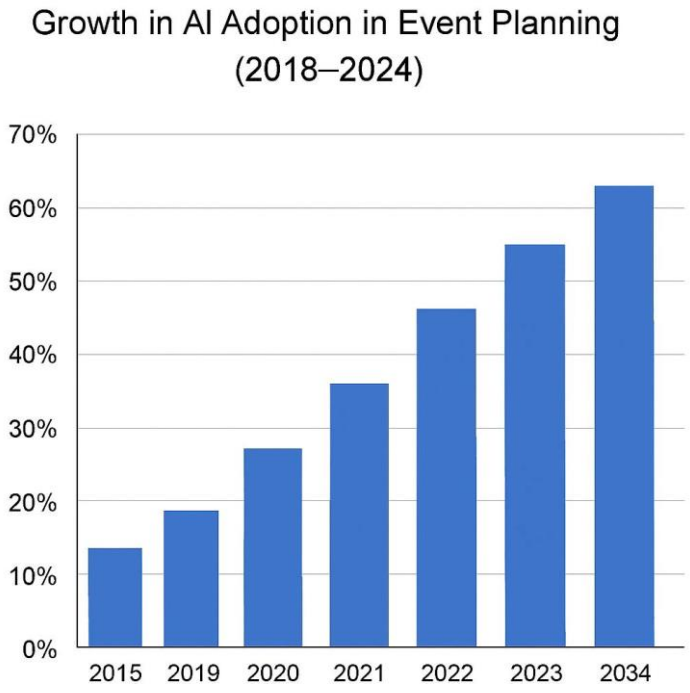

Figure 1 Growth in AI Adoption in Event Planning (2018–2024)

Figure (1) shows the global increase in AI adoption within the event planning industry, based on data synthesized from Deloitte (2023), Statista (2024), and PwC (2022). The steady upward trend reflects growing reliance on predictive tools for risk management.

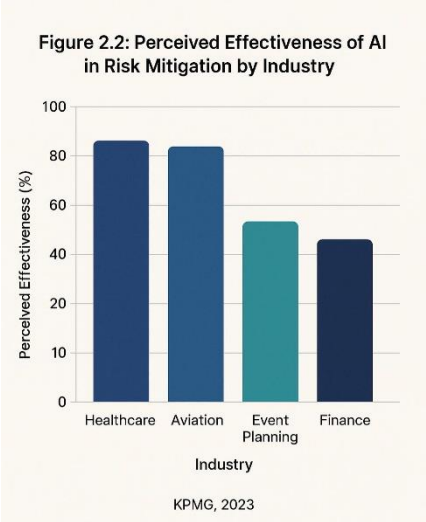

Figure 2 compares stakeholder perceptions of AI's effectiveness in managing risk across several sectors

Figure (2) compares stakeholder perceptions of AI's effectiveness in managing risk across several sectors. While healthcare and aviation show high confidence, the event planning industry trails behind, indicating an opportunity for further integration and innovation (KPMG, 2023).

Table 2 outlines gaps in the existing body of literature, providing justification for the current study's focus on the Saudi Arabian event planning sector and the need for localized AI applications.

Limitation	Description	Implications
Geographic Bias	Limited focus on MENA/Saudi Arabia	Lack of context specific insights
Tech-Practice Gap	Few studies combine Al theory with practical event tools	Weak integration in operational planning
Sector Neglect	Most literature focuses on healthcare/finance	Event sector remains underexplored

This chapter provides a comprehensive literature review on risk management in event planning and the role of artificial intelligence (AI) in improving it. It reviews the evolution of traditional risk management practices and common risk types, highlighting the limitations of traditional models in predicting complex and changing risks. It also highlights the contributions of AI, through technologies such as machine learning and predictive analytics, to enhancing risk

prediction and management, citing successful applications in sectors such as healthcare and aviation. However, research gaps remain, particularly in the application of AI to event risk management, and the lack of studies specifically focused on Saudi Arabia.

The theories of "technology acceptance" and "risk society" are employed to frame the research and understand stakeholder behavior toward AI adoption. The chapter as a whole emphasizes the importance of current research in bridging these gaps and paves the way for discussion of the study methodology in the next chapter.

3. Research Methodology

3.1. Introduction

This chapter discusses the research methodology used to study the role of artificial intelligence (AI) in enhancing risk management in event management in Saudi Arabia. The study relied on a quantitative approach to analyze the impact of AI technologies such as predictive analytics, real-time monitoring, and automation tools on improving risk detection, crisis response, and decision-making. The chapter covers the research design, sampling methods, data collection methods, data validation, analysis tools, and ethical considerations, in line with the applied and practical nature of the study.

3.2. Research Methodology

The research adopts a quantitative approach using a cross-sectional design to capture participants' views and practices on risk management and artificial intelligence in event management at a specific point in time. This approach is preferred for identifying relationships and trends between variables within a large sample. It is also suitable for the rapidly evolving Saudi context, as quantitative methods enable generalizable findings that support data-driven decision-making, in line with the Kingdom's Vision 2030. A correlational design is also used to analyze the relationship between the speed of AI adoption and the effectiveness of risk management in events.

3.3. Study Community and Sample

- Target Population

The study targets professionals involved in organizing, coordinating, and assessing event risks in Saudi Arabia, such as event organizers, AI solution developers, operations managers, safety officers, and consultants. It focuses on those with experience in major events such as the Riyadh

Season and the Red Sea Festival. This category comes amid the growth of the entertainment and tourism sector in the Kingdom, making the adoption of advanced risk management systems a strategic priority.

- Sampling Technique and Sample Size

Purposive sampling was used to select participants with experience in event management and the use of AI tools. Following the Cochrane formula, the sample size was set between 150 and 200 participants to achieve statistical precision. Participants will be recruited via LinkedIn, professional networks, AI companies, and event management associations to ensure a diverse background.

3.4. Data Collection Procedures and Tools

The primary data collection tool is a structured questionnaire, which will be administered through Google Forms. The survey instrument will be developed in both English and Arabic to address linguistic diversity and improve accessibility.

The six parts of the questionnaire are:

1. Demographics (org. role, org. size, years of exp.)
2. Current Risk Management Practices
3. AI Adoption in Event Planning
4. Effectiveness of AI in Risk Identification and Crisis Mitigation
5. Challenges and Barriers to AI Integration
6. Ethical and Privacy Concerns.

3.5. Data Quality and Accuracy Standards

To ensure the validity and reliability of gathered data, quality assurance techniques of various types have been integrated into the research design. Data accuracy is crucial, particularly for studies focusing on evidence-based decision-making processes in rapidly changing sectors like event planning.

3.5.1. Measures of Reliability

Reliability refers to internal consistency and steadiness of the instrument. To attempt this, a pilot study was conducted on 15 practitioners from the target population. Pilot feedback helped to clarify ambiguous items and increase logical flow.

Additionally, Cronbach's alpha will be used to assess the internal consistency of the survey measure. A value of $\alpha \geq 0.70$ is a satisfactory value since it suggests that the measure of the underlying concepts is reliable (Bell, Bryman, & Harley, 2022).

3.5.2. Measures of Validity

- Content Validity was maintained by seeking comments from academic and industry professionals in AI and event risk management. Their comments guaranteed that the items include all the aspects related to the study.

- Construct Validity will be established using exploratory factor analysis (EFA) through SPSS, to guarantee that each set of questionnaires is measuring the theoretical constructs intended (e.g., adequacy of AI, effectiveness of risk avoidance).

- Face Validity was validated through non-expert reviewers to make sure that the questions are understandable and seem logically related to the research question.

Other controls are the use of required response settings in Google Forms to avoid missing data, and duplicate response prevention through distinctive access links.

3.6. Data Analysis

Data analysis will be conducted using SPSS version 27 from data collected through the questionnaires. The package was selected due to its robust statistical processing capacity and common usage in business and social science research (Saunders et al., 2019).

The methodology to be used is as follows:

1. Descriptive Statistics: In order to show a description of demographic data and general trends that relate to the use of AI, for instance, means, frequencies, and standard deviations.
2. Correlation Analysis: To determine whether AI adoption relates to characteristics like increased risk recognition, faster response to crisis situations, and stakeholder coordination.
3. Multiple Regression Analysis : Hypothesis testing about AI tools' predictive ability in designing event safety and risk outcomes. For example, how much AI adoption will be a predictor of response time or risk avoidance success.
4. ANOVA (Analysis of Variance): Can be applied to contrast risk perception or AI confidence levels between various demographic segments (e.g., public vs. private sector).

5. Factor Analysis: In order to identify patterns or clusters of responses, to confirm the constructs and dimensions within the survey (particularly the "AI effectiveness" and "perceived barriers" ones).

3.7. Variables Overview

Different kinds of variables are examined in this study, classified in the following way:

- Independent Variable:

- Level of adoption (indicated by the number of AI tools utilized, degree of integration, and frequency)

- Dependent Variables :

  - Risk detection accuracy

  - Speed of crisis response

  - Efficiency of stakeholder communication

- Control Variables :

  - Type of event (government, private, or public)

  - Size and duration of the event

- Respondent professional role

- Moderator Variable :

  - Availability of training and organizational support

- Mediator Variable :

  - Trust in AI tools and willingness to depend on them in case of emergencies

All these will be assessed using specific survey items that aim to assess both practice and perception, and statistically tested to examine the research model.

3.8. Ethical Considerations

The study adheres to scientific research ethics in accordance with King Abdulaziz University guidelines and international standards, with approval from the Ethics Committee prior to data collection. Ethical procedures include obtaining informed consent, ensuring voluntary participation, maintaining confidentiality and privacy, securing data, and considering cultural sensitivity in designing the questionnaire to suit the Saudi context.

3.9. Limitations of the Methodology

While the selected methodology is suitable for the objectives of the study, it has some limitations:

- Exclusion of Qualitative Data : The employment of quantitative methods alone limits the extent of understanding personal attitudes and experiences.

- Self-Reported Bias: Respondents may overestimate or underestimate their use of AI tools or risk practices, especially if they are not sufficiently informed about technical systems.

- Access Constraints Some key professionals may be difficult to access, especially if their organizations restrict participation in academic research.

- Generalizability : Although purposive sampling ensures relevant responses, it will not necessarily include the entire Saudi event industry. However, efforts will be made to ensure that the sample is representative by sector, role, and region.

These limitations will be freely acknowledged within the discussion chapter and will be used to define the scope and generalizability of the study's conclusions.

4. Analysis of Results

4.1. Demographic data analysis

a. How many years of experience do you have in event planning or risk management?

Table (3) Sample distribution by years of experience in event planning or risk management?

How many years of experience do you have in event planning or risk management	Frequency	Percent
Less than 3 years	26	25.5
3–5 years	34	33.3
6–10 years	28	27.5
More than 10 years	14	13.7
Total	102	100

Figure (3) years of experience do you have in event planning or risk management

The distribution of years of experience among participants reflects a variety of levels of expertise in event organization or risk management. Those with 3 to 5 years of experience constituted the largest proportion (33.3%), followed by those with less than 3 years (25.5%), those with 6 to 10 years (27.5%), and finally those with more than 10 years (13.7%). This diversity indicates a mix of beginner, intermediate, and advanced experience, enriching the study with multiple perspectives on risk assessment and management.

b. What type of organization do you currently work for?

Table (4) Sample distribution by type of organization you currently work for

type of organization do you currently work for	Frequency	Percent
Government	42	41.2
Private Sector	30	29.4
Non-profit Organization	18	17.6
Freelance or Consultant	12	11.8
Total	102	100

Figure (4) type of organization do you currently work for

The table illustrates the diversity of sectors in which participants work, with government sector employees constituting the largest percentage (41.2%), followed by those working in the private sector (29.4%), the non-profit sector (17.6%), and finally, independents or consultants (11.8%). This diversity reflects the different institutional contexts that influence event and risk management practices.

4.2. Analysis of questionnaire statements

Table (5) Arithmetic means and standard deviations of questionnaire items

	phrase	Mean	STd.devation	Trends	Arrangement
1	What is your current professional role	2.06	0.983	Risk Manager	10
2	Have you participated in large-scale events in Saudi Arabia (e.g., Riyadh Season, Formula 1, Book Fair?)	1.27	0.448	Yes	12
3	How important is risk management in your event planning process	3.35	1.123	Slightly Important	1
4	Which methods do you use to assess risks in events (Select all that apply)	2.75	1.391	Emergency Response Plans	5

5	Have you used any AI tools in your event planning process	1.20	0.399	Yes	13
6	What is the level of AI integration in your current risk management activities	2.55	0.828	Minimal Integration	8
7	Which of the following AI technologies have you used in risk management? (Select all that apply)	2.69	1.170	Facial Recognition or Crowd Monitoring	6
8	To what extent do you believe AI helps identify potential risks early	2.84	0.829	Moderately	3
9	How much does AI improve your crisis response time during events	2.76	0.842	Moderately	4
10	How confident are you in the accuracy and reliability of AI tools in high-pressure situations	2.54	0.834	Confident	9
11	What are the main challenges you face when using or adopting AI? (Select all that apply)	2.67	0.821	Data Privacy Concerns	7
12	Do you believe AI raises ethical issues in event planning? (e.g., surveillance, data collection)	1.88	0.868	Yes	11
13	In your opinion, should AI be integrated as a standard component in future event risk management strategies	2.94	0.839	Agree	2

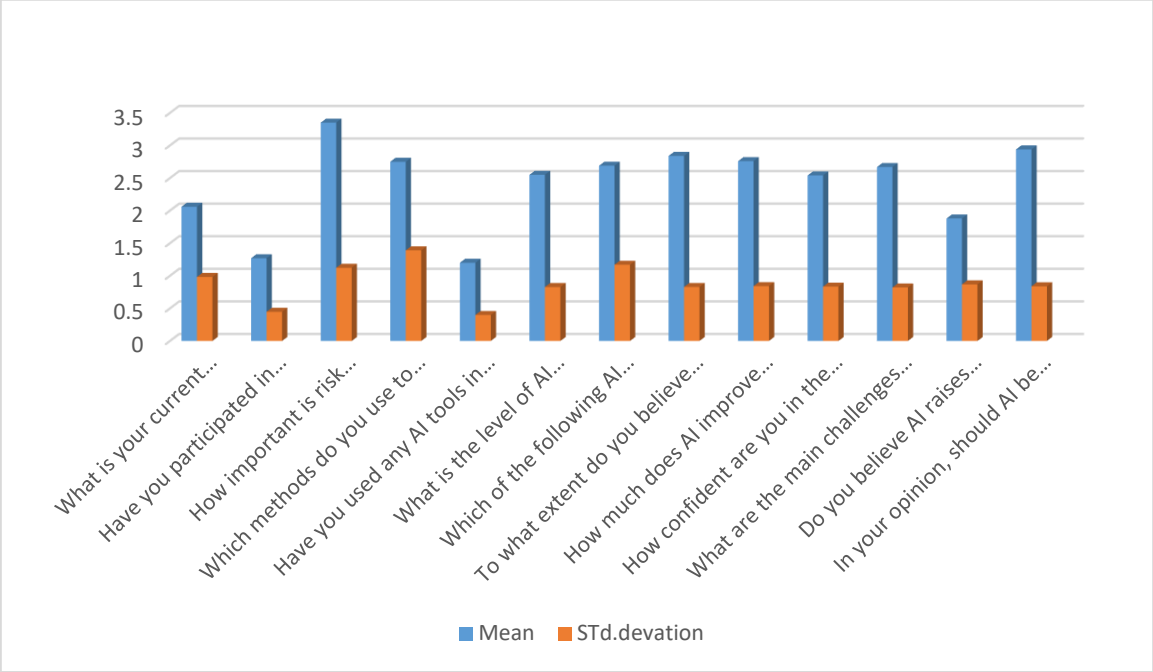

Figure (5) Arithmetic means and standard deviations of questionnaire items

The table shows participants' assessment of the importance of risk management and the use of AI in event planning. Risk management is considered somewhat important, with increasing support for the future integration of AI, but its use remains limited and raises concerns about trust and ethics.

4.3. Study objectives test

a. To analyze the key issues in traditional risk management for event planning and identify areas that can be addressed by AI.

Table (6) Chi-Square Tests

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	19.607[a]	12	.075
Likelihood Ratio	19.939	12	.068
Linear-by-Linear Association	1.198	1	.274
N of Valid Cases	102		

a. 10 cells (50.0%) have expected count less than 5. The minimum expected count is 3.02.

The results of the chi-square test showed a weak and statistically insignificant relationship between the two variables ($p > 0.05$), with similar results in the likelihood ratio test. The linear correlation test confirmed the absence of a significant linear relationship. However, the presence of cells with a low frequency reduces the reliability of the results, necessitating caution in interpretation and the possible use of other tests or modification of the data distribution to ensure the validity of the conclusions.

b. To explore how AI technologies such as machine learning, predictive analytics, and real-time surveillance can be utilized to improve risk detection and response strategies.

Table (7) Correlations

Correlations

			Have you used any 5 in your event planning process	What is the level of AI integration in your current risk management activities	Which of the following AI technologies have you used in risk management? (Select all that apply)	To what extent do you believe AI helps identify potential risks early	How much does AI improve your crisis response time during events
Spearman's rho	Have you used any 5 in your event planning process	Correlation Coefficient	1.000	-.025	.284**	-.005	.124
		Sig. (2-tailed)	.	.802	.005	.957	.219
		N	102	102	98	102	100
	What is the level of AI integration in your current risk management activities	Correlation Coefficient	-.025	1.000	.385**	.383**	.489**
		Sig. (2-tailed)	.802	.	.000	.000	.000
		N	102	102	98	102	100

	Which of the following AI technologies have you used in risk management? (Select all that apply)	Correlation Coefficient	.284**	.385**	1.000	.074	.396**
		Sig. (2-tailed)	.005	.000	.	.472	.000
		N	98	98	98	98	96
	To what extent do you believe AI helps identify potential risks early	Correlation Coefficient	-.005	.383**	.074	1.000	.362**
		Sig. (2-tailed)	.957	.000	.472	.	.000
		N	102	102	98	102	100
	How much does AI improve your crisis response time during events	Correlation Coefficient	.124	.489**	.396**	.362**	1.000
		Sig. (2-tailed)	.219	.000	.000	.000	.
		N	100	100	96	100	100

**. Correlation is significant at the 0.01 level (2-tailed).

The results showed a strong, statistically significant positive correlation between the use of AI tools and the diversity of risk management technologies, such as facial recognition and crowd control. They also demonstrated a relationship between AI integration into operations and its ability to detect risks early and respond quickly to crises, highlighting the importance of effectively integrating AI into systems and procedures. Conversely, the relationship between occasional AI use and the level of integration or effectiveness was weak and insignificant, indicating that the success of AI depends on the quality of its implementation and integration, not merely its presence or limited use.

c. To identify the effectiveness of AI-powered risk management tools in mitigating uncertainties regarding stakeholder coordination, security threats, and operational disruptions in mega events.

Table (8) Chi-Square Tests

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	77.140[a]	42	.001
Likelihood Ratio	87.895	42	.000
N of Valid Cases	100		

a. 52 cells (86.7%) have expected count less than 5. The minimum expected count is .20.

The results of the chi-square test showed a statistically significant relationship between the studied variables. The test value reached 77.140 at 42 degrees of freedom and a significance level of 0.001, indicating a significant correlation between the variables. The likelihood ratio test also confirmed this with a value of 87.895 and a significance level of 0.000, indicating a significant discrepancy between the actual and expected distribution of the data.

4.4. Overall Conclusion and Linking Results to Objectives:

The study results indicate a diverse range of participants' experiences and work environments, with a predominance of those with intermediate experience (3-5 years) and working in the government sector, which supports understanding the participants' characteristics and work context. The results also demonstrated participants' appreciation for the importance of risk management and their positive attitude toward integrating AI, despite limited use and concerns regarding privacy and ethics, which calls for enhanced training and awareness.

Correlation analyses also revealed a statistically significant positive relationship between AI integration and the effectiveness of crisis response and risk anticipation, confirming that institutional and technical integration is the key factor for the successful use of AI. The chi-square test revealed mixed relationships between variables, with some limitations in the data distribution, which requires caution in interpretation. Overall, the study confirms that the effectiveness of AI in

managing event risk depends on its actual level of integration within the institutional system and not solely on awareness of its importance.

5. Conclusion and Recommendations

5.1. Summary of the main findings of the study

The study aims to explore the role of artificial intelligence (AI) in enhancing risk management in event planning and organization, particularly in anticipating and effectively managing crises. Given the complexity of modern events and the multiplicity of organizing entities, there is a need for intelligent systems that rely on live and predictive data to make proactive decisions.

The results revealed a diversity of participants' experiences and work environments, with a strong focus on the government sector, where there is a high awareness of the importance of risk management and a desire to integrate AI. However, actual use is limited due to privacy concerns, weak digital infrastructure, and the absence of clear legislation. The analysis confirmed a strong positive relationship between the integration of AI into organizational processes, the effectiveness of crisis response, and the speed of risk prediction, emphasizing that comprehensive institutional and technical integration is the foundation for achieving real impact, not just partial or experimental use.

5.2. Conclusions based on the results

Based on the results of the study, the following conclusions can be drawn:

- Artificial Intelligence (AI) is a promising but underutilized tool:
- There is a gap between theoretical orientations and practical application of AI:
- Risk management effectiveness increases with the level of institutional and technical integration of AI:
- The relationship between AI and crisis management depends on the degree of systematic deployment and technical integration:
- The regulatory environment directly influences the adoption of AI technologies:
- The dominance of the government sector indicates the impact of policies and regulations on regulating or restricting use:
- Ethical and legal concerns remain barriers to the full adoption of smart technologies:

- Privacy and trust issues highlight the need for clear legislative and ethical frameworks:
- Professional experience influences the evaluation and adoption of AI technologies:
- The intermediate category demonstrates a balance between caution and openness to innovation, making them suitable for pilot applications.

5.3. Proposed solutions to the study problem

Based on the above, the study proposes a set of practical solutions to address the weak actual integration of AI in event risk management:

- Developing institutional strategies for integrating AI:
- Launching employee training and awareness programs:
- Providing clear technology governance:
- Establish specialized analytical units within work teams:
- Stimulate innovation through public-private partnerships:

5.3. Recommendations

Practical recommendations related to the study results:

- Event organizers should integrate AI into risk management strategies from the early planning stages, using tools such as crowd forecasting analytics and digital emergency models to take proactive action.
- The government sector is advised to develop a comprehensive regulatory framework for the use of AI in public events, including clear guidelines and performance standards to ensure the safe and effective use of the technology.
- The private sector can foster innovation by testing and adopting new crisis management technologies such as live aerial imagery analysis or machine learning applications for immediate risk detection and response.
- Nonprofit organizations are benefiting from low-cost AI tools, particularly for early warning and crowd management, particularly for charitable and volunteer events with limited resources.
- New event organizers should develop their digital skills, particularly in risk management and AI, by enrolling in specialized training programs to enhance their competency and future-readiness.

- Enhance the integration of AI into risk management systems by integrating it into institutional policies and procedures, rather than using it experimentally or in a limited capacity.
- Develop training programs for event professionals, especially those with limited experience, to enhance their proficiency in using AI technologies, risk analysis, and decision-making.
- Support investment in advanced technologies such as facial recognition and crowd analysis, given their clear positive association with improving crisis response speed and reducing damage.
- Consider ethical and legal considerations when designing AI systems used in events, by establishing controls to protect privacy and ensure transparency.
- Encourage non-governmental and private sectors to adopt more innovative strategies for AI-based risk management, similar to the government sector.
- Redesign measurement tools in similar studies to avoid low replication issues and provide more reliable results, and perhaps use alternative tests such as Fisher's Exact Test.
- Conduct future studies with larger and more diverse samples to verify weak statistical trends and generalize the results to different contexts.

5.4. Future recommendations for scientific research

- It is recommended to conduct quantitative studies on larger, more geographically diverse samples to improve the accuracy and generalizability of the results.
- A comparative analysis of the experiences of developed and developing countries in using AI for event management can be conducted to identify successful models that can be adapted locally.
- There is an urgent need to study the ethical and legal aspects of using AI in major events to establish responsible regulatory frameworks.
- The return on investment of AI tools in event planning should be measured to assess economic feasibility and support evidence-based decision-making.
- It is recommended to design smart technology integration models within simulated crisis scenarios to evaluate the effectiveness of the tools prior to actual implementation.

5.5. General conclusion:

Artificial intelligence has significant potential to transform event risk management, but achieving this requires integrating it into an integrated institutional and strategic framework.

Awareness of the importance of AI is only the first step. It must be followed by practical and systematic implementation that integrates the technology with existing technical and administrative systems.

Success depends on a supportive regulatory environment that includes clear policies and appropriate laws, as well as building qualified human capital at the institutional level.

There is an urgent need for ongoing research to keep pace with technological developments, which helps update strategies and develop tools to meet future challenges.

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