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DIGITAL TRANSFORMATION IN JAKARTA'S MUSEUMS: LEVERAGING AI AND IOT TO OPTIMIZE SMART SUSTAINABLE TOURISM

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Abstract

This study investigates the implementation of Artificial Intelligence (AI) and the Internet of Things (IoT) in three museums in Jakarta, National Museum, Jakarta History Museum, and Wayang Museum, as part of a digital transformation strategy to support smart and sustainable tourism. Employing a qualitative case study approach, data were collected through in-depth interviews, participant observation, and document analysis. The findings reveal several challenges, including limited infrastructure, inadequate digital equipment, and low digital competency among staff. Among the three, the National Museum demonstrates more advanced adoption, particularly in digital guide applications and institutional support. A preliminary survey of 56 respondents aged 18–30 indicates strong interest in Augmented Reality (AR), Virtual Reality (VR), and interactive media, with 72% actively sharing their museum experiences on Instagram. These insights highlight the need for digital strategies aligned with the preferences of digital-native generations. To address existing gaps, the study proposes a Smart Navigation and Information System (SNIS) that integrates AI-driven personalization with IoT-based environmental monitoring to optimize visitor engagement and curatorial practices. Overall, this research underscores the strategic role of digitalization in advancing sustainable tourism through enhanced cultural preservation, visitor experience, and institutional resilience.

Keywords: museum digitalization, artificial intelligence, internet of things, smart sustainable tourism, cultural tourism.

1. Introduction

Digital transformation has become a strategic necessity in the development of the global tourism industry, particularly in supporting the concept of Smart Sustainable Tourism, which emphasizes efficiency, inclusivity, and sustainability (Setiawan & Cakrawala, 2024). This concept not only focuses on reducing the environmental impact of tourism activities but also on enhancing visitor experiences through the integration of technology. Museums, as cultural destinations that play an important role in education and historical preservation, need to adopt this approach to remain relevant in the digital era.

Jakarta, as Indonesia’s economic and cultural center, holds great potential for the development of cultural tourism. Numerous national and local museums are located in the city, preserving invaluable historical heritage. However, many museums in Jakarta continue to face challenges in enhancing their appeal to modern society, particularly to the younger generation, which consists of digital natives. The limited use of advanced technologies, such as interactive information systems, digital applications, and multimedia integration, has made museum visits less attractive

compared to other forms of educational entertainment.

A study by Nabillah et al. (2024) revealed that the low adoption of technology in presenting collections and the lack of data-driven strategies in museums have significantly reduced engagement and visitation rates, especially among young cultural tourists. Meanwhile, a UNESCO survey (2022) shows that over 70% of cultural tourists aged 18–30 expect interactive and personalized elements in their museum experiences.

Globally, the implementation of technologies such as Artificial Intelligence (AI) and the Internet of Things (IoT) has proven to positively impact museum management and visitor experiences. AI enables personalized interaction through computer vision, natural language processing (NLP), and interest-based recommendations. IoT allows the use of sensors to monitor temperature, humidity, and visitor flow in real-time, aiding in collection conservation and facility management (Centrinorino et al., 2019). García-Madurga et al. (2023) noted that the integration of AI and IoT can increase visitor satisfaction by up to 35% and reduce museum operating costs by 20% through resource efficiency.

However, the reality in Indonesia remains starkly different. According to a report by the Ministry of Tourism and Creative Economy (2023), only about 15% of museums have fully implemented digital technologies. Most still rely on conventional methods that are less appealing to younger visitors. In contrast, museums that have adopted digitalization, such as AR/VR use and interactive guide applications, have seen visitor numbers increase by up to 50% over the past five years (Gill et al., 2019). This indicates that digital transformation is not merely a supplementary need but a key factor in maintaining the competitiveness of museums in the technology-driven tourism era.

Furthermore, the digital transformation of museums aligns with national strategic policy directions. The Provincial Government of DKI Jakarta, through its Regional Development Plan (Bappeda DKI Jakarta, 2023), targets the digitalization of the cultural sector as part of its Smart City initiative. The national vision of "Indonesia Digital 2045" also positions tourism and culture as top priorities in the country's technology and innovation-based transformation agenda.

Unfortunately, to date, there has been very limited research specifically addressing the implementation strategies of intelligent technologies such as AI and IoT in Jakarta's museums. Existing studies tend to be conceptual and do not provide concrete models that can be used as policy references or practically applied. In fact, a comprehensive understanding of current conditions, challenges, and the potential for technology utilization is crucial in designing effective systems.

Therefore, this study aims to develop a strategy for implementing AI and IoT technologies to support the digital transformation of museums in Jakarta. It will assess the current state of digitalization, identify structural and technical challenges, and design a prototype system based on AI and IoT that can be piloted in selected museums. The final outcome is expected to contribute not only to academic discourse but also to offer a replicable model for technology adoption in other museums across Indonesia, ultimately strengthening the competitiveness of the cultural tourism sector in the digital age.

2. Literature Review

2.1. Sustainable Tourism

Sustainable tourism is a development approach that balances economic, social, and environmental dimensions to ensure long-term benefits for local communities while supporting the preservation of culture and nature (Veronica, 2024). This approach emphasizes the active involvement of communities in the planning and management of tourist destinations, allowing them to directly experience the positive impacts of tourism.

Sofiani & Yulia (2023) examined the implementation of sustainable tourism principles in the development of the Cihideung Udik Tourism Village in Bogor. They highlighted the importance of collaboration among academics, government institutions, and local communities in developing community-based tourism attractions, ultimately contributing to the improvement of local economic well-being.

Meanwhile, Wibawa (2025) explored strategies for optimizing local culinary assets to support sustainable culinary tourism in Jakarta. They emphasized that effective promotion, infrastructure development, and the adoption of sustainability practices are key factors in enhancing the competitiveness of local culinary destinations.

Similarly, Ardiansyah et al. (2024), through a community service project in Cihideung Udik, stressed the importance of education and training for local residents, particularly in homestay management and financial literacy. These initiatives are considered essential in supporting sustainable community-based tourism.

From these studies, it can be concluded that sustainable tourism requires a comprehensive approach involving multiple stakeholders, including academics, government, industry players, and local communities. Effective collaboration among these actors can help create tourist destinations that are not only attractive to visitors but also provide long-term social and economic benefits for the local population.

2.2. Smart Tourism

Smart tourism refers to the integration of information and communication technology (ICT) to enhance tourist experiences, operational efficiency, and sustainability. Technologies such as Augmented Reality (AR), the Internet of Things (IoT), and big data analytics enable more personalized and interactive services at tourism destinations.

Stevenson et al. (2024) found that the use of AR, smart tables, and interactive books at the Digital Museum of Gedung Juang 45 in Bekasi significantly enhanced the attractiveness and visitor experience. Meanwhile, Tham and Abidin (2023) emphasized the importance of integrating technology into tourism education to produce a more competent workforce in the digital era.

The concept of smart rural tourism is also emerging as a strategy to modernize rural tourism with the support of digital technology. Collaboration among governments, academics, and local communities is identified as a key success factor. Overall, smart tourism not only improves tourist comfort but also contributes to sustainability, as well as economic and social benefits for local communities (Kelvin et al., 2022).

2.3. Artificial Intelligence (AI) in Tourism

Artificial Intelligence (AI) plays a crucial role in enhancing operational efficiency, personalizing tourist experiences, and optimizing digital marketing within the tourism industry. The application of AI is evident in various areas, such as AI-powered chatbots that provide fast and accurate tourist information (Rahayu et al., 2020) and big data analysis used to tailor destination marketing strategies (Widarti et al., 2024).

In the MICE sector, AI improves event management efficiency through automated registration systems, agenda recommendations, and participant satisfaction analysis (Prabowo & Widagdyo, 2023). Moreover, AI is also used in promotional content creation, such as machine learning-based video production, which enhances the appeal of destinations on social media (Santoso et al., 2023).

Furthermore, the integration of AI with the Internet of Things (IoT) within the smart tourism concept enables real-time data-driven tourism management, creating more interactive and efficient visitor experiences. Successful implementation of AI in this sector relies on collaboration between governments, academics, and industry stakeholders (Ulimaz et al., 2024).

Given its numerous benefits, AI not only enhances tourist convenience but also supports the sustainability of the tourism industry. Therefore, its development must continue to adapt to market needs to foster smarter and more innovative tourism.

2.4. Internet of Things (IoT) in Tourism

Smart tourism integrates information and communication technology (ICT) to enhance tourist experience and improve destination operational efficiency. One of the core technologies within this concept is the Internet of Things (IoT), which enables interconnected devices to exchange data in real-time, supporting service personalization and resource optimization (Yulianti et al., 2024).

The implementation of IoT in tourist destinations has brought about innovations such as environmental monitoring, visitor flow management, and interactive information delivery through QR codes, RFID, and Bluetooth Low Energy (BLE) technologies at museums and cultural sites (Sornalatha & Kavitha, 2017). Additionally, real-time data analysis using IoT sensors facilitates strategic decision-making, such as the tourist density monitoring system in South Korea designed to prevent over-tourism.

However, major challenges in IoT adoption include data security and user privacy. The collection of vast amounts of data increases the risk of information breaches, necessitating the use of security protocols such as encryption and blockchain-based systems (Mercan et al., 2020). Furthermore, high investment costs and complex infrastructure pose obstacles for certain destinations, making collaboration between governments and the private sector essential to establish an inclusive IoT ecosystem (Ramadhan & Annisa, 2024).

2.5. Integration of AI and IoT in Sustainable Tourism

The utilization of Artificial Intelligence (AI) and the Internet of Things (IoT) in sustainable tourism contributes to enhancing tourist experiences, improving operational efficiency, and supporting environmental conservation (Buhalis et al., 2019). The concept of Smart Tourism emphasizes the use of IoT sensors to monitor

visitor density and AI-driven data analysis to optimize resources and reduce environmental impact (Suanpang & Pothipassa, 2024). These technologies assist destination managers in making data-driven decisions to prevent over-tourism and enhance environmental carrying capacity (Jamilati et al., 2023).

In the context of Digital Tourism, digital innovation plays a key role in destination management, including real-time monitoring and automation of energy consumption in hotels and tourist attractions (Xiang & Fesenmaier, 2017). AI is also applied in big data analytics to identify tourism trends, forecast tourist demand, and develop sustainable strategies (Femenia-serra & Gretzel, 2020). Furthermore, IoT is used to monitor energy and water usage in tourism facilities, supporting environmentally friendly practices (Deep et al., 2020).

3. Research Methods

This study employs a qualitative approach with a case study method to analyze the digital transformation of a museum in Jakarta through the implementation of Artificial Intelligence (AI) and the Internet of Things (IoT) in support of smart sustainable tourism. The Jakarta Museum was selected due to its early adoption of digital technologies aimed at enhancing visitor experiences and serving as a model for other museums in Indonesia. The case study method enables an in-depth exploration of the phenomenon within its real-life context, providing a comprehensive understanding of technology implementation in the museum setting (Assyakurrohim et al., 2022).

Data collection was conducted through in-depth interviews, participant observation, and document analysis. Semi-structured interviews involved museum managers, IT staff, and visitors, who were selected purposively based on their direct involvement in the implementation of digital technologies (Wisnawa & Oktaviani, 2024). Museum managers were interviewed regarding digitalization policies and strategies, IT staff about technical aspects and implementation challenges, and visitors about their experiences with the technologies. Participant observation focused on how visitors interact with AI and IoT applications, including how these technologies affect their overall museum experience. Document analysis included annual reports, government digitalization policies, and the museum's strategic plans for digital transformation.

The research began with a preliminary study involving a literature review on smart tourism, AI, and IoT, as well as the identification of museums that have adopted these technologies as potential case study sites. The collected data were analyzed using thematic analysis, which involved initial coding, pattern identification, grouping of major themes, and interpretation to gain deeper insights.

To enhance validity and reliability, the study applied data triangulation by comparing findings from interviews, observations, and document analysis to ensure consistency. Member checking was also conducted, allowing participants to review interview transcripts to ensure the accuracy of the information. An audit trail was maintained to systematically document the entire research process, thereby improving transparency and accountability (Fiantika et al., 2022).

In terms of research ethics, written informed consent was obtained from all participants prior to the interviews, with clear explanations about the research objectives, data confidentiality, and their right to withdraw at any time. All data were anonymized to protect participant privacy, and the study adhered to established

academic ethical standards (Frechtling, 2018).

Through this approach, the study is expected to offer valuable insights into the optimization of AI and IoT in supporting museum digitalization. The findings can also serve as a reference for the development of digital strategies in the museum sector across Indonesia, and provide recommendations for stakeholders such as other museums, government bodies, and technology startups involved in museum digitalization.

4. Results and Discussions

Several museums in Jakarta, including the National Museum and the Wayang Museum, are currently undergoing a transition toward the use of digital technology in the management and presentation of their collections. In this process, there are a number of infrastructure challenges that still need to be addressed to support the optimal implementation of technologies such as the Internet of Things (IoT) and Augmented Reality (AR). For instance, at the National Museum, limited signal coverage in certain areas poses a challenge to the comprehensive application of digital technology. This is likely related to the need for network upgrades, as well as the importance of strengthening awareness regarding the strategic role of technology in supporting museum management and enhancing the visitor experience.

Similarly, the Wayang Museum has begun adapting to technological developments by providing digital devices, although it still faces challenges related to the availability of adequate equipment and the need for staff training to ensure optimal use. These challenges reflect broader dynamics also faced by many cultural institutions across Southeast Asia, where, as noted by Nikaido & Koga (2021), physical preservation is often prioritized over digital innovation.

The development of technology in these museums requires larger investments, not only in terms of hardware and software but also in enhancing human resource capacity to manage and maintain the technology. Previous initiatives in countries like Singapore and South Korea have shown that museum staff digital literacy programs significantly improve technology adoption and maintenance (UNESCO, 2020). Therefore, synergy between the government, educational institutions, and private sectors is crucial to effectively overcome these technical barriers.

Table 1 presents a comparison of the main challenges at the National Museum, Jakarta History Museum, and Wayang Museum:

Table 1. Comparison of Main Challenges at the National Museum, Jakarta History Museum, and Wayang Museum

Type of Challenge	National Museum	Jakarta History Museum	Wayang Museum
Signal	3 (Moderate)	2 (Low)	2 (Low)
Equipment	3 (Moderate)	2 (Low)	3 (Moderate)

HR Training	3 (Moderate)	3 (Moderate)	2 (Low)
Funding	4 (High)	3 (Moderate)	3 (Moderate)

Scale: 1 = Very Low, 5 = Very High
Source: Author's field observation and descriptive analysis, 2025.

The scoring presented in Table 1 is based on qualitative field observations and informal interviews with museum staff, using a Likert-type scale ranging from 1 (Very Low) to 5 (Very High) to assess the severity of challenges in implementing digital technologies. Among the key issues identified, funding limitations and inadequate signal infrastructure emerged as the most significant barriers.

Table 1 compares the main challenges faced by three major museums in Jakarta: the National Museum, the Jakarta History Museum, and the Wayang Museum. The findings suggest that the National Museum performs relatively better across several aspects, including connectivity, digital equipment, human resource training, and funding, although these areas remain at a moderate level. In contrast, both the Jakarta History Museum and the Wayang Museum encounter greater obstacles, especially with internet access and the limited availability of interactive digital tools. Additionally, the Wayang Museum struggles with human resource capacity, particularly in digital competency. When it comes to funding, the National Museum benefits from stronger institutional support, while the other two museums depend more heavily on constrained local government budgets and external contributions.

The Jakarta History Museum focuses more on preserving collections with IoT technology integration, which allows visitors to obtain more in-depth information about the museum's collections in real-time. Although IoT technology plays an important role in preservation, the interactive aspects of this museum are still not fully developed. To attract more young visitors, technologies such as Augmented Reality (AR) or Virtual Reality (VR) could be utilized to create a more immersive and interactive experience. For instance, an AR app that allows visitors to view a visual reconstruction of Jakarta's history could be an attraction, especially for digital native generations who are more familiar with technology.

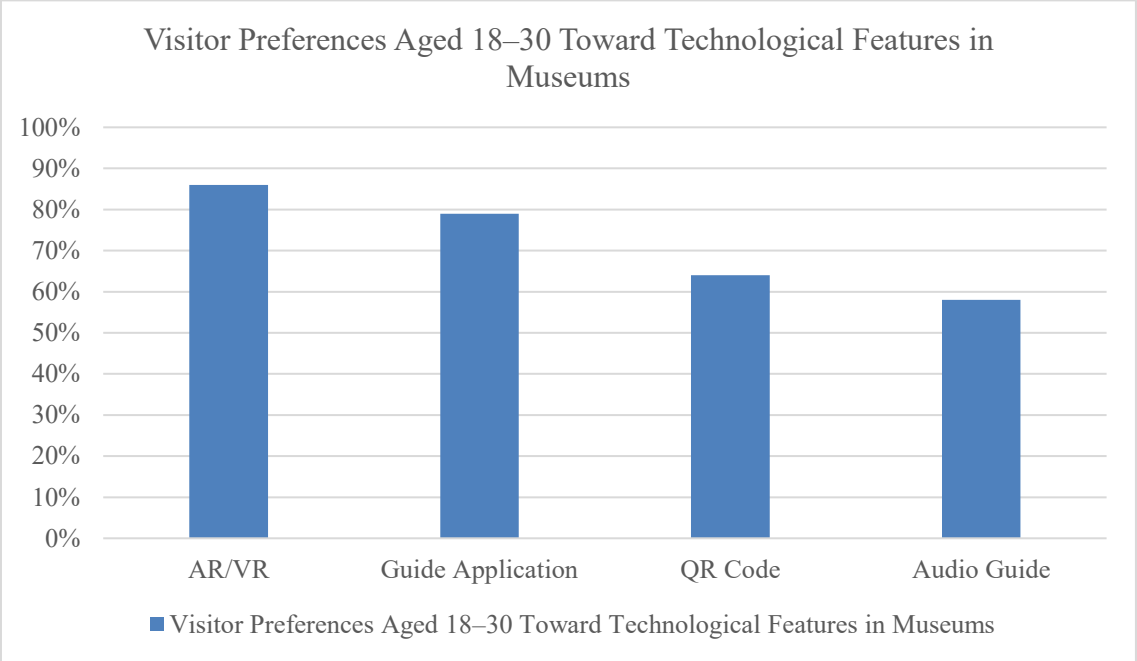
VR technology could also offer simulation experiences, such as taking visitors on a "visit" to colonial-era Jakarta or witnessing important historical events through VR headsets. Such innovations could help museums remain relevant to younger generations and enhance the educational value of the experiences offered. Research by (tom Dieck & Jung, 2017) shows that the use of AR/VR technology in museums contributes significantly to increased visitor engagement and satisfaction.

However, up to now, there has been little empirical data that directly measures the effectiveness of this technology in museums in Jakarta. To fill this gap, a preliminary survey was conducted involving 56 respondents aged 18–30 years to identify their preferences regarding the technological features they expect when visiting a museum. This survey used a multiple response approach, allowing respondents to choose more than one feature.

The following shows data on Visitor Preferences Aged 18–30 Regarding

Technological Features in Museums:

Figure 1. Visitor Preferences Aged 18–30 Regarding Technological Features in Museums
(Multiple responses allowed; based on 56 respondents)



Source: Primary data obtained from a preliminary survey, 2025

Based on a preliminary survey of 56 respondents aged 18–30 years, data were obtained regarding visitor preferences for technological features in museums. The survey used a multiple response approach, allowing respondents to select more than one preferred feature. The results showed that the majority of respondents were interested in the use of Augmented Reality (AR) and Virtual Reality (VR) at 86%, followed by digital guide applications (79%), QR codes (64%), and audio guides (58%). These findings indicate that the younger generation, as digital natives, has a strong interest in interactive and technology-based museum experiences. Therefore, the integration of these technologies is crucial in digital transformation strategies to enhance the appeal and satisfaction of young museum visitors.

Although there has been an in-depth discussion on the implementation of technology, the lack of empirical data supporting its effectiveness remains a major limitation. Case studies from other museums that have successfully integrated technology can offer clearer insights. For instance, the use of Augmented Reality (AR) technology in various museums around the world has been proven to enhance visitor engagement and extend the duration of visits. Research by Jung et al. (2016) shows that AR can improve understanding, interaction, and visitor satisfaction in museums. Institutions such as the Smithsonian have also piloted AR programs to increase visitor engagement through immersive digital tools.

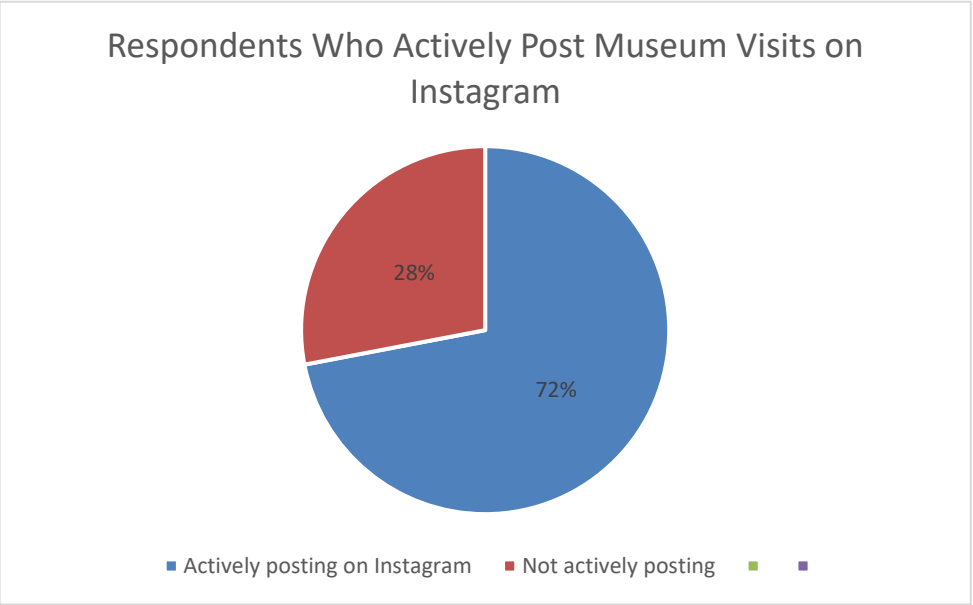
To strengthen the argument that technology enhances visitor experience and

satisfaction, direct measurements of the impact of technology usage, such as visitor satisfaction surveys after implementing interactive features, would be highly beneficial.

Young generations, known as digital natives, are more interested in experiences connected to technology and social media. Therefore, museums must adopt approaches that leverage their habits, such as through gamification or social media-based features. For example, exhibitions that integrate gaming elements could invite visitors to "compete" in answering questions or challenges related to the museum's collections, offering rewards like digital badges or discounts for future visits. According to a report by We Are Social and Meltwater (2024), social media plays a significant role in influencing travel decisions among Gen Z users in Southeast Asia, with visual appeal and shareability often determining destination choice. This trend makes Instagrammable moments a strategic consideration for museums aiming to attract younger audiences.

The following shows respondents who actively post their museum visits on Instagram:

Figure 2. Respondents Who Actively Post Museum Visits on Instagram



Source: Primary data obtained from a preliminary survey, 2025

The data indicate that Instagram plays a significant role in shaping how younger audiences experience and share museum visits. With 72% of respondents actively posting their experiences, museums can leverage this behavior by designing visually appealing installations, offering social media challenges, and encouraging the use of branded hashtags to increase digital reach and relevance. This aligns with recent trends showing that social media visibility influences leisure destination choices among Gen Z.

Museums can also leverage social media platforms to build further engagement

with visitors. Features like Instagrammable spots or hashtag challenges can extend the museum experience even after visitors leave the venue, increasing engagement and attracting more attention from the youth actively using social media.

One of the main challenges in implementing technology in museums is ensuring that visitors can effectively utilize the available technology. Clear and easy-to-understand communication strategies are essential for this. Museums can consider using interactive signage or digital guides to help visitors understand how to access and use the available technologies, such as AR apps or audio guides.

The use of digital media, such as mobile museum apps, can also help visitors access more information about collections independently. Museums abroad have successfully implemented these digital guiding systems, allowing visitors to choose tour routes based on their interests and access relevant information via their phones. For example, the British Museum's "Smartify" app enables users to scan artworks and receive detailed audio-visual content, enabling users to scan artworks and access audio-visual content directly via their smartphones, offering a more interactive alternative to printed maps.

Technology not only changes the way visitors interact with collections but also impacts on curatorial aspects. The integration of technologies like IoT, AR, and VR allows curators to design more dynamic exhibitions that respond to visitor desires. This technology gives curators more freedom to create interactive narratives that can be more easily tailored to different audiences. For instance, in museums that integrate AR technology, curators can enrich explanations of artifacts with additional information that appears on visitors' mobile screens, making the experience more immersive and personalized.

Furthermore, the application of technology allows curators to monitor how visitors interact with exhibitions, providing them with direct feedback on the most engaging content or the least popular. This allows curators to change and update exhibitions more effectively and based on data.

Based on the analysis conducted, technology has great potential to enhance visitor experiences in Jakarta's museums, especially in attracting younger generations. However, there are still several main challenges to overcome, particularly related to limited infrastructure and the lack of concrete evaluations on the impact of technology. To achieve more effective and sustainable museum management, it is crucial for museums to invest more in interactive technology, improve infrastructure capacity, and develop clear communication strategies for visitors. By doing so, museums in Jakarta can strengthen their position as educational destinations that are attractive and relevant to all types of visitors, especially younger generations.

The implementation of Artificial Intelligence (AI) and the Internet of Things (IoT) in museum environments is a digital transformation strategy that is beginning to be applied by cultural institutions in Jakarta. The National Museum, the Jakarta History Museum, and the Wayang Museum each show diverse applications of technology, tailored to the context of their collections, management visions, and the challenges they face. All three demonstrate that digitalization in museums is not just about modernizing facilities, but also about how learning experiences, emotional

engagement, and the interpretation of history can be conveyed through relevant technologies. This transformation aligns with findings that technology can enhance visitor engagement and provide deeper experiences, particularly in terms of interaction and narration in museum exhibition spaces.

The National Museum, for example, has progressively applied AI-based technology, reflecting an inclusive spirit in presenting historical heritage. The digital guide feature, based on an app, allows visitors to explore exhibition spaces independently without compromising the quality of information received. The app not only provides text and audio narratives but also offers options to explore specific themes or historical figures, creating a more personalized experience. Hindu-Buddhist statues, prehistoric objects, and other ancient artifacts are presented with a digital approach that connects them to cultural narratives and past social contexts. AI, thus, not only serves as a tool but also plays a role in reshaping how humans understand history.

However, the main challenge still faced is the uneven digital access within the building, especially in certain exhibition spaces where signals or technology devices are not yet well-covered. This indicates that digital transformation in museums requires gradual and sustainable development, as identified in literature that recognizes infrastructure limitations as a key challenge in adopting technology in museums. Studies such as by (Mazzetto, 2024) emphasize the importance of phased implementation and ongoing assessment in digital infrastructure deployment, especially in historical buildings with preservation constraints.

The Jakarta History Museum takes a more focused approach to collection preservation through IoT integration. Temperature, humidity, and light sensor systems have been implemented to maintain ideal environmental conditions for historical collections. While this technology is important for conservation, the visitor experience at this museum still lacks much interactive content based on technology. The historical narrative presented remains conventional, with text and photos that are less engaging for digital native generations. Therefore, further development in the use of interactive technology is needed to provide visitors with a deeper and more emotional experience.

Meanwhile, the Wayang Museum takes a simpler approach by adding QR codes to some collections, directing visitors to digital content that provides additional insights about the puppetry figures. While this offers a new experience, this technology is still limited and lacks a clear navigation system, so it's important to improve communication and orientation so visitors can fully utilize these features. Based on field observations during this study, the lack of wayfinding or user instruction signage in several Jakarta museums has led to underutilization of available digital features, such as QR codes or mobile guides. Based on the findings, this study proposes the development of a Smart Navigation and Information System (SNIS) that integrates AI-based recommendation algorithms with IoT-enabled environmental monitoring to personalize visitor experiences and optimize curatorial management.

The integration of AI and IoT has great potential to create a holistic system in museums. For example, AI that regulates narrative flow can be combined with IoT

technologies that automatically control lighting, temperature, and contextual information delivery, enhancing visitor comfort and supporting collection conservation. A conceptual model such as a Smart Navigation and Information System (SNIS) could be developed to enable integration between IoT and AI for more personalized visitor journeys. This synergy not only improves the quality of the visitor experience but also contributes to more efficient spatial management and long-term cultural heritage preservation.

Thus, technology is not only changing the way visitors interact with collections but also enriching the overall museum experience. Technology allows museums to become dynamic, ever-evolving institutions that can attract more visitors through more responsive and dynamic approaches. Museums that integrate technology well will not only remain relevant but also create richer, more sustainable, and forward-thinking experiences. As supported by various digital heritage initiatives, museums that adopt user-focused digital strategies often observe improvements in both visitor engagement and educational impact.

The insights gained from this study can inform the development of a replicable AI-IoT prototype for museums across Indonesia, thereby supporting digital transformation at a national scale and enhancing the competitiveness of cultural tourism in the digital era.

5. Conclusions and Recommendations

This study examines the implementation of digital technologies—specifically the Internet of Things (IoT) and Artificial Intelligence (AI), in several museums in Jakarta, such as the National Museum, Jakarta History Museum, and Wayang Museum. The digitalization process still faces major challenges, including limited network infrastructure, insufficient digital equipment, and a lack of staff training. The National Museum shows relatively better performance than the other two, particularly in terms of funding support and availability of digital tools.

A preliminary survey involving 56 respondents aged 18–30 revealed that the majority of young visitors desire a technology-based museum experience, especially features such as Augmented Reality (AR), Virtual Reality (VR), and digital guides. These findings highlight the need for museums to align their strategies with the preferences of digital-native generations.

Beyond the technical aspects, the study also emphasizes the importance of interactive, technology-based approaches such as gamification and shareable content on social media. With 72% of respondents actively posting their museum visits on Instagram, there is an opportunity for museums to enhance engagement through visually appealing elements and online challenges.

Examples of technology implementation include the integration of IoT sensors at the Jakarta History Museum for collection conservation, and the use of QR codes at the Wayang Museum to enrich visitor information. However, limitations in navigation systems and digital communication still hinder the effectiveness of these features.

As a solution, the study proposes the development of a Smart Navigation and Information System (SNIS), a system model that integrates AI for narrative personalization and IoT for environmental monitoring, aiming to create a more interactive, efficient, and sustainable museum experience.

Technology not only enriches visitor experiences but also revolutionizes the way museums present historical narratives and manage their collections. The findings of this study can serve as a reference for developing digitalization strategies in other museums across Indonesia, supporting cultural transformation in the digital era.

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