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COLLABORATION IN THE APPLICATION OF ARTIFICIAL INTELLIGENCE-BASED TECHNOLOGY IN HERITAGE TOURISM DESTINATIONS CASE STUDY: TAMAN SARI YOGYAKARTA

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DOI: https://doi.org/10.62567/micjo.v2i3.1057

Article info:
Submitted: 07/07/25 Accepted: 28/07/25 Published: 30/07/25

Abstract

This study explores the integration of Artificial Intelligence (AI) in the development of the heritage tourism destination Taman Sari Yogyakarta. As a cultural site with rich historical and architectural values, Taman Sari has great potential to become a leading historical tourism destination through the application of modern digital technologies. This research is highly relevant in the context of the Society 5.0 era, where digital transformation and multi-stakeholder collaboration through the pentahelix model (government, academia, business sector, community, and media) are key approaches in sustainable tourism governance.The objectives of this research are: (1) to identify the potential of AI application in enhancing the attractiveness of Taman Sari as a heritage tourism site, (2) to analyze the role of local communities in the digital transformation of the destination, and (3) to formulate a structured collaborative strategy for the development of AI based heritage destinations. The research employs a qualitative method using data collection techniques including observation, in-depth interviews, and documentation. Informants included representatives from government, local communities, academia, tourism businesses, and tourists. Thematic analysis was used to interpret the data and identify patterns and meanings related to stakeholder participation and partnership.The findings indicate that AI can serve as a tool for cultural preservation and enhancement of tourist experiences, through features such as historical chatbots and augmented reality. However, challenges remain, including limited infrastructure, low digital literacy among local communities, and weak inter-stakeholder collaboration. The study also finds that local communities have the potential to act as agents of digital literacy if actively involved in training programs and AI-based tourism management.The research concludes that developing heritage tourism destinations like Taman Sari requires strong synergy among stakeholders through the formation of inclusive digital collaboration forums. AI technology can be a valuable medium for cultural preservation when implemented in a contextual, participatory, and sustainable manner.

Keywords: artificial intelligence, heritage destination, pentahelix partnership, Taman Sari, tourism digitalization

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1. INTRODUCTION

Yogyakarta is one of the cities with prominent historical and cultural wealth in Indonesia, making it a leading tourist destination that can compete with Bali (Saputri & Widyaningsih, 2020, p. 10). The city's unique architecture, Javanese traditions, and vibrant creative economy are the main attractions for domestic and foreign tourists (Mahmudah et al., 2019, p. 12). One of Yogyakarta's cultural heritage icons is Taman Sari, a former royal garden that has now developed into a heritage tourism center with high historical, architectural, and spiritual value (Fadli & Lubis, 2018, p. 16). However, along with the times, the management and promotion of heritage destinations face new challenges, especially in terms of digitalization and the involvement of local communities (Prasetyo & Wibowo, 2020, p. 135).

Digital transformation in the tourism sector, particularly through the integration of artificial intelligence (AI) technology, offers opportunities to enhance the tourist experience, strengthen cultural preservation, and expand the reach of destination promotion (Santoso & Widodo, 2022, p. 56). However, the implementation of AI in historical tourism destinations such as Taman Sari still faces various obstacles, including the low digital literacy of the community, limited infrastructure, and not optimal collaboration across stakeholders (Prasetyo & Wibowo, 2020, p. 140). The local government has started digitalization initiatives through platforms such as Jogja Smart Service, but specific AI integration for heritage management and promotion has not been systematically realized (Saputri & Widyaningsih, 2020, p. 15).

The main problem identified in this research is the suboptimal application of AI technology to improve the attractiveness and management of Taman Sari heritage destination, as well as the limited role of local communities in the digitization process. In addition, collaboration between pentahelix elements—government, academia, business, community, and media—is still partial and unstructured, so digital innovation has not had a significant impact on cultural preservation and community empowerment (Santoso & Widodo, 2022, p. 60). Previous studies have highlighted similar issues in other heritage destinations, such as the lack of integrated smart tourism strategies (Buhalis & Amaranggana, 2014), low digital literacy among local stakeholders (Achmadi, Purnamasari, & Rahardjo, 2024), and the need for community-based approaches to digital heritage (Nugroho, 2021; Hapsari & Saraswati, 2023). These findings reinforce the need for a holistic digital transformation that includes inclusive stakeholder collaboration and adaptive technology adoption tailored to the local socio-cultural context.

This research aims to identify the potential and challenges of AI implementation in the development of Taman Sari heritage tourism destination, analyze the role of local communities in the digitization process, and formulate collaborative strategies across stakeholders to create an innovative, inclusive, and sustainable tourism ecosystem (Prasetyo & Wibowo, 2020, p. 150). The results of the study are expected to make a theoretical contribution to the development of technology-based tourism, as well as a practical reference for the government, destination managers, and local communities in building a digitization strategy that is oriented towards cultural preservation and community empowerment.

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2. RESEARCH METHOD

This research uses a qualitative approach with a case study design to analyze partnerships in the development of artificial intelligence (AI)-based technology in the Taman Sari Yogyakarta heritage tourism destination. This method was chosen because it allows in-depth exploration of the dynamics, challenges, and potential for cross-stakeholder collaboration in the context of cultural tourism digitization.The materials used in this research include policy documents, official reports, academic publications, as well as primary data from interviews and field observations. The tools used include: Stationery (notebook, pen), Voice recorder for interview documentation, Digital camera for visual documentation, Laptop for data processing and analysis, List of interview questions (semi-structured), Structured observation sheet. The research was conducted in the Taman Sari heritage tourism area, which is located in Patehan Village, Kraton District, Yogyakarta City. This location was chosen because it is one of the main cultural heritage sites in Yogyakarta that is undergoing a digital transformation process in tourism management and promotion.

The main problem behind this research is the non-optimal application of AI technology in the management and promotion of Taman Sari heritage destination. In addition, the involvement of local communities in the digitization process is still limited, and collaboration between stakeholders has not been systematically structured. This research was conducted to identify the potential, challenges, and formulate collaborative strategies in developing an inclusive and sustainable technology-based heritage tourism ecosystem.

Methods/Data Collection

Data collection was conducted through the following techniques: Direct observation: Researchers observed the implementation of AI technology in Taman Sari, visitors' interaction with digital features, and the role of local communities in tourism activities, In-depth interviews**:** Conducted with key stakeholders, such as government representatives, destination managers, local communities, businesses, academics, and tourists. The interviews used a semi-structured guide to explore perceptions, experiences, and expectations regarding the digitization of heritage tourism, Documentation study**:** Analysis of policy documents, tourism development reports, scientific publications, and digital promotional materials relevant to the application of AI in the heritage tourism sector, Literature review: Researchers reviewed literature related to partnership theory, community empowerment, technology adoption, and cultural preservation in the context of tourism.

The collected data were analyzed thematically with the following stages: Data familiarization through reading interview transcripts, observation notes, and documents, Data coding to identify key themes related to stakeholder roles, AI implementation challenges, and collaboration strategies, Grouping the codes into major themes, such as partnerships, technological innovation, community empowerment, and cultural resilience, Drawing connections between themes to understand the dynamics of collaboration and the impact of digitalization on cultural preservation, Narration of analysis results supported by primary data quotations and documentation findings. Data validity was maintained through source triangulation (interview, observation, documentation), member checking with informants, and discussion of results with co-researchers. Analysis is conducted reflectively and contextually

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so that the research results can provide practical recommendations and theoretical contributions for the development of technology-based heritage tourism.

3. RESULTS AND DISCUSSION

This research examines the application of artificial intelligence (AI) technology in the development of Taman Sari Yogyakarta heritage tourism destination. Data were obtained through field observations, in-depth interviews with various stakeholders, and documentation of policies and digital promotional materials. Thematic analysis was used to identify patterns and main themes related to the potential, challenges, and collaborative strategies in the implementation of AI in this historical tourist destination.

Research Results

The results show that the application of AI technology in Taman Sari is still in its early and partial stages. Some technologies such as augmented reality (AR) for virtual tours and simple chatbots have begun to be used, but have not been thoroughly integrated in destination management. Supporting digital infrastructure, such as stable internet networks and application-based information systems, is still limited.

Local communities living around Taman Sari have an active role in the creative economy sector, such as craft sales and tour guide services, but their involvement in digitalization and AI technology is minimal. The community's digital literacy level is low, so training and technical assistance are key needs for them to optimally participate in the destination's digital transformation.

Collaboration among stakeholders-government, academics, businesses, communities and media-is still normative and unstructured. A collaborative forum involving all elements of the pentahelix has not been established permanently, so digitalization initiatives are sectoral and not synergistic.

Travelers, especially the younger generation, welcome the use of AI and AR technologies that can enrich the tourism experience with more interactive and personalized information. However, they also emphasize the importance of a balance between technology and human interaction, such as the irreplaceable role of tour guides.

Table 1. Thematic Matrix of Stakeholder Interview Results

Main Theme	Sub-Themes/Categories	Summary of Remarks	Relevance to Problem Formulation
Application of AI Technology	Use of AR and Chatbot	"AR and chatbots have started to be used, but not yet integrated."	Addressing AI potential and implementation

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Local Community Readiness	Low Digital Literacy	"Communities need training to participate in digitalization."	Addressing community roles and empowerment
Pentahelix Collaboration	Unstructured	"There is no collaboration forum, initiatives are still sectoral."	Answering cross-sector partnership strategies
Traveler Experience	Technology and Interaction Support	"Technology helps, but human guides are still important."	Addressing the balance of technology and culture
Infrastructure Challenges	Network and Human Resources Limitations	"Infrastructure and human resources are still the main obstacles."	Addressing barriers to technology implementation

Discussion

The results of this study confirm that AI technology has great potential to improve the attractiveness and management of heritage tourism destinations such as Taman Sari. Technologies such as AR and chatbots can provide a more personalized and educative tourism experience, in line with previous research findings showing that AI can improve tourist satisfaction and destination operational efficiency (Tussyadiah et al., 2020; Santoso & Widodo, 2022).

However, limited infrastructure and low digital literacy of local communities are significant barriers to AI implementation. This is in line with technology adoption theory, which emphasizes the importance of social and technical readiness in accepting new innovations (Kauffman & Techatassanasoontorn, 2010). Therefore, community training and empowerment are crucial for inclusive and sustainable digital transformation.

The ideal cross-sector collaboration according to the pentahelix model has not been optimized in Taman Sari. This study supports the view that effective partnerships must involve all stakeholders in an active and structured manner to create an innovative and sustainable tourism ecosystem (Bramwell & Lane, 2000; Miles et al., 2010). Permanent and applicable collaborative forums are needed to integrate academic research, government policy, technological innovation, and community and media participation.

From a cultural perspective, the importance of maintaining a balance between the use of technology and the preservation of local values is a major concern. AI technology should serve as a tool that complements cultural narratives rather than replacing human interaction, especially the role of tour guides who bring an authentic and emotional feel (Fickers, 2023). This human-centered approach in digitizing heritage tourism is in line with the concept of smart tourism that integrates technology with local wisdom (Gretzel et al., 2015).

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Younger generation tourists show high enthusiasm for digital innovations such as AR and interactive applications, which supports the theory that the digital native generation prefers visual and personalized tourism experiences (Santoso & Widodo, 2022). However, the lack of socialization and digital facilities in the field hinders the maximum utilization of technology.

Figure 1. Diagram of Pentahelix Collaboration Model in AI Development in Heritage Destinations

This diagram illustrates the synergistic relationship between the government, academics, business actors, local communities, and the media as the main pillars in the development of sustainable and culturally oriented AI technology in Taman Sari.

Table 2. Recommended Strategy for AI Development in Taman Sari

Aspects	Recommendation
Infrastructure	Strengthening internet networks and digital facilities at tourist sites
Community Empowerment	Digital literacy training and technology-based local content production
Collaboration	Establishment of a structured and applicable pentahelix forum
Technology Development	Development of culturally adaptive AI applications, such as historical chatbot and interactive AR
Promotion and Education	Socialization of digital features to tourists and integration of AI-based social media

Overall, this research confirms that the integration of AI in the development of Taman Sari's heritage tourism destination has great potential to improve the tourist experience and cultural preservation. However, successful implementation is highly dependent on infrastructure readiness, community empowerment, and inclusive and sustainable cross-sector collaboration. Approaches that prioritize cultural values and active participation of local communities are key to creating an innovative and sustainable digital tourism ecosystem.

The findings make a theoretical contribution by expanding the study of AI integration in cultural tourism and cross-sector partnership theory, as well as providing practical input for government, academics, communities, and businesses in designing humanistic and effective heritage digitization strategies.

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4. CONCLUSION

This research confirms that the integration of artificial intelligence (AI) in the development of the Taman Sari Yogyakarta heritage tourism destination has great potential to strengthen cultural preservation while enhancing the personalized and interactive tourist experience. The findings show that the success of digital transformation in the heritage tourism sector depends not only on technological sophistication, but also on inclusive cross-stakeholder collaboration, empowerment of local communities, and alignment between digital innovation and local cultural values.

The pentahelix partnership model involving the government, academics, businesses, communities and media needs to be optimized so that digitalization is not just a symbol, but really encourages active and sustainable participation from all elements. The low digital literacy of the community and limited infrastructure are the main challenges that must be overcome through training, mentoring, and strengthening community capacity. In addition, AI implementation should be designed as a tool that enriches cultural narratives, not replacing the role of humans in maintaining authenticity and historical meaning.

This research also recommends the need for a structured collaborative forum, the development of AI applications based on local wisdom, and digital promotion strategies that are adaptive to the needs of the younger generation. For future research, it is recommended to conduct comparative studies in other heritage destinations, empirical measurement of the effectiveness of AI on tourist satisfaction, and development of an evaluation model for the success of pentahelix collaboration in digitizing cultural tourism.

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