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## Development of Situ Gede Lake Tourism and Local MSMEs through Web-Based Digital Promotion and Data Analysis

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### ABSTRACT

**Background:** The development of tourism at Situ Gede Lake and local MSMEs through a web-based digital promotion and data analysis approach addresses the need for local tourism to compete more effectively. This community service focuses on empowering local MSMEs within the tourism ecosystem using digital technology.

**Purpose of the Study:** This study aims to develop a web-based platform that integrates digital promotion and data analysis to support tourism digitalization at Situ Gede Lake, enhance MSME empowerment, and introduce data-driven visitor trend analysis using the Long Short-Term Memory (LSTM) deep learning method.

**Methods:** The platform was developed using daily visitor data from the Situ Gede Village Office. The LSTM model was applied to forecast tourist numbers through 2026. Socialization and training were conducted on July 3, 2025, with 31 participants from POKDARWIS, MSME actors, village officials, and the community. The web application (<https://situgede-ssmi.ipb.ac.id/>) integrates a visitor statistics dashboard, MSME catalog, interactive map, event schedule, and waste management education.

**Results:** The dashboard reveals an average of 53 visitors per day, 17 active communities, and estimated daily revenue of 2.5 million rupiah. LSTM predictions indicate a seasonal surge in mid-2026 potentially exceeding 400 visitors per day. MSME actors showed readiness to utilize the digital catalog, and participants responded positively to improved information access. Early findings demonstrate that combining web-based digital promotion and data analysis enhances MSME visibility, supports sustainable tourism development, and strengthens environmental awareness at Situ Gede Lake.

### Keywords

Digital Promotion; Web Application; Local Tourism; SMEs Empowerment; Visitor Trend Prediction; Deep Learning; LSTM; Sustainable Tourism

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## Introduction

Tourism is an essential sector in the Indonesian economy and is currently adapting to developments in digital technology and the creative economy. Digital technology has changed many things, from online booking and virtual tours to using data and applications to enhance the tourist experience. This aligns with the ASEAN Declaration on Digital Tourism (2021), emphasizing technology's role in strengthening tourism's resilience and sustainability (Kartika, 2023). In Indonesia, the Ministry of Tourism and Creative Economy also actively promotes digitalization by developing information technology infrastructure, digital marketing, and online tourism promotion (Kementerian Pendidikan & Riset, 2020).

Sustainable tourism is now a priority in national policy. The Ministry of Tourism and Creative Economy has established four main pillars, namely business, economic, cultural, and environmental management (Rakista et al., 2024). The goal is for tourists to enjoy nature and culture without damaging local resources. Technological innovation combined with environmental conservation is believed to increase the value of the creative economy while preserving nature. Several studies show that digitizing tourism MSMEs is crucial to accelerate the creative economy's growth and increase destinations' competitiveness. Through digital platforms, MSME players can expand their markets and increase efficiency, although there are still challenges, such as access to technology and digital skills (Sartika et al., 2025).

Situ Gede Lake in Bogor City has great potential as a natural tourist destination. The lake is located in the conservation area of the Forestry Research and Development Center and has been managed as an ecotourism site that prioritizes nature conservation and community empowerment (Setiawan & Batubara, 2022). The revitalization of Situ Gede in January 2023 aims to increase tourist appeal, preserve the ecosystem, and support the local economy (Rakista et al., 2024). However, management of the area still faces challenges such as waste accumulation and the need for a more straightforward environmental strategy. River clean-up programs and fish stocking demonstrate a commitment to the cleanliness and economy of the area, but long-term management still requires better planning (Umarputri & Rahardjo, 2020). In addition to environmental challenges, local MSMEs around Situ Gede face various limitations. Many MSME players have not fully utilized digital technology for promotion and transactions. The main obstacles are low digital literacy, limited internet access, and a lack of understanding of data analysis. As a result, local products find it difficult to compete in the digital market (Angelia & Gilang Widagdyo, 2024; Setiawan & Batubara, 2022).

Several studies have addressed related topics separately. Some article highlights the importance of digital transformation for tourism MSMEs to increase competitiveness and the creative economy (Sartika et al., 2025). Meanwhile, other studies emphasize the economic value of the environment and local culture (Anom Pancawati & Rieka Yulita Widawara, 2023). However, little literature still discusses integrating digital technology, SME empowerment, and environmental management simultaneously. There are several practical initiatives, such as the collaboration of IPB University in developing applications and data analysis for the management of Situ Gede tourism, as well as the cooperation between BRI and the sub-district government that combines environmental cleanliness with SME empowerment. However, no academic study has comprehensively evaluated the effectiveness and integrative model of these initiatives. As a result, there are still no guidelines or frameworks for developing tourist destinations such as Situ Gede that utilize technology, empower the local economy, and preserve the environment (Fatahudin et al., 2021).

This study aims to implement a focused digital-tourism intervention in Situ Gede by developing a web-based tourism information platform, conducting MSME empowerment activities, and promoting environmentally responsible practices. The research analyzes the existing level of digital adoption, MSME capacity, and ecological conditions, and identifies challenges and

opportunities in integrating digital technology to support local economic actors. The study further evaluates the initial outcomes of the intervention and formulates practical recommendations for strengthening digital-based tourism and sustainable community engagement in the area.

This research is based on the theory of sustainable tourism and technological innovation in the creative sector. Sustainable tourism emphasizes the importance of synergy between economic, socio-cultural, and environmental aspects. In Situ Gede, strengthening the local economy through MSMEs supports the sustainable economic pillar, while nature and cultural preservation strengthen the ecological and cultural pillars. The concept of smart tourism encourages digital technology to improve the efficiency of destination management and tourist engagement. The use of web applications, social media, and big data analysis of tourists is considered to increase the number of visits and the effectiveness of tourism product marketing (Park, 2021).

Based on the above explanation, comprehensive research is urgently needed. From the previous explanation, it is clear that thorough research is required on the development of Situ Gede as an integrated tourist destination. Integrating digital technology, empowering MSMEs, and managing the environment are expected to produce innovative and sustainable solutions. The results of this research are expected to enrich scientific literature, serve as a reference for regional tourism development policies, and support the achievement of sustainable development goals (SDGs). In this way, Situ Gede has the potential to become an example of innovative and sustainable tourism in Indonesia, while improving the welfare of the community and preserving nature in the area.

## Method

This study uses digital technology to support tourism promotion, MSME empowerment, and environmental management at Lake Situ Gede. The activities are carried out in several stages: preparation, digital media development, community training, program implementation, and evaluation. Each stage is designed to achieve the research objectives and program sustainability. The program began with identifying key needs for digital tourism promotion, MSME empowerment, and environmental management at Lake Situ Gede. This stage included coordination with tourism managers, local government, environmental communities, and MSME actors, as well as collecting baseline data on visitor numbers, cleanliness conditions, waste volume, and local economic activities.

Based on these findings, the team developed a digital tourism web application featuring a visitor statistics dashboard, seasonal trend analysis, interactive maps, event schedules, and an MSME product catalogue. Social media content, including interactive videos and promotional infographics, was also produced to support tourism promotion and raise awareness about environmental cleanliness.

Training activities were then provided to community members and MSMEs, covering digital literacy, the operation of the tourism web application, social media promotion strategies, fundamental data analysis, and the use of digital tools for waste management. Practical waste management training was conducted in collaboration with local environmental communities.

The program continued with the official launch of the web application and MSME catalogue, accompanied by the “Clean Situ Gede Tourism” campaign through social media platforms. Digital tools were also utilized to monitor cleanliness and identify priority areas for waste handling. In the final stage, an evaluation was conducted to assess changes in visitor engagement, the effectiveness of MSME digitalization, responses to social media campaigns, and environmental management outcomes. Findings from this evaluation informed recommendations for further development, including enhancements to digital features and long-term strategies for

sustainable environmental management.

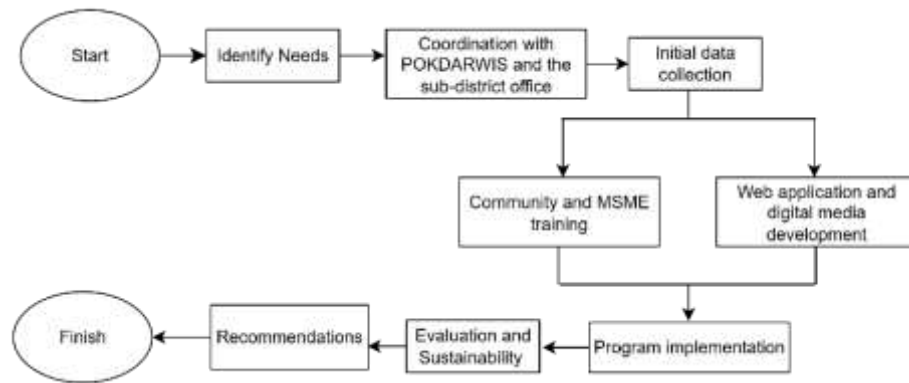


Figure 1. Research process

## Result

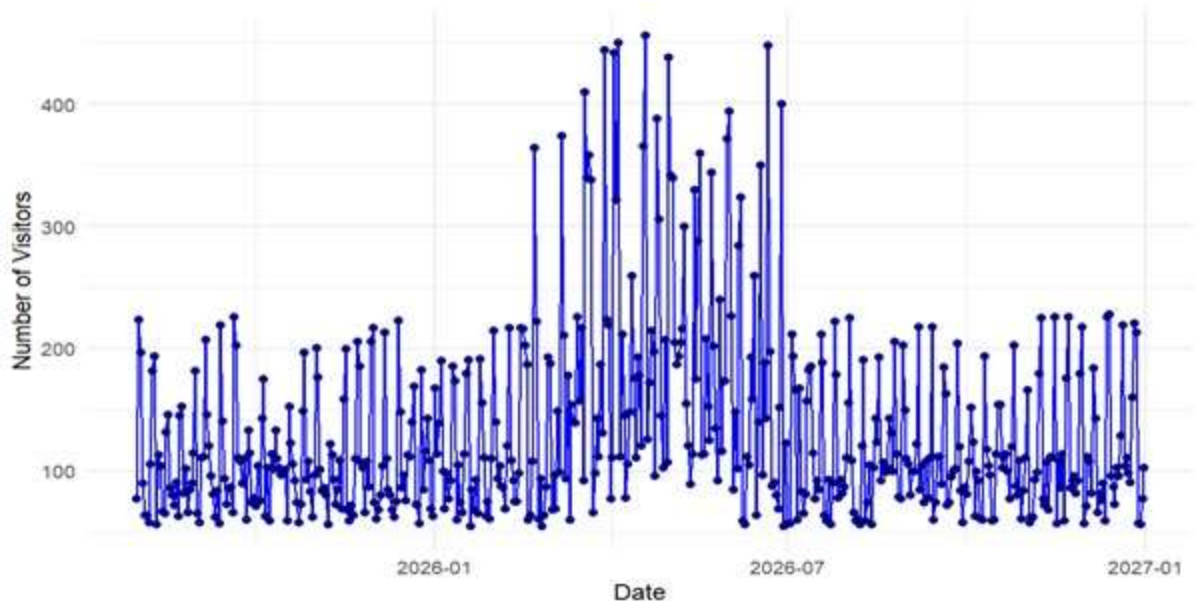
The community service activity at Situ Gede Lake has yielded significant achievements in tourism digitization through the development of a statistical dashboard, as shown in Figure 2. This dashboard was built using daily tourist visit data obtained from the Situ Gede Village Office. The information presented includes an average of 53 visitors per day, 17 active communities, and an estimated daily revenue of 2.5 million rupiah. In addition, the graph depicting average visitor trends from 2018 to 2025 provides an overview of year-over-year changes in tourist numbers. In addition to year-to-year historical data, this program also produces visitor forecasts using the Long Short-Term Memory (LSTM) method. The LSTM model was applied to daily visitor data to predict the number of tourists through 2026, and the results are shown in the figure.



Figure 2. Situgede Lake Tourism Statistics: Data in Figures

The prediction graph reveals a clear seasonal pattern, with a significant increase in visitors in mid-2026, marked by a surge that may exceed 400 visitors per day (Figure 3). This rise is followed by substantial daily fluctuations, reflecting dynamic visitation patterns that are sensitive to holiday

periods, weather conditions, or specific events. Meanwhile, at the beginning and end of the year, the number of visitors appears more stable, ranging from 50 to 150 visitors per day. This visualization provides valuable insights for site managers to anticipate visitor surges, plan service capacity, and develop more effective, adaptive data-driven tourism management strategies. These forecasting results have not yet been integrated into the web application because they are still in development. Still, they will be added once the model and system refinement processes are complete. These visualizations are then integrated into a web application to make it easier for area managers and the community to understand the tourism conditions at Situ Gede Lake in a more informative, data-driven manner.



*Figure 3.* Trends and Projections of Tourist Visits to Lake Situ Gede with LSTM

The socialization was conducted on July 3, 2025, and attended by 31 participants comprising community members, the Tourism Awareness Group (POKDARWIS) board, MSME actors, and village officials. The documentation of activities shown in Figure 4 demonstrates the participants' enthusiasm for attending each socialization session. This activity not only introduced the concept of tourism digitization but also illustrated the collaborative commitment of the service team and the community to driving digital transformation in the Situ Gede area.



*Figure 4.* Collaboration with POKDARWIS and Socialization of Activities

Participant engagement was increasingly evident during the interactive discussion session, as depicted in Figure 5. Many participants posed questions regarding digital marketing for MSMEs, strategies for creating social media content, and how to utilize tourist visitation data to estimate business opportunities. The distributed questionnaires indicated positive responses regarding the developed web application; participants stated that information such as visitor numbers, the MSME catalog, and tourism activity agendas became more accessible without the need to visit the location in person.



Figure 5. Question and answer session

In addition to strengthening digital tourism promotion, this activity also emphasized the importance of environmental management in the Situ Gede Lake area. The waste management education material visualized in Figure 6 provided participants with an understanding of sorting organic, inorganic, and recyclable waste. Participants very much appreciated this simple schematic visualization, as it offered practical guidelines that were easily applicable at home or in the tourism sector. This education is highly pertinent, as an increase in tourist numbers often directly correlates with an increase in waste volume in the Situ Gede area.

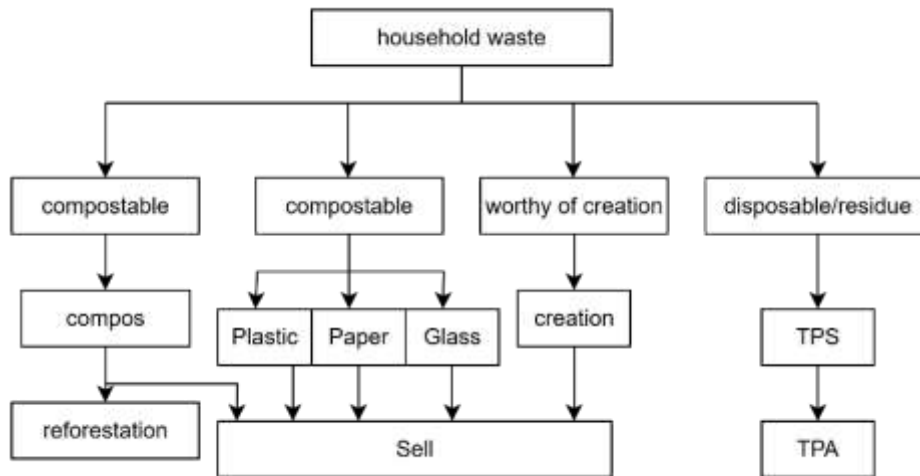


Figure 6. Household Waste Management Scheme in Tourist Areas

Regarding local economic empowerment, several MSME actors participated and expressed their interest in utilizing the web application to promote their products and services. Through the MSME catalog and tourism information features, the application not only showcases local products but also provides comprehensive, engaging details on various tourism activities in Situ Gede, such as fishing, traditional boat rides, picnicking, photo spots, painting areas, and garden spaces, as illustrated in Figure 7. This informative visual display helps tourists better understand the activities they can enjoy before visiting the site. The enthusiasm shown by MSME actors and

tourism managers reflects their readiness to adopt digital technologies to enhance visibility, attract visitors, and strengthen local economic potential.

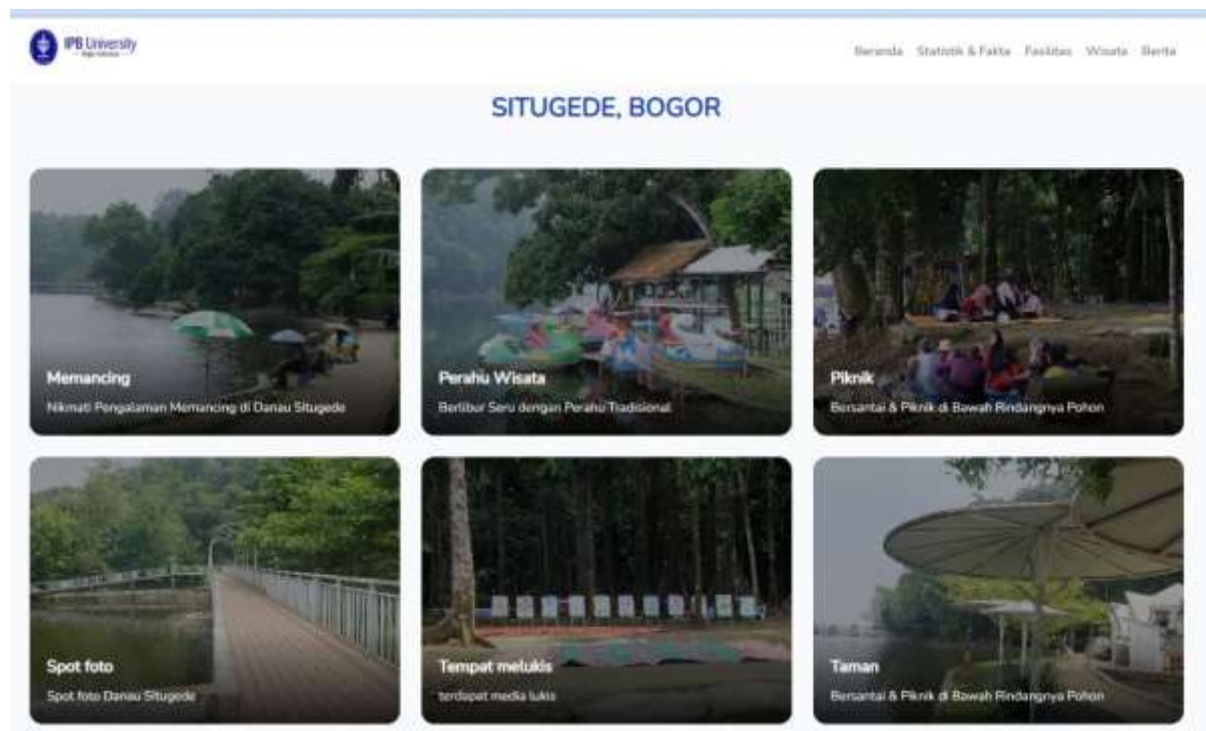


Figure 7. Facilities and Activities in the Situ Gede Lake Tourist Area

As the primary output, the Situ Gede tourism web application was successfully developed and is accessible via <https://situgede-ssmi.ipb.ac.id/>, integrating various features such as a visitation statistics dashboard, LSTM prediction, an MSME catalog, an interactive map, and environmental education. The application provides an LSTM-based visitation statistics and prediction dashboard, an MSME catalog showcasing a variety of local products, an interactive map facilitating navigation, tourism activity information updating community agendas and activities, and a waste management education feature fostering community awareness of the importance of maintaining environmental cleanliness. The presence of these features marks a significant step toward an integrated digital ecosystem that connects tourists, MSME actors, and tourism area managers through a single, easily accessible platform.

The visualization of tourist activities in Figure 7 demonstrates that Situ Gede Lake has significant potential for development as a tourism area, driven by technology and environmental sustainability. This documentation also reinforces the rationale for digitization as part of the strategy to renew tourism area management.

Overall, the results of this activity indicate that tourism digitization via a web application can enhance information access, support MSMEs in digital marketing strategies, and strengthen community awareness of environmental management. The integration of technology into a single platform provides tangible benefits for visitors, MSME actors, and Situ Gede area managers, enabling more informed, efficient, and sustainable decision-making.

## Discussion

The findings indicate that the community and MSME actors in Situ Gede possess a high level of readiness in adopting digital technology to develop local tourism. The participants' enthusiasm during the socialization sessions (Figures 3 and 4) demonstrates that the community

not only attended but also actively engaged in understanding digital strategies and environmental management. This condition aligns with the findings of (Sitanggang et al., 2022), who stated that strengthening tourism through e-tourism heavily depends on community involvement and their readiness to use digital technology (Kartika, 2023) also emphasizes that the utilization of digital technology has become a key factor in transforming Indonesia's tourism sector, particularly in enhancing information accessibility and strengthening destination branding.

Digitalization is highly relevant for MSME actors in the Situ Gede area. (Angelia & Gilang Widagdyo, 2024; Setiawan & Batubara, 2022) found that MSME actors in the Situ Gede tourism area have indeed begun leveraging digital marketing to enhance product appeal, although its optimization remains limited. The results of this activity reinforce those findings, where MSME actors welcomed the digital catalog feature (Figure 6) as a more structured promotional medium. Strengthening MSMEs through digitalization is also supported by the research of (Anom Pancawati & Rieka Yulita Widaswara, 2023) and (Sartika et al., 2025) both of which emphasize that the digital transformation of MSMEs is part of sustainable creative economy development. Thus, the Situ Gede web application serves not only as an information platform but also as a tool for local economic empowerment.

The environmental education aspect provided during the activities (Figure 5) is a crucial component in efforts to strengthen Situ Gede's ecotourism. Research by Setiawan and (Setiawan & Batubara, 2022) shows that the success of an ecotourism destination depends on the implementation of conservation principles understood by the community. This is supported by (Fatahudin et al., 2021) and (Umarputri & Rahardjo, 2020), who note that the Situ Gede area has significant ecotourism potential but faces challenges in waste management and environmental quality. Therefore, integrating waste management education into the web application is a vital step to enhance residents' and tourists' ecological literacy and support more sustainable environmental management.

The innovation introduced in this research is the use of a data-driven visitation prediction model through the Long Short-Term Memory (LSTM) method (Figures 2). Although the existing literature in the reference list does not specifically discuss the use of LSTM in tourism, this approach aligns with (Park, 2021) concept regarding the importance of big data in smart tourism development. Park emphasizes that modern destination management requires data utilization to enhance service efficiency and tourist experiences. By displaying seasonal trends and visitation peaks, LSTM predictions can assist Situ Gede managers in determining service capacity needs, waste mitigation, MSME readiness, and formulating promotional strategies during peak tourist periods. This adds functional value to the web application as a destination management tool rather than just an information platform.

The finding of a visitation surge trend in mid-2026, as show in Figure 3, is also relevant to the study by (Rakista et al., 2024), which notes that the revitalization and enhancement of attractions in Situ Gede increased public visitation interest, particularly during holiday periods. The prediction data generated by this application can then serve as a basis for annual tourism activity planning, including festivals, community activities, and public facility management.

Regarding policy strategy, the urgency of tourism digitalization has been underscored in the Ministry of Education, Culture, Research, and Technology's (2020) document, which states that digital transformation is an essential factor in accelerating innovation and the competitiveness of the creative sector. Therefore, the development of the Situ Gede web application aligns with national policy directions while addressing local needs for a digital platform that integrates tourism promotion, MSME empowerment, and environmental education.

Overall, this discussion demonstrates that integrating digital technology, local economic empowerment, and sustainable environmental management can serve as a model for developing the Situ Gede tourist destination into smart, sustainable tourism. The developed web application

not only improves information access and enhances MSME competitiveness but also strengthens ecological awareness and provides relevant data-based tools for destination management decision-making.

## Conclusion

Community service activities at Situ Gede Lake demonstrate that digitalizing tourism and local MSMEs can be a strategic solution to increase competitiveness, expand markets, and support sustainable environmental management. Collaboration between IPB University, the Tourism Awareness Group (POKDARWIS), the village government, and the community has resulted in a web application that integrates an MSME catalog, event information, visitor forecasting, and waste management education. This application is expected to help tourists plan their visits, open up broader promotional opportunities for MSMEs, and raise awareness of the importance of maintaining a clean environment. Thus, the development of digital tourism at Situ Gede Lake boosts the local economy and maintains ecosystem sustainability and community well-being.

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