JMDB
Jurnal Manajemen dan Dinamika Bisnis
publikasi.dinus.ac.id/index.php/jmdb

Vol 5 (No 1), 2026, Hal: 10-27
e-ISSN 2829-5978

SEMARTOUR : IMPLEMENTING SMART TOURISM FOR THE FUTURE OF SEMARANG CITY TRAVEL

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ABSTRACT

The research aims to explore the benefits, challenges, and barriers associated with the adoption of smart tourism technologies in the local tourism industry. A qualitative approach was used, with purposive sampling selecting 22 key stakeholders, including destination managers, accommodation providers, technology developers, and government officials. Data were collected through in-depth interviews, participatory observation, and social media analysis. Thematic analysis was employed to interpret the findings, which revealed that "SEMARTOUR" Smart Tourism, such as location-based applications and IoT in accommodations, have significantly improved resource management and visitor satisfaction. However, challenges such as high implementation costs, limited digital infrastructure, and data security concerns remain as significant barriers. The study contributes to the growing body of knowledge on smart tourism by providing practical insights for both the tourism sector and policymakers, offering recommendations for enhancing the adoption of "SEMARTOUR" Smart Tourism in other cities.

Keywords: Smart Tourism, Semarang City, Digital Technologies, Operational Efficiency, Tourism Development.

ABSTRAK

Penelitian ini bertujuan untuk mengeksplorasi manfaat, tantangan, dan hambatan yang terkait dengan penerapan teknologi smart tourism dalam industri pariwisata lokal. Pendekatan kualitatif digunakan dalam penelitian ini, dengan teknik purposive sampling yang melibatkan 22 pemangku kepentingan utama, termasuk pengelola destinasi, penyedia akomodasi, pengembang teknologi, dan pejabat pemerintah. Data dikumpulkan melalui wawancara mendalam, observasi partisipatif, serta analisis media sosial. Analisis tematik digunakan untuk menginterpretasikan temuan penelitian, yang menunjukkan bahwa implementasi "SEMARTOUR" Smart Tourism, seperti aplikasi berbasis lokasi dan Internet of Things (IoT) pada akomodasi, secara signifikan meningkatkan pengelolaan sumber daya dan kepuasan pengunjung. Namun, tantangan seperti tingginya biaya implementasi, keterbatasan infrastruktur

Received: February 2026, Revised: April 2026, Published: May 2026

digital, serta isu keamanan data masih menjadi hambatan utama. Studi ini berkontribusi pada pengembangan literatur smart tourism dengan memberikan wawasan praktis bagi sektor pariwisata dan pembuat kebijakan, serta menawarkan rekomendasi untuk meningkatkan adopsi "SEMARTOUR" Smart Tourism di kota-kota lainnya.

Kata Kunci: *Smart Tourism*; Kota Semarang; Teknologi Digital; Efisiensi Operasional; Pengembangan Pariwisata.

INTRODUCTION

The rapid development of information and communication technology (ICT) has significantly transformed various sectors, including tourism. The concept of smart tourism has emerged as a response to the need for more integrated, efficient, and data-driven travel experiences (Novera et al., 2022). In Indonesia, Semarang City has become one of the examples of smart tourism implementation worth noting. As the capital of Central Java, Semarang City boasts a rich tourism potential, ranging from historical sites in the Old Town, iconic local dishes like lumpia, to natural attractions such as Rawa Pening and Gedong Songo. However, to optimize these potentials, a digital approach is necessary. The Semarang City Government has implemented several digital innovations to support the development of smart tourism, including location-based apps, free Wi-Fi at tourist destinations, and the use of analytic CCTV to monitor visitor density and traffic conditions (Putra et al., 2022).

In 2024, Semarang City won two prestigious awards in digital transformation: First place in the Gajah Mada Digital Transformation Governance Index (GM-DTGI) and recognition as the city with the best digital innovation in public services. These achievements demonstrate the city's commitment to integrating technology to enhance public services and improve tourists' experiences. However, despite the numerous innovations, challenges remain in the implementation of smart tourism in Semarang City. One major issue is the low adoption rate of Lunpia, the official tourism app for Semarang City, among locals and tourists. This highlights the need for greater awareness and understanding of digital technology in tourism. Furthermore, the reliance on infrastructure that is not evenly distributed such as internet connectivity in some tourist areas presents another obstacle in optimizing smart tourism implementation (Wibowo & Putra, 2023).

Issues in the Implementation of Smart Tourism in Semarang City

1. Limited Access to and Infrastructure for Technology
    - Unequal availability of internet access and digital facilities, especially in rural or natural tourist areas.
    - Lack of stable connections hampers the use of smart tourism applications and services.
2. Slow Adoption of Technology
    - Limited use of tourism apps (e.g., Lunpia) due to insufficient socialization, usability concerns, and low public awareness.
    - Tourists and locals show reluctance to fully embrace digital platforms.
3. Digital Divide Between Urban and Rural Areas
    - Concentration of digital infrastructure in urban hubs (e.g., Kota Lama, Simpang Lima).
    - Rural attractions remain underdeveloped, leading to unequal visitor experiences.
4. Data Security and Privacy Concerns
    - Use of personal data (travel history, preferences, location) raises risks of misuse and privacy violations.
    - Lack of clear data management policies undermines user trust.

5. Lack of Collaboration Among Stakeholders
    - Limited coordination between local government, tourism operators, technology providers, and communities.
    - Absence of an integrated framework for infrastructure, application development, and human resource capacity building.

Although several studies on smart tourism in Indonesia, including Semarang City, have been conducted, significant research gaps remain that need to be addressed to provide a deeper understanding of the challenges and opportunities associated with its implementation. Most existing research primarily focuses on the technical and infrastructural aspects of smart tourism, such as the development of digital applications and technological infrastructure at tourist destinations. However, there is a notable lack of studies evaluating the social and economic impacts of smart tourism. Specifically, how smart tourism affects the local economy, particularly small businesses, and how it influences social disparities between locals and tourists. The economic implications such as the effects on local entrepreneurship, income distribution, and the overall socio-economic development of the region warrant deeper investigation to ensure that smart tourism contributes positively to the community (Um & Chung, 2021).

In addition, while much of the literature focuses on the technological aspects of smart tourism, there is a significant gap in research exploring tourist behavior regarding the adoption of these technologies. Understanding tourists' willingness to engage with these technologies, as well as the factors that influence their adoption or reluctance, is crucial for optimizing the implementation of smart tourism. Insights into tourist behavior will help tailor services and platforms to better meet tourists' needs, thereby enhancing their overall experience and satisfaction (Hamid et al., 2021). Furthermore, there is limited research on how personalized experiences can be integrated into smart tourism through the use of advanced technologies. Although big data and analytics present vast potential for offering customized travel recommendations, studies that explore how these tools can be leveraged to create more precise, tailored experiences are scarce. Investigating how big data can predict tourist preferences and behaviors would be invaluable for developing smarter, more responsive tourism systems (Zhang et al., 2022).

Another critical research gap exists in the study of rural tourism. Most research on smart tourism in Indonesia has focused on urban areas, leaving a gap in the understanding of how smart tourism can be implemented in rural or off-the-beaten-path destinations. While urban centers like Semarang City’s downtown are well-equipped with technological infrastructure, rural destinations often lack the same level of development. Research focused on the unique challenges and opportunities of implementing smart tourism in these areas is essential to ensure equitable access to its benefits across all regions (El Archi et al., 2023). Lastly, data security and privacy remain pressing issues in the digital age. While some initiatives have been implemented to protect tourist data, there is still insufficient research on how personal data collected via smart tourism platforms can be securely and transparently managed. As tourists grow increasingly concerned about the safety of their personal information, it is crucial to explore ways to balance the personalization of services with the need to safeguard privacy. Further research is necessary to design robust mechanisms that ensure both the protection of tourist data and the delivery of personalized experiences (Xiang et al., 2021).

The implementation of smart tourism in Semarang City offers significant potential to enhance the tourism sector and create more efficient, enjoyable, and personalized travel experiences. However, challenges such as limited infrastructure, slow adoption of technology, digital divides, and data privacy concerns need to be addressed to optimize smart tourism

implementation. This research focusing on the social, economic, and technological aspects of smart tourism in Semarang City is essential to bridging the existing knowledge gaps and contributing to the development of sustainable and inclusive tourism. The aim of this research is to investigates the implementation of "SEMARTOUR" Smart Tourism in Semarang City, focusing on the integration of digital technologies to enhance tourism experiences and improve operational efficiency.

LITERATURE REVIEW

Definition and Key Concepts of Smart Tourism

Smart tourism is the application of advanced technologies to improve the tourism experience, enhance destination management, and increase operational efficiency for businesses in the tourism industry (Mehraliyev et al., 2019). At its core, smart tourism relies on the integration of digital tools such as the Internet of Things (IoT), artificial intelligence (AI), big data, cloud computing, augmented reality (AR), and mobile applications to offer a more personalized, connected, and efficient travel experience (Ye et al., 2020). The key concepts of smart tourism include: (Shafiee et al., 2019)

a. Personalization: The ability to offer customized experiences to tourists based on their preferences, behavior, and past experiences. By utilizing big data and AI, tourism providers can tailor recommendations for attractions, accommodations, transportation, and dining options, creating a more satisfying and engaging experience.
b. Real-Time Information: With the help of IoT and mobile applications, tourists can access up-to-date information on various aspects of their trip, such as flight delays, transportation schedules, opening hours of attractions, and even the weather. This real-time data allows tourists to make informed decisions during their travel, minimizing inconvenience and optimizing their experience.
c. Connectivity: Smart tourism encourages seamless communication and interaction between tourists, service providers, and local authorities. IoT sensors, Wi-Fi networks, and mobile apps enable tourists to access information and services from a wide range of devices, ensuring a smooth and efficient travel experience.
d. Sustainability: Smart tourism promotes the use of technology to reduce the environmental impact of tourism. This can include optimizing the use of energy and water, reducing waste, and encouraging more sustainable tourism practices. By leveraging technology, destinations can monitor environmental factors and make real-time adjustments to manage resources more efficiently.
e. Automation and Efficiency: The integration of technologies like AI, machine learning, and robotics can help automate various tourism-related processes, from booking accommodations to providing customer service. This leads to reduced operational costs, improved service quality, and enhanced visitor satisfaction.

Smart tourism has become essential in the modern tourism industry due to the growing expectations of tourists, the demand for personalized experiences, and the need for businesses to operate efficiently. As technology has become more deeply embedded in people's daily lives, tourists now expect the same level of connectivity, personalization, and convenience when traveling (Li et al., 2017). The growing reliance on digital platforms for travel planning, booking, and on-the-ground navigation underscores the importance of smart tourism in creating a competitive and sustainable tourism ecosystem (Baggio et al, 2020). The importance of smart tourism can be highlighted in several key areas: (Tribe et al., 2017)

a. Enhanced Tourist Experience: In an era where tourists expect seamless, personalized, and tech-enabled experiences, smart tourism plays a pivotal role in meeting these demands. By leveraging technologies such as mobile apps, IoT, and AI, destinations can provide tailored recommendations, real-time assistance, and instant access to information, improving the overall travel experience.
b. Operational Efficiency: By integrating technologies that automate processes and optimize resource use, smart tourism helps businesses reduce costs and improve their operational efficiency. The smart hotel management systems can optimize energy consumption and enhance customer service, while IoT-enabled transportation systems can reduce congestion and improve the efficiency of city-wide travel networks.
c. Sustainability and Environmental Impact: With increasing concerns about the environmental impact of tourism, smart tourism provides a way to manage resources more sustainably. IoT sensors can monitor and control energy usage, smart water management systems can reduce waste, and AI-driven platforms can help encourage eco-friendly tourism behaviors, all of which contribute to a greener tourism industry.
d. Data-Driven Insights: Smart tourism relies heavily on big data, which can offer insights into tourist behaviors, preferences, and demographics. These insights enable tourism businesses and destinations to tailor their services, develop targeted marketing strategies, and optimize pricing. For example, understanding peak visitation times and popular attractions allows for better crowd management and resource allocation.
e. Economic Growth and Competitiveness: As global competition in the tourism industry intensifies, adopting smart tourism strategies helps destinations differentiate themselves and attract more visitors. By offering unique, tech-driven experiences, destinations can increase their appeal to tech-savvy travelers and open up new opportunities for economic growth.

Smart Tourism Components

Smart destinations refer to cities or regions that utilize technology to improve the overall experience for tourists while also enhancing the management and sustainability of tourism operations. These destinations integrate various digital tools, such as mobile applications, IoT devices, and data analytics, to offer a seamless, personalized, and efficient travel experience (Jasrotıa & Gangotıa, 2018). The concept of a smart destination goes beyond just providing information, it involves creating an intelligent environment that connects all stakeholders, including tourists, businesses, and local authorities, to foster a more sustainable and enjoyable tourism experience (Dorcic et al., 2019).

a. Smart Cities: Many cities around the world are adopting smart city technologies to enhance the quality of life for residents and visitors alike. Smart city initiatives include things like intelligent public transportation systems, energy-efficient buildings, and data-driven management of public services. The smart sensors and data analytics to optimize traffic flow, reduce energy consumption, and improve waste management, making the city more sustainable for both residents and tourists. By leveraging smart city infrastructure, destinations can offer tourists a more comfortable and connected experience.
b. Smart Attractions: Smart attractions integrate advanced technologies to enhance the tourist experience at cultural and recreational sites. This can include interactive exhibits powered by augmented reality (AR), real-time updates on mobile apps, and even virtual tours that allow remote exploration of attractions. For instance, the digital tours and personalized recommendations for art enthusiasts based on their interests. These smart attractions provide a more immersive and engaging experience for visitors.

Smart services are digital platforms and applications that cater to the needs of modern tourists by offering personalized travel assistance, recommendations, and easy access to information. These services leverage technology to provide tourists with real-time, context-aware, and location-based services that help them make informed decisions and enhance their overall travel experience (Kontogianni & Alepis, 2020).

a. Mobile Apps: Travel apps can assist tourists in navigating their destinations. These apps provide personalized itineraries, restaurant suggestions, real-time travel updates, and local attraction recommendations. Using data and algorithms, these apps adjust their suggestions based on the tourist's location, preferences, and even weather conditions.
b. Personalized Recommendations: Smart services use data analytics and AI to make personalized recommendations for tourists. These recommendations could range from suggesting nearby attractions to offering exclusive discounts on hotels or events. For instance, the apps offers personalized trip suggestions based on a traveler's previous search history and preferences, helping them discover new places and experiences that align with their interests.
c. Seamless Booking and Payments: Smart services also include seamless booking platforms that integrate flight, hotel, car rentals, and event bookings into a single interface. Services from the apps allow tourists to book their accommodations and activities with minimal effort, often with personalized suggestions based on past preferences and user reviews. In addition, digital wallets and contactless payment systems simplify the payment process for tourists, making transactions faster and more secure.

Smart infrastructure refers to the integration of digital technologies, such as IoT devices and sensors, into the physical infrastructure of tourism destinations to optimize the use of resources, improve operational efficiency, and provide a better experience for tourists. Smart infrastructure helps cities and businesses manage resources more effectively while enhancing the convenience and safety of tourists (Ghorbani et al., 2019).

a. Smart Transportation: One of the most important components of smart infrastructure is transportation. Smart cities and destinations are incorporating technologies like smart buses, electric vehicles, and ride-sharing platforms to make transportation more efficient and sustainable. The smart transportation system where tourists can access real-time data on bus schedules, traffic conditions, and public transport availability through mobile apps, improving the convenience and ease of getting around the city. Additionally, electric scooters and bike-sharing programs offer tourists sustainable and efficient alternatives to traditional transportation.
b. Smart Hotels: Smart hotels incorporate technology into their operations to enhance guest comfort and reduce operational costs. This could include smart room features like automated lighting, temperature control, and voice-activated assistants. The integration of IoT devices allows guests to adjust their environment based on their preferences, while the hotel management system optimizes resource use and streamlines check-in/check-out processes.
c. Smart Parking: Parking management is another area where smart infrastructure plays a role. IoT-enabled sensors can be used to monitor parking spaces in real-time, allowing tourists to find available spots quickly. Smart parking systems can also provide pricing information, direct drivers to the nearest open spaces, and enable cashless payments.

Tourist Experience and Behavior

Smart tourism significantly impacts how tourists make decisions, behave during their travels, and their overall satisfaction with the experience. By incorporating advanced

technologies such as mobile apps, IoT, big data, and AI, smart tourism offers tourists the ability to make more informed decisions. They can access real-time information on mobile platforms, such as comparing hotel prices, reading reviews, and checking crowd density at popular attractions, which helps reduce uncertainty and enables better trip planning (Ardito et al., 2019). Personalized suggestions based on past behaviors, preferences, and social media activity further enhance the decision-making process, guiding tourists to experiences that match their interests. With the convenience of seamless booking and real-time availability, tourists can make instant decisions on accommodations, dining, or activities, minimizing decision fatigue and promoting spontaneity. In terms of behavior, smart tourism influences tourists by encouraging flexibility and engagement. For instance, real-time notifications allow tourists to adapt their plans, maximizing their experience (Coca-Stefaniak, 2019).

Additionally, technologies like augmented reality (AR) apps encourage tourists to interact with their surroundings, enhancing their engagement with cultural and historical sites. The ease of mobile payments and instant access to services also leads to impulse spending, allowing tourists to make spontaneous purchases, such as booking unplanned excursions or buying souvenirs, which benefits local businesses. Moreover, smart tourism plays a crucial role in enhancing overall satisfaction. By streamlining processes like check-ins, offering mobile concierge services, and providing real-time transportation updates, smart tourism reduces common travel pain points like long queues and waiting times, thus making the journey more convenient. The ability to provide personalized services, such as tailored itineraries or dining recommendations, makes the travel experience more enjoyable and satisfying. Furthermore, by offering seamless access to services, predictive insights, and real-time management tools, smart tourism reduces travel-related stress, enabling tourists to have a more relaxed and enjoyable trip, ultimately increasing their satisfaction (Femenia-Serra & Ivars-Baidal, 2021).

Data analytics plays a crucial role in smart tourism by enabling businesses and destinations to understand tourist preferences and offer highly personalized experiences. By analyzing behavioral data, such as search histories, previous bookings, social media activity, and interactions with apps, tourism providers can identify what types of experiences, attractions, and services tourists are most likely to engage with, allowing them to cater to individual needs. Demographic insights, such as age, gender, and nationality, further refine these offerings, ensuring that recommendations are relevant to specific customer segments. Additionally, sentiment analysis of online reviews and social media content helps businesses gauge tourists' moods and satisfaction levels, providing valuable feedback for improvement. Data analytics also facilitates personalized experiences by enabling customized recommendations in real-time, such as suggesting activities based on a tourist's past preferences, location, or even local events (Romao & Neuts, 2017).

Furthermore, dynamic pricing models, powered by data, adjust in real-time according to demand, helping businesses offer discounts and special deals to enhance value. Context-aware services, such as real-time notifications about nearby attractions or events, provide tourists with immediate, relevant information, further enriching their experience. Predictive analytics also allows tourism providers to anticipate future behaviors, suggesting activities tourists are likely to enjoy based on past patterns. Proactively addressing needs, such as offering late check-ins for delayed flights, ensures a seamless experience and strengthens customer satisfaction. In essence, data analytics empowers smart tourism to provide tailored, efficient, and engaging travel experiences, enhancing both tourist satisfaction and business performance (Orden-Mejía & Huertas, 2022).

Technological Foundations of Smart Tourism

Smart tourism is underpinned by several advanced technologies that work together to create a more personalized, efficient, and seamless travel experience for tourists while

enhancing the operational efficiency of tourism businesses. The key technologies that enable smart tourism include the Internet of Things (IoT), big data, artificial intelligence (AI), mobile applications, and cloud computing. These technologies are not just stand-alone innovations but are intricately integrated into tourism management systems, revolutionizing the way tourists interact with destinations and how businesses manage operations. IoT plays a significant role in smart tourism by connecting devices and sensors to collect and share data in real time. In smart hotels, IoT-enabled systems allow guests to control room settings through mobile apps, while transportation systems use IoT to track real-time vehicle availability, helping to improve transit efficiency. IoT also contributes to crowd management at popular tourist attractions by providing real-time data on visitor density, allowing businesses to adjust services accordingly (Ivars-Baidal et al., 2021).

Big data is another crucial component, as it allows tourism providers to collect, analyze, and interpret vast amounts of data from multiple sources, such as booking platforms, mobile apps, and social media. This data provides invaluable insights into tourist behaviors, preferences, and spending patterns, helping businesses refine their offerings and improve personalized services. For instance, by analyzing past behaviors, big data can help predict what types of experiences a tourist may enjoy, enabling tailored recommendations. AI and machine learning enhance the ability to offer personalized experiences at an even deeper level. AI-powered systems can analyze tourist data in real-time to provide recommendations, such as suggesting restaurants based on past choices or highlighting nearby attractions based on current location. Furthermore, machine learning algorithms help predict trends, such as predicting peak visitation times or understanding demand fluctuations, which helps businesses optimize operations and manage resources more effectively.

Mobile applications are central to smart tourism, providing tourists with a direct channel to access a variety of services. From booking accommodations and flights to finding local attractions, transportation options, and even restaurant reservations, mobile apps serve as one-stop platforms that integrate various tourism services. These apps also collect data on user preferences, helping businesses offer real-time, location-based services that enhance the overall tourist experience. In addition, mobile apps facilitate instant communication, making it easier for tourists to receive updates, alerts, and personalized offers. Cloud computing enables seamless collaboration and real-time data access among different stakeholders in the tourism industry. Tourism management systems that use cloud-based platforms can integrate various services such as booking systems, transportation management, and customer service operations. Cloud computing makes it possible for businesses to scale operations easily, sharing and accessing up-to-date data without the need for expensive on-site infrastructure. It also ensures that all connected systems are synchronized, which is essential for delivering consistent and efficient services to tourists.

Furthermore, current advancements in technology are pushing the boundaries of smart tourism even further. 5G networks, for example, enable faster and more reliable connections, ensuring that IoT devices and mobile applications function smoothly in real-time. This is particularly important for services like real-time crowd control and live streaming of events. AI-powered customer service is becoming increasingly sophisticated, with chatbots and virtual assistants capable of answering complex questions, providing personalized recommendations, and improving overall customer engagement. Blockchain technology is being explored for secure, transparent transactions, enabling safe payment systems and the management of customer data. Blockchain can also be used in loyalty programs, where tourists earn and redeem rewards more securely and transparently. Additionally, sustainable tourism technologies are becoming more prevalent, with smart solutions aimed at reducing the environmental impact of tourism. These include energy-efficient smart buildings, waste management systems, and apps that encourage eco-friendly behaviors, such as choosing sustainable transportation options.

Previous Studies

A substantial body of research has explored the integration of various technologies into the tourism industry, particularly in terms of how IoT, big data, AI, and mobile applications have transformed the way destinations and businesses operate. One study by Vujko et al. (2025) highlighted the potential of ICT (Information and Communication Technologies) in tourism, outlining how the convergence of mobile technologies, IoT, and data analytics could lead to the creation of a "smart" tourism environment. Research by Quevedo et al. (2021) further emphasized the importance of mobile applications in shaping the smart tourism experience, focusing on how apps enhance the convenience and personalization of services for tourists. In more recent studies, authors such as Gursoy (2024) have examined the integration of AI and machine learning algorithms into smart tourism platforms. These technologies enable businesses to offer personalized services and predict future tourist behaviors, thereby improving service delivery and customer satisfaction. The research also explores the role of cloud computing in facilitating the collaboration and data-sharing needed for smart tourism, allowing businesses to manage and optimize resources effectively.

Data analytics plays a central role in providing personalized experiences in smart tourism. Research by Xu et al. (2025) discussed how data collected from tourists' online activities, mobile apps, and social media can be used to understand their preferences and offer tailored services. These findings are supported by a study by Benaddi et al. (2024), which emphasized the significance of big data in shaping personalized recommendations and improving resource allocation in tourism destinations. The ability to analyze vast amounts of data allows for real-time, location-based services that are highly relevant to the individual tourist, such as suggesting nearby attractions or offering deals based on their preferences and behavior. However, while much of the research has focused on the positive impacts of data analytics in personalization, studies by Tiwari et al. (2024) have highlighted the challenges related to data privacy and security. As tourism businesses collect more data on tourists, concerns about how this data is managed, shared, and protected have become a critical issue. These challenges necessitate the development of more robust data protection frameworks to ensure that tourists feel safe and confident in using smart tourism servic**es.**

Another significant area of research has been the impact of smart tourism on destination management. Studies by Ma (2024) have explored how smart tourism technologies can be used to manage the flow of tourists and reduce congestion at popular destinations. The use of real-time data allows for more effective crowd control, helping destinations manage visitor numbers and ensure that popular attractions do not become overcrowded. This has led to more sustainable tourism practices and an improved visitor experience. Further studies, such as those by Oakes (2024), have examined how smart tourism technologies contribute to the sustainable development of tourism destinations. By utilizing data analytics to optimize resource use (e.g. energy, water, waste management), destinations can reduce their environmental footprint and improve their overall sustainability. These findings align with the growing interest in sustainable tourism and the use of smart technologies to minimize the negative impact of tourism on local ecosystems.

METHODS

This type of research is qualitative, used to understand social phenomena, behavior, and the experiences of tourists in the context of technology use in the tourism sector. The advantage of this research type is its focus on in-depth interpretation and understanding of context, subjective experiences, and how technology influences tourists' journeys and destination management. In this study, the criteria for selecting respondents for research on smart tourism

in Semarang City involve stakeholders directly involved in the implementation and management of technology in the tourism sector. Destination managers involved in managing destinations with smart tourism technologies, such as location-based applications, digital information systems, or IoT technologies for operational efficiency, will be one category of respondents. The sample will also include accommodation managers, such as hotel managers, who use smart tourism technologies like automated check-in systems and technology-based booking apps to enhance guest experience and service efficiency.

Additionally, technology providers or app developers involved in creating technological solutions, such as tourist guide apps or digital booking platforms, will be selected because of their deep understanding of the implementation and impact of these technologies. Government or local authorities who play a role in creating smart tourism policies in Semarang City will also be included to provide perspectives on regulations and policies that support the development of this sector. Finally, technology companies that provide infrastructure to support smart tourism, such as providers of high-speed internet networks or data analytics platforms, will be considered because of their role in delivering solutions to enhance tourist experiences and destination management. Using expert sampling, this study will deliberately select respondents who possess specialized knowledge and direct involvement in Semarang City's smart tourism. This approach ensures that only stakeholders with relevant expertise are included. The sample captures in-depth insights into the technological, managerial, and policy aspects of smart tourism, thereby enhancing the validity and relevance of the findings. The expected sample size is 22 stakeholders who can provide in-depth insights into the implementation and impact of smart tourism technologies in Semarang City, as well as the challenges and opportunities present.

The data collection methods used in qualitative smart tourism research include in-depth interviews, participatory observation, and social media analysis. In-depth interviews are conducted to explore the experiences, views, and perceptions of tourists or stakeholders regarding the use of technology in tourism. Participatory observation allows the researcher to engage directly with tourists interacting with technology, providing contextual insights into how it is used and its impact in real-world settings. Social media analysis is used to gather data from online platforms like Instagram, Twitter, or TripAdvisor to understand how tourists share their experiences and respond to technologies implemented at tourist destinations. The strength of these methods lies in their ability to provide both in-depth, contextual data and a combination of subjective individual views with broader trends reflected in social media. By integrating these three methods, researchers can obtain a more holistic understanding of the impact of technology in smart tourism, encompassing firsthand experiences, spontaneous reactions, and behavioral trends among tourists. The interview questions designed to gain deeper insights into the implementation of smart tourism in Semarang City, as well as its impact on tourist experiences and destination management, are as follows:

1. Can you explain your role in the implementation of smart tourism technologies at your destination or accommodation in Semarang City, and what technologies are currently applied at your site?
2. What are the main benefits that tourists experience from the use of smart tourism technologies, and have you received any positive or negative feedback regarding these technologies?
3. What are the biggest challenges you face in implementing smart tourism, and how have you addressed these challenges?
4. How has the implementation of smart tourism technologies affected operational efficiency and destination management at your site?
5. What are your expectations for the future development of smart tourism in Semarang City, especially regarding government support and the evolution of new technologies?

This study employs data analysis using a thematic analysis and coding approach to identify patterns and themes from data collected through interviews, participatory observation, and social media analysis. The process begins with transcribing interviews and documenting the results of observations and social media data. The transcribed data is then coded to identify important categories such as technology implementation, challenges faced, and tourist experiences. The coded data is grouped into key themes related to the research topic, such as the benefits of technology for tourists, its impact on operational efficiency, and stakeholders' views on the future of smart tourism. For social media data, sentiment analysis is used to assess tourists' reactions to the technology implemented. The findings are interpreted to gain a deeper understanding of the implementation of smart tourism technologies in Semarang City, as well as their impact on tourist experiences and destination management. Data triangulation is used to compare interviews, observations, and social media analysis to ensure the validity and reliability of the results. This study provides comprehensive insights into the challenges, benefits, and potential development of smart tourism in Semarang City.

RESULT AND DISCUSSION

The table 1 presents the respondent identities in the study on the implementation of smart tourism in Semarang City, involving 22 respondents from various stakeholder groups. These respondents include destination managers, accommodation managers, technology providers, and government/local authorities, all of whom have direct roles and experience in implementing smart tourism technologies. The destination managers consist of 7 respondents, managing tourist attractions that integrate location-based technology and online ticketing systems. The accommodation managers include 6 respondents, involved in implementing technologies like IoT in hotels to enhance comfort and service efficiency. The technology providers consist of 5 respondents, who play a key role in developing apps and digital solutions used in the tourism sector. Lastly, government/local authorities make up 4 respondents, who are involved in planning policies and regulations related to smart tourism in Semarang City. With a total of 22 respondents, this study provides in-depth insights into the experiences and perspectives of various stakeholders involved in the implementation of smart tourism in Semarang City.

Table 1. Respondents Identity

No.	Type	Number of Respondents	Age	Experience in the Industry	Role in Smart Tourism Implementation
1	Destination Managers	7	35-50 years	5-10 years	Managing attractions implementing location-based technology and online ticket booking systems
2	Accommodation Managers (Hotels)	6	30-45 years	6-12 years	Implementing IoT technology in hotels for room control and app-based services
3	Technology Providers	5	30-50 years	5-15 years	Developing apps and digital systems to enhance tourist experiences and operational efficiency

No.	Type	Number of Respondents	Age	Experience in the Industry	Role in Smart Tourism Implementation
4	Government / Local Authorities	4	40-55 years	10-20 years	Involved in policy-making and regulation of smart tourism implementation in Semarang
Total		22			

Source: Data processed, 2025.

The "SEMARTOUR" Smart Tourism Implementation in Semarang City and Its Advantages

The implementation of "SEMARTOUR" smart tourism in Semarang City as figure 1 has been carried out with various technologies aimed at enhancing tourist experiences and operational efficiency. Based on interviews with destination and accommodation managers, some of the most widely applied technologies include location-based applications, online ticket booking systems, and use the Internet of Things (IoT). Location-based applications are used in major tourist destinations like Lawang Sewu and Kota Lama, providing real-time information about attractions, crowd density, and recommendations for nearby restaurants and other places of interest. In the accommodation sector, hotels like Hotel Ciputra and Hotel Quest Semarang have implemented IoT technology, allowing tourists to control room temperature, lighting, and other services via mobile applications, as well as using sensors to optimize energy usage. Additionally, online ticket booking systems have been applied at various attractions in Semarang, making it easier for tourists to purchase tickets without waiting in line. In the transportation sector, applications like Gojek and Grab have made it convenient for tourists to book rides connecting them to various tourist destinations in the city. Overall, the implementation of these technologies has improved operational efficiency and tourist comfort, while also facilitating better management of tourism destinations and accommodation services.

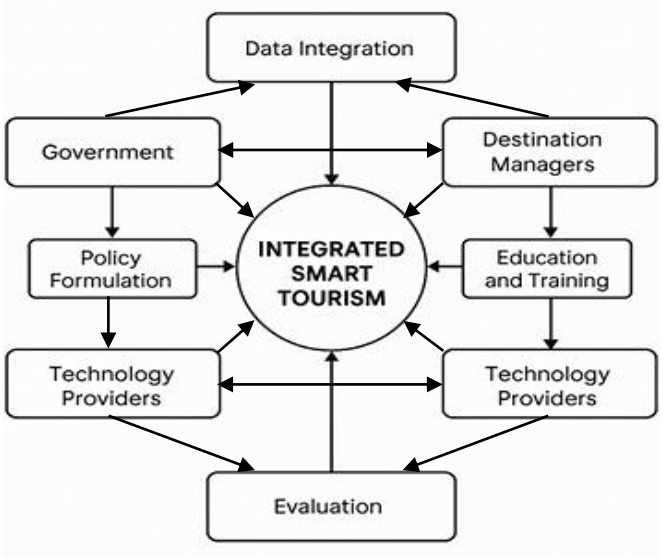

Figure 1. "SEMARTOUR" Smart Tourism Integration Model

The Integrated Smart Tourism framework presented here distinguishes itself from previous models in smart tourism studies by highlighting a more comprehensive and dynamic integration of key stakeholders. Unlike many existing frameworks that primarily emphasize

technological infrastructure and data-driven approaches, this model introduces two critical dimensions often overlooked: policy formulation and education and training. The explicit inclusion of government-driven policy formulation ensures regulatory alignment and long-term governance, while the direct linkage between destination managers and technology providers through education and training establishes an adaptive learning mechanism that strengthens human capital development. Moreover, the presence of evaluation as a continuous feedback loop enhances the model's methodological contribution. Rather than representing a static mapping of actors and functions, this framework captures the cyclical and evolving nature of smart tourism ecosystems. It underscores sustainability, adaptability, and capacity building as central pillars—elements that are less emphasized in earlier frameworks. Consequently, the model not only integrates multi-stakeholder collaboration but also advances a more holistic and sustainable perspective of smart tourism management.

However, to make the concept of smart tourism implementation in Semarang City supports an effective policy, several critical steps must be taken in the integration process. The first step is the collaboration between the government, destination managers, and technology providers. The Semarang government can facilitate policies that support digital technology adoption and develop the necessary infrastructure, such as high-speed internet connectivity and digital booking systems across all tourism destinations. Destination managers and technology providers can collaborate to develop technology solutions that align with both the needs of tourists and destination management goals. For example, the government can regulate operational standards for technologies used across tourist attractions, ensuring that the systems implemented at each site are integrated and easily accessible to tourists.

The policy formulation to support technological innovation in the tourism sector is crucial. The Semarang City government could issue policies that encourage the adoption of digital technologies by tourism industry players, such as providing incentives or subsidies for destination managers and hotels that implement IoT-based technologies, location-based apps, or online ticketing systems. This would expedite the technology adoption process and enhance the quality of tourism services. Moreover, data integration and information systems across sectors must be implemented. Destination managers, accommodation providers, and transport services should be connected within a unified system that allows tourists to access information in real-time. An integrated information system would enable tourists to access information about attractions, transportation, accommodations, and activities in Semarang City through a single platform. The government and managers can develop an integrated platform application that links ticket booking systems, accommodations, and transport services, making it easier for tourists to plan their trips efficiently. This would also provide useful data for destination managers to monitor tourist satisfaction and optimize capacity management.

For technology adoption to run smoothly, education and training to improve technology literacy among destination managers, hotel staff, and tourists themselves is essential. Destination managers and hotel providers could offer training workshops or webinars to help staff understand and effectively use the new systems. Additionally, tourists can be provided with digital tutorials on how to use the available applications, either through social media or destination websites. After the implementation of smart tourism technologies, it is crucial to conduct continuous evaluation of the systems that have been implemented. This evaluation aims to determine whether the technologies applied have truly enhanced tourist experiences and operational efficiency and to identify any challenges that may have arisen. The government and destination managers can form an evaluation committee consisting of various stakeholders to monitor the development and impact of the technology implementation. Feedback from tourists, staff, and other stakeholders can be used to make continuous improvements to existing systems and policies.

With the proper integration of policies, technology, and collaboration across sectors, smart tourism can become an effective solution to enhance both tourist experiences and destination management in Semarang City. The smart tourism implementation not only improves the quality of tourism but also provides a foundation for policies that support the development of technology-based tourism, ensuring that Semarang City becomes a more efficient, tech-friendly, and sustainable destination in the future.

The Challenges and Barriers of Smart Tourism Implementation

The table 2 presents the implementation of smart tourism in Semarang City faces several significant challenges and barriers that must be overcome for it to be successful. One of the primary challenges is the limitation of digital infrastructure. Many tourist destinations, especially those in more remote or lesser-developed areas, suffer from uneven internet connectivity, which hinders tourists from accessing digital applications or real-time information. This lack of reliable connectivity reduces the effectiveness of location-based services, real-time booking systems, and other digital tools that are essential for enhancing the tourist experience. To address this, improving the city's digital infrastructure by expanding access to high-speed internet across all destinations is essential for ensuring that tourists can fully benefit from smart tourism technologies. Another barrier is the high cost of implementing these technologies, such as Internet of Things (IoT) devices, location-based applications, and online ticketing systems. The significant upfront investment required to develop and integrate these systems may be a financial burden, particularly for smaller tourism operators or hotels that lack the capital to fund such initiatives. Offering financial incentives or subsidies from the government could help alleviate this barrier, enabling more industries to adopt smart tourism.

Table 2. The Challenges and Barriers of Smart Tourism

No.	Challenges	Barriers
1	Digital Infrastructure Limitations	Data Security and Privacy Issues
	Uneven internet connectivity in some tourist destinations hinders access to digital applications and real-time information.	The collection of personal data by apps and digital systems raises concerns about data security and potential misuse or breaches of personal information.
2	High Implementation Costs	Resistance to Change
	The upfront investment required for implementing IoT, location-based applications, and online booking systems is high, posing a financial challenge for smaller destinations or accommodations.	Destination managers and hotel staff, accustomed to traditional methods, may resist adopting new technologies or feel overwhelmed by the changes.
3	Digital Literacy Gap	Human Resource Limitations
	Many tourists, especially older generations or those not familiar with digital technologies, struggle with using mobile apps or digital systems, leading to unequal experiences.	The tourism sector lacks adequately trained staff who can operate advanced technological systems, slowing down the adoption process.

Source: Data Processed, 2025.

Additionally, there is a digital literacy gap that presents a challenge, especially among older tourists or those less familiar with technology. This creates an unequal experience, where some tourists may struggle to use digital applications or tools, leaving them at a disadvantage. Moreover, many workers in the tourism sector are not equipped with the necessary skills to operate or maintain advanced technological systems, further slowing the adoption of smart

tourism. Providing targeted training for both tourism professionals and tourists themselves would help bridge this gap, ensuring that everyone can benefit from the technologies available. Data security and privacy are also major concerns. With many smart tourism systems collecting personal information, such as location and payment details, the potential for data breaches or misuse of personal information is a significant risk. To mitigate this, strong data protection measures must be implemented, including compliance with privacy regulations and clear transparency about how data is used. This will help build trust with tourists, encouraging them to embrace digital tools.

Resistance to change is another barrier, particularly among destination managers and hotel staff accustomed to traditional methods. Some may feel overwhelmed by the complexity of adopting new technologies or may fear that these changes will disrupt their current operations. To overcome this resistance, it is crucial to demonstrate the benefits of smart tourism, such as improved operational efficiency, better customer service, and increased profitability. Additionally, providing proper training and support can help stakeholders feel more comfortable with the transition. Human resource limitations also play a role in hindering the implementation of smart tourism. The tourism sector often lacks adequately trained staff who can manage and operate advanced technology systems. Addressing this challenge requires investing in training programs that equip workers with the skills needed to handle the evolving demands of the industry.

The "SEMARTOUR" Smart Tourism Impact on Operational Efficiency and Destination Management

The implementation of smart tourism technologies in Semarang City has had a notable impact on the operational efficiency and destination management. By integrating advanced digital tools and systems, various tourism stakeholders, including destination managers, accommodation providers, and transportation services, have been able to streamline their operations and improve the overall visitor experience. One of the key benefits is the optimization of resource management in destinations, hotels, and attractions. For instance, through the use of Internet of Things (IoT) technology in hotels, such as those in Semarang, room temperature, lighting, and energy consumption can be efficiently monitored and adjusted based on real-time data. This results in reduced energy costs and better management of hotel resources, ensuring that operational costs are minimized. Similarly, the adoption of location-based applications and online ticketing systems in tourist destinations has helped improve the flow of visitors, reduce congestion, and manage crowding. By allowing tourists to book tickets in advance through mobile apps, the number of visitors on-site at any given time can be better regulated. For example, attractions like Lawang Sewu or Kota Lama can anticipate high traffic periods and adjust their staff or facilities accordingly, improving the overall efficiency of their operations. Additionally, these applications provide valuable data on peak visitation times, enabling better planning and staffing for peak seasons or special events.

The introduction of smart transportation systems has also significantly contributed to improving the operational efficiency of tourism in Semarang. Through platforms like Gojek and Grab, tourists can easily book rides to and from various attractions, eliminating the need for manual bookings or reliance on less efficient transportation options. This seamless integration of transportation with digital systems enhances the tourist experience while simultaneously optimizing traffic flow and reducing delays. In terms of destination management, smart tourism technologies have allowed for more precise data collection and analysis. For example, by using real-time data from mobile apps, social media platforms, and ticketing systems, destination managers can track visitor behavior, identify trends, and make data-driven decisions. This ability to collect and analyze large amounts of data in real-time

helps destination managers allocate resources more effectively, plan better promotional campaigns, and adapt quickly to changing visitor needs.

Furthermore, the integration of systems between different sectors—accommodation, attractions, and transport—ensures that tourists have a more coordinated and efficient experience throughout their journey. This integration reduces redundancy in processes, such as booking and payments, and ensures that each part of the tourist journey is seamlessly connected. For example, when tourists make a booking for an attraction, they can simultaneously arrange transportation and find suitable accommodation, all through the same platform. However, these improvements in operational efficiency and destination management also come with the need for continuous investment in technology maintenance and upgrades. As tourism technology evolves, it is crucial for stakeholders to keep their systems updated and ensure their integration remains seamless across various sectors. The impact of smart tourism on operational efficiency and destination management in Semarang City has been largely positive, resulting in optimized resource use, improved visitor flow, and better coordination across the tourism value chain. These technologies have helped reduce operational costs, improve the tourist experience, and enable destination managers to make informed, data-driven decisions. However, maintaining and evolving these systems will be essential for ensuring that Semarang continues to benefit from smart tourism in the long term.

CONCLUSION

The implementation of "SEMARTOUR" smart tourism in Semarang City has proven to be a significant advancement in enhancing the tourist experience and improving the operational efficiency of various tourism-related sectors. The integration of technologies such as location-based applications, IoT in accommodation, online ticketing systems, and smart transportation has enabled destination managers and accommodation providers to streamline operations, reduce costs, and enhance resource management. Smart tourism also facilitate better coordination between tourism services, offering tourists a more seamless and efficient travel experience. However, the challenges of limited digital infrastructure, high implementation costs, and the digital literacy gap remain key barriers that need to be addressed for broader adoption and optimization of these technologies. While the study provides valuable insights into the implementation of "SEMARTOUR" smart tourism in Semarang City, several limitations need to be acknowledged. First, the research primarily focused on a select group of stakeholders, which may not fully represent the entire tourism ecosystem. Additionally, the research relied on qualitative data from interviews, which, while offering in-depth perspectives, may be subject to personal biases and interpretations. The scope of the study was also limited to Semarang City, and therefore, the findings may not be fully generalizable to other regions with different levels of infrastructure and technological adoption.

Furthermore, the rapid pace of technological advancement means that the study's findings could evolve as new technologies and trends emerge in the field of smart tourism. Future research on smart tourism should focus on exploring the long-term impacts of technology implementation on both the tourism industry and local communities. Specifically, future studies could examine how smart tourism affects local economic development, small businesses, and the social inclusion of local communities, particularly in less-developed or rural areas. It would also be beneficial to investigate the adoption barriers among tourists themselves, focusing on their acceptance and trust in digital technologies, particularly in the context of data privacy and security. Future research should aim to develop models that balance the use of technology with environmental conservation and cultural preservation, ensuring that smart tourism remains both effective and responsible. The smart tourism holds great potential to

transform the tourism industry, but it requires continuous collaboration, innovation, and adaptation to new technologies. By addressing existing barriers and expanding research to explore broader implications, Semarang City and other destinations can successfully harness the benefits of smart tourism while ensuring its long-term sustainability.

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