



Digitalization in Mycelia Forest Management, Cikole Village: Innovative efforts toward sustainable tourism

Desy Nur Aini Fajri^{1*} and Intan Pratiwi¹

Abstract

This research elaborates on innovative efforts to develop Mycelia Forest, Cikole Village using digital information technology. A descriptive qualitative approach was applied. Data were collected using in-depth interviews, observation, and documentation, and analyzed through three stages, i.e., data reduction, data presentation, and conclusion drawing. Results demonstrated three innovative digitalization efforts effective for developing Mycelia Forest to achieve sustainable tourism, namely (1) Deploying digital information technology media, (2) Elevating accessibility and service quality, and (3) Building cooperation with diverse stakeholders. Accordingly, the research provided new insights into how digital information technology could buoy the management and promotion of tourist destinations, especially tourist forests.

Keywords: Digitalization, Forest, Innovative, Sustainable Tourism, Village

Introduction

Tourism is one of the sectors which greatly contribute to the national economy of many countries. Especially in Indonesia, it has a positive effect on enhancing the country's foreign exchange income, creating jobs, bolstering related sectors, e.g., hospitality, transportation, and trade, and advancing infrastructure in tourist destination areas. Data from the Indonesian Ministry of Tourism and Creative Economy in 2024 note that the number of foreign tourists visiting Indonesia through all entrances in January 2024 was 927,746. The number experienced a growth of 16.19% compared to January 2023, while most tourists were reportedly from Malaysia, Australia, Singapore, China, and Timor Leste (Indonesian Ministry of Tourism and Creative Economy, 2024).

In several big cities in Indonesia, we notice that tourism and recreation in forest areas are beginning to be in demand by tourists. For instance, the growing influx of tourists in Bandung is allegedly motivated by the 'Thousand City Parks' program, where the Elderly Park, Film Park, City Hall Park, and Singles Park fall under its umbrella. The city has been nicknamed 'Swiss Van Java' as it resembles the mountainous landscape in Switzerland, which combines with the air coolness typical of the highland. And yet, some challenges exist, such as how to balance - tourist needs with conservation measures.

*Correspondence:
Desy Nur Aini Fajri

desynur@staff.gunadarma.ac.id

Author list information is available at the end of the article.



In the digital era, forest development confronts other challenges in attracting tourists and improving adequate services using digital information technology. Pramudya et al. (2024) enumerate some frequent issues, covering minimum infrastructure and facilities, deprived publications and promotions, limited human resources, low investment, and a lack of tourist attractions. Another serious problem is related to the allocation of forest land to build tourist facilities, causing forests to suffer from tourism pressure (Kuvan, 2005). Because tourism facilities built within forest areas can pollute water and compromise biological integrity (Chen & Nakama, 2013), creating a balance between private sector interests, tourists needs, and environmental sustainability conservation hence becomes critical.

To address the challenges, we propose digital device utilization, which we believe is effective for developing and managing tourism in forest areas and escalating tourist experiences. Besides, it allows tourist area management to easily promote, market, increase service quality for tourists, and even develop forests in a sustainable way. It is aligned with Korcz et al. (2024), that employing digital tools is crucial in forest management and outdoor tourism strategies. Additionally, Sgroi & Modica (2024) indicate a link between sustainable tourism models and natural resource management in Ficuzza Forest once new digital technologies are drawn on.

Table 1. Forest Area in West Java (in Hectares)

Forest Area Function	Forest Area	Forest Area Percentage
Conservation forest	170,658.39	21.62
Protected forest	229,221.57	29.05
Permanent production forest (permanent)	213,117.67	27.00
Limited production forest (limited)	176,181.86	22.32
Limited production forests	15,127.00	10,468.00
Total	789,179.49	100.00

Source: Central Statistics Agency, West Java, accessed at <https://jabar.bps.go.id/> on March 30th, 2024 at 11:54 PM

In this study, we set our focal point in Mycelia Forest, one of the favourite destinations in Cikole, Lembang, Bandung Barat, which has exploited digital information technology to espouse sustainable tourism. Fangfang et al. (2024) point out that digital technology is essential for developing integrated forest tourism, boosting rural revitalization, increasing market operations, and preserving forest cultural heritage. Ecological resources for sustainability can be monitored by adopting five models, which are the digital forest ecotourism model, the personalized big data forest tour model, the digital forest product e-commerce sales model, the virtual forest ecology experience model, and the social media forest tourism promotion model.

Mycelia Forest, Cikole Village, known for its cool and beautiful pine forests and the potential for education about mushroom ecosystems, offers a unique experience for tourists. In October 2023-June 2024, it attracted 145,000 tourists, implying an average number of visits of 18,000 tourists/month. Digital information technology reportedly also contributes to the success and hence fosters sustainable tourism.

To our knowledge, research on forest innovation efforts to realize sustainable tourism through digital information technology remains limited. Therefore, in this research, we present innovative measures Mycelia Forest takes to achieve sustainable tourism through digitalization. This research is expected to provide new insights into how digital information technology can effectively support the management and promotion of tourist destinations, especially tourist forests.

Methods

A descriptive qualitative approach was leveraged to describe and explain innovative efforts to develop Mycelia Forest using digital information technology. The approach was chosen because it enabled us to examine related phenomena and delve into field facts, where a quantitative explanation was thus impossible. Several facts we inspected encompassed innovative strategies and measures, challenges faced, and innovations made. The data collection techniques were in-depth interviews, observation, and documentation. Data analysis was carried out in three stages: data reduction, data presentation, and conclusion drawing. The research area was Mycelia Forest, Cikole Village, Lembang, Bandung Barat, West Java, selected under the consideration of the forest's reputation as an ecotourism destination with natural tourism and digital technology concepts in its management. As for the informants, we chose some based on particular rationales and considerations as listed in Table 2.

Table 2 Reasons and Considerations for Selecting Informants

No.	Informants	Reasons and Considerations
1	Human resource development staff (Informant 1)	To find out information on Mycelia Forest management, including the management of facilities, forest conditions, and forest preservation policy implementation, and cooperation with any party in educational tourism or technology fields.
2	Marketing staff (Informant 2)	To find out information regarding promotional and marketing strategies for elevating Mycelia Forest's popularity and innovation development to enhance tourist experiences. The latter included the use of new technology, the addition of new facilities, and the development of more innovative educational programs.
3	Operational staff (Informants 3, 4, and 5)	To find out insights into how Mycelia Forest developed educational programs which could enhance tourist experiences concerning fungi and their ecosystems.

Source: Field Results, 2024

Data collection in this study was conducted with three main techniques, i.e., in-depth interviews, field observations, and documentation.

In-Depth Interview

Semi-structured interviews were performed with research subjects, namely Mycelia Forest HRD staff, marketing staff, and operational staff, to gain in-depth information on digital technology roles in Mycelia Forest management. The questions were concentrated on three main aspects, namely the use of technology in promotion, visitor management, and challenges faced during implementation.

Field Observation

Observations were undertaken to directly monitor how digital technology was applied in Mycelia Forest, especially in the online ticketing system, the use of social media, and other digital information technology facilities available in the tourist area. The observations were carried out on weekdays and weekends to discover the variation in the number of tourists and the use of digital information technology.

Documentation

Documentation was conducted to supplement interview- and observation-generated data. Documents collected in this phase covered visitor data, digital promotional materials, e.g., social media uploads and websites, and internal documents related to management policies and destination development plans.

Subsequently, the data collected were analyzed in three steps, which were data reduction, data presentation, and conclusion drawing/verification. To ensure data validity and reliability, we made use of the triangulation technique of data sources. Data from interviews, observations, and documentation were compared to ensure consistency and accuracy of the information contained. In addition, cross-checks between data from informants were performed to ensure the conformity between conclusions drawn and field reality.

Findings and Discussion

Mycelia Forest, Cikole Village at A Glance

Mycelia Forest was located in Cikole, Lembang, Bandung Barat, West Java. The name was taken after 'mycelia', referring to fungal tissues commonly found in the forest, and accordingly, signified mushrooms as the theme. The natural forest, rich in diversity of fungi or soil fungi, bore a vision of educating visitors about mushrooms, particularly the Mycelia species. It also provided tourists with natural beauty and fun activity experiences, such as hiking, mushroom observation, and photography. In terms of accessibility, visitors could travel to Mycelia Forest on a paved road connecting Lembang with Bandung. Facilities available in the forest included kid playgrounds, food courts, souvenir shops, prayer rooms, parking lots, and toilets.



Figure 1. Mycelia Forest
Source: Researcher Archives, 2024

Innovative Efforts to Develop Mycelia Forest through Digitalization

We found three innovative efforts to develop Mycelia Forest using digital information technology, as follows:

1. Utilizing Digital Information Technology through Websites, Mobile Applications, Social Media, SEO, and Digital Advertising

According to our findings, the Mycelia Forest management ran an official website, released a mobile application, and conducted social media optimization, Search Engine Optimization (SEO), and digital advertising.

a. Official Website and Mobile Application

The Mycelia Forest management designed and developed an official website (<https://www.grafikacikole.com/hutan-mycelia/>), which served as the primary information portal for prospective tourists. The website was designed by highlighting visitors' need for

accurate and accessible information. Some main features on the official website encompassed the Location and Accessibility Information, Ticket Price and Facility Details, Tourist Activities and Attractions, and Rules and Regulations.

Capitalizing on the development of mobile technology and the increasing use of smartphones, the Mycelia Forest management launched a mobile application designed to provide a more personalized and interactive experience for visitors. The application offered several advanced features underpinning visitors' convenience and satisfaction, including Ticket Reservation and Service Booking, which helped potential visitors to book tickets online, access interactive maps, and get real-time notifications, Interactive Maps and Navigation, and Notifications. As shown by Buhalis and Sinarta (2021), smart technology, such as mobile applications and online reservation systems, escalated accessibility for tourists with various needs and improved service inclusion by addressing physical and cognitive challenges.

b. Social Media Optimization

The Mycelia Forest management also optimized the forest's social media platforms, covering Instagram, Facebook, and Twitter, by making creative content and implementing integrated digital marketing strategies to boost audience interaction. They uploaded creative visual content on digital platforms, hence providing up-to-date information and creating a direct interaction line with visitors. It conformed to Gretzel et al. (2015), who suggested that digital technology could foster engagement and interaction between management, tourists, and other stakeholders. The Instagram account of Mycelia Forest, @officialgrafika, with 1K video and image uploads, had appealed to 47.3K followers (Instagram, January 10, 2025). Most of the content routinely posted on Instagram were beautiful scenery, typical flora and fauna, and interesting moments from tourism activities in the forest. Besides, short videos/testimonials of tourists regarding their experiences were also uploaded, affecting the decision of potential tourists and enticing them to visit Mycelia Forest. The well-planned actions were proven effective in raising tourists' awareness, drawing their interest, and establishing an active online community.

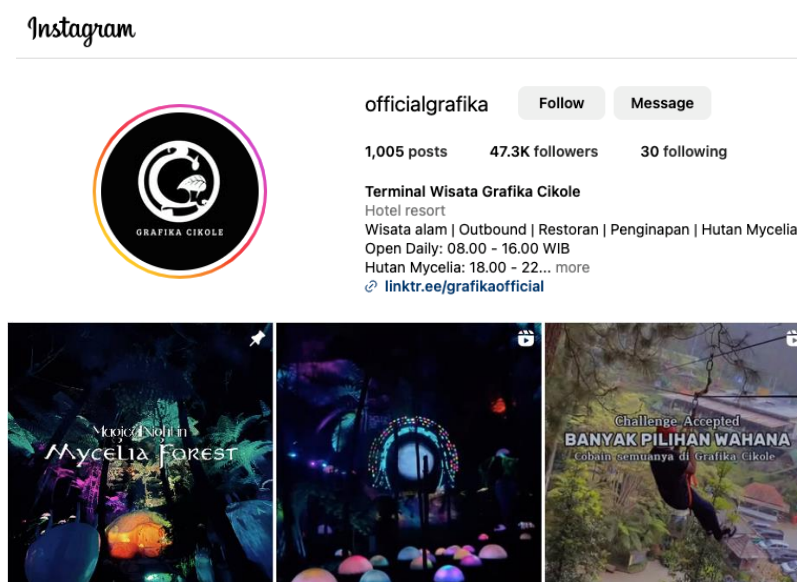


Figure 2. Mycelia Tourism Forest Instagram @officialgrafika
Source: Instagram, January 2025

c. Search Engine Optimization (SEO) and Digital Advertising

The Mycelia Forest management applied two key digital marketing strategies, i.e., Search Engine Optimization (SEO) and digital advertising, to increase the Mycelia Forest website's discoverability on search engines and maximize its promotion reach through online advertising. Five SEO aspects implemented by the Mycelia Forest management were (1) Keyword Research:

The Mycelia Forest management performed research to find out keywords relevant to natural tourism, such as “best tourist forest in West Java,” “Cikole natural tourist destination,” or “activities in Mycelia Forest”, (2) Content Optimization: Only high-quality content which was informative and relevant was taken into account since Google prioritized websites with useful and quality information, (3) Technical Optimization: The Mycelia Forest management ensured the forest’s website was responsive and accessible on mobile devices and there were no technical errors which might influence rankings on search engines, (4) Backlinks: The Mycelia Forest management was determined to obtain quality backlinks from tourism-related websites or local news, thus increasing its website’s authority and ranking in search results, and (5) Measurement and Analysis: The Mycelia Forest management deployed analysis tools, e.g., Google Analytics, to monitor the forest’s website performance.

In terms of digital advertising, the Mycelia Forest management drew on several main platforms, namely:

- (1) Google Ads: The Mycelia Forest management employed Google Ads, targeting audiences who were looking for information related to nature and forests in a specific area.
- (2) Facebook Ads: The Mycelia Forest management created ads targeted to audiences interested in tourism, adventure, and outdoor activities. The ads could be images, videos, or carousels showcasing Mycelia Forest’s eminence.
- (3) Instagram Ads: The Mycelia Forest management exploited Instagram Ads to show off the natural beauty and activities in Mycelia Forest through aesthetic and engaging content, drawing users’ interest.
- (4) Retargeting: The Mycelia Forest management proposed relevant ads to familiar audiences, inviting them to visit or revisit the forest.

The Mycelia Forest management adopted digital information technology to boost the efficiency of visitor management and services. For example, they implemented a visitor management system to prevent overcapacity which could damage forest ecosystems, a digital payment system, covering e-wallet and QR codes, and digital technology-based collection and analysis of visitor data to collect data on visitor behaviours, travel preferences, and feedback).

2. Enhancing Accessibility and Service Quality for Tourists through Digital Technology Application

The Mycelia Forest management also adopted technology to build more interactive and engaging tourist experiences. Some of the initiatives implemented included:

a. Virtual Reality (VR) and Augmented Reality (AR)

VR and AR technology helped visitors acquire a unique and immersive travel experience. For instance, through an AR app, visitors could get additional information about the flora and fauna in a particular forest area by only pointing their smartphones at a specific point in the area. Meanwhile, VR provided a virtual tour to potential visitors who were anxious to experience the thrill of traveling in the Mycelia Forest before making a decision on coming physically. Smith and Green (2023) suggested that digital applications, covering augmented reality (AR) and virtual reality (VR), could expand visitors’ educational experience, contribute to conservation by providing real-time information about forest conditions and biodiversity, and improve efficiency in forest resource management.

The Mycelia Forest management also provided an interactive map accessible through a mobile application or tablet at the tourist site, allowing visitors to explore forest areas, find points of interest, and get information about trekking routes, rest locations, and other facilities. The digital guide enabled visitors to plan their trip better and ensured that they could enjoy the tour without worrying about getting lost.

The management drew on the Geographic Information System (GIS) to monitor forest area conditions and development in real time, helping them identify areas calling for care,

maintenance, or conservation. Data from GIS could be employed in optimizing the layout of tourist facilities, encompassing trekking trails and picnic areas to provide a more comfortable and safe experience for visitors. Additionally, an online reservation system allowed the management to manage the number of visitors in the tourist area and avoid overcrowding which could disrupt tourist experiences and forest environment preservation. The booking system could also enable tourists to more readily organize their visits and book tickets, thereby increasing their comfort and satisfaction.

The Mycelia Forest management was also monitoring reviews given by visitors through Google Reviews on a regular basis, daily and monthly, as the reviews contained data which helped them to figure out visitor satisfaction, trends, and patterns from the feedback and find areas urgent for improvement. In addition, the reviews outlined many different aspects related to visitors' experience, including cleanliness, facility quality, and staff service. Finally, fast responses to complaints and feedback were given by the Mycelia Forest management through WhatsApp, comments, or reviews on online social media.

3. Building Cooperation with Stakeholders

Mycelia Forest was committed to elevating the quality of tourist experiences through various innovations and therefore cooperated with stakeholders. Freeman and Reed (2022) argued that cooperation between diverse stakeholders was essential to ensure that all parties had their interests represented and that decisions taken were mutually agreed upon. By working together, resources could be exploited more effectively and projects could last longer. Some cooperation which had been undertaken was:

a. Cooperation with Educational Tourism Vendors

Mycelia Forest cooperated with vendors focusing on educational tourism to enrich visitor experiences. For example, the management established a cooperation with a vendor specializing in colorful character light installations, such as those in the Grafika Cikole tourist area.

b. Cooperation with the Government

Mycelia Forest was one of the ecotourism destinations which offered natural beauty and educational potential for visitors. The management of the forest encountered diverse challenges, ranging from environmental preservation to an increasing number of visitors. To alleviate this challenge, the management cooperated with the government and paid more attention to legal and administrative aspects, financial aid funding, training and capacity building, promotion and marketing, and supervision and evaluation.

c. Cooperation with Schools and Other Institutions

Besides cooperating with the government, Mycelia Forest was also active in establishing partnerships with schools and other educational institutions who consented to give education and training programs. Some of the cooperation was in the form of (1) environmental education programs, which covered providing facilities and resource persons for educational tours, flora and fauna observations, and workshops on environmental conservation, (2) fieldwork and research practices, which allowed participating students to be directly engaged in forest management. The practices encompassed ecosystem monitoring, visitor management, and natural resource management, and (3) social and environmental activities, such as social services, tree planting, and cleanliness campaigns, conducted in Mycelia Forest. Through the cooperation, the government, institutions, and local communities could get the distribution of forest tourism benefits (Song et al., 2020).

Conclusion

In conclusion, we could confidently convey that digital information technology played an imperative role in developing Mycelia Forest and supporting tourism sustainability. The Mycelia Forest management had made strategic efforts to leverage digital information technology for

promotion and marketing, enhance visitor services, and establish cooperation with many different stakeholders. However, we also found several issues in digital technology applications in Mycelia Forest, including limited technological infrastructure, e.g., inadequate internet access in some forest areas. It could hinder tourists from accessing digital services optimally, such as booking tickets or acquiring information through QR codes. Based on the results, we suggest that the Mycelia Forest management continue to elevate infrastructure in forest areas, such as by expanding the reach of internet access in all areas.

Furthermore, digital literacy levels of visitors, specifically those unfamiliar with technology, were also a challenge. The management should continue to educate tourists on how to make use of this technology through more intensive education programs. Additionally, They should provide on-site information centers or digital guides easy to understand, allowing for a more optimum use of digital information technology to support the development of this tourist destination.

Concerning the study limitation, as the research emphasizes initial exploration of the management's efforts in utilizing digital information technology, other aspects related to Mycelia Forest development, e.g., the effectiveness of digital marketing strategies implemented to attract more tourists or levels of visitor satisfaction with the facilities and services provided, are left unobserved. Thus, we also suggest further researchers dig deeper into the effectiveness of the digital marketing strategies invoked by analyzing promotional data on social media or other digital platforms to understand digital marketing impacts on increasing the number of visitors. Besides, future researchers can also focus on evaluating levels of visitor satisfaction with the facilities and services available. The evaluation will lead to specific recommendations for escalating the quality of Mycelia Forest Forest tourism and thus developing this tourist destination.

Acknowledgment

For the completion of this article, we thanked to Universitas Gunadarma and also the management of Mycelia Forest Cikole Village for their cooperation and support during the interview activities in the field.

Declaration

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

The data presented in this study may be obtained on request from the corresponding author.

Competing interests

The authors declare that they have no competing interests.

Author contributions

DNAF conceptualization, methodology, validation, formal analysis. IP investigation, data curation, writing - original draft preparation, writing - review and editing, supervision, project administration. All authors have read and agreed to the published version of the manuscript.

Funding

This research is supported by Universitas Gunadarma, Indonesia.

Authors detail

¹Tourism Study Program, Faculty of Letters and Cultures, Universitas Gunadarma, West Java, Indonesia.

Received: 02 January 2025

Accepted: 20 January 2025

Published online: 22 January 2025

References

- Buhalis, D., & Sinarta, Y. (2021). *Smart Tourism and Accessibility: Enhancing the Travel Experience for All*. *Tourism Management Perspectives*, 30, 189-197.
- Chen, B., & Nakama, Y. (2013). Thirty years of forest tourism in China. *Journal of forest research*, 18(4), 285-292.
- Fangfang, Z. O. U., Kejia, L. U., Haiyan, Z. H. A. N. G., & Jinhuang, L. I. N. (2024). The Integrated Development of Forest Tourism and Rural Revitalization in Fujian Province under the Digital Economy. *Issues of Forestry Economics*, 44(3).
- Freeman, R. E., & Reed, D. L. (2022). *Stakeholder Collaboration in Sustainable Tourism Development*. *Journal of Sustainable Tourism*, 30(5), 721-738.
- Gretzel (2011). "Intelligent systems in tourism: A social science perspective." *Annals of Tourism Research*, 38(3), 757-779.
- Irawan, H., Nurhazizah, E., & Panjaitan, J. N. C. (2022). Analisis Perpindahan Wisatawan dan Preferensi Destinasi Wisata Favorit Berdasarkan Geotag Instagram (Studi Kasus pada Destinasi Wisata Bandung Raya). *Jurnal Teknologi Informasi dan Ilmu Komputer*, 9(3), 639-646.
- Korcz, N., Ciesielski, M., Kamińska, A., Choromański, K., Gotlib, D., Stefán, F., & Taczanowska, K. (2024). The use of digital tools in forest tourism and recreation-Experiences from Warsaw agglomeration in Poland. *Trees, Forests and People*, 18, 100697.
- Kuvan, Y. (2005). The use of forests for the purpose of tourism: the case of Belek Tourism Center in Turkey. *Journal of environmental management*, 75(3), 263-274.
- Pramudya, M. R., Setianingsih, E. L., & Lituhayu, D. (2024). Analisis Strategi Pengembangan Pariwisata Pada Hutan Wisata Tinjomoyo Kota Semarang. *Journal of Public Policy and Management Review*, 13(2), 1-20.
- Sgroi, F., & Modica, F. (2024). Digital technologies for the development of sustainable tourism in mountain areas. *Smart Agricultural Technology*, 8, 100475.
- Smith, K., & Green, R. (2023). "Innovations in Forest Tourism Management: The Role of Digital Tools." *Forest Policy and Economics*, 150, 102-115.
- Song, M., Xie, Q., Tan, K. H., & Wang, J. (2020). A fair distribution and transfer mechanism of forest tourism benefits in China. *China Economic Review*, 63, 101542.

Publisher Notes

Borneo Novelty Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.