



# Digitalization of Sanja Village Vegetation Conservation Through 360° Virtual Exploration to Support Smart Eco-Tourism Development in the Tosari Area

Randy Tirto Buana<sup>1</sup>, Tirta Puspa Arum<sup>2</sup>, Zahra Widiyanti<sup>3</sup>, Budi Handoyo<sup>4</sup>, Alfyananda Kurnia Putra<sup>5\*</sup>

<sup>1,2,3,4,5</sup> Geography Education, Universitas Negeri Malang, 64185, Indonesia

Email: [alfyananda.fis@um.ac.id](mailto:alfyananda.fis@um.ac.id)

<p><b>ABSTRACT</b></p> <p>Tosari Village is one of the tourist support villages in the Bromo Tengger Semeru National Park (TNBTS) area and has a tourist village known as Sanja Village. Sanja Village tourism is a form of ecological conservation, which utilizes the potential of the land with the presence of various vegetation supporting the land, which is arranged, and this potential is used as an ecotourism area. Based on survey results, observations, and interviews with Sanja Desa managers, there are still shortcomings in packaging content and tourism branding in the current digital era. So, in this case there is a need for technological innovation that is in line with tourism trends, one of which is Virtual Exploration which can fully explore tourist destinations virtually. The development of virtual exploration can build smart ecotourism in Sanja village. The development stages in this research start from planning, preparation, implementation, and reporting. Through virtual exploration of vegetation conservation, Sanja Desa can support the development of smart ecotourism in Tosari village. The development of virtual exploration is a form of digitalization by exploring the diversity of vegetation conservation, ecology, and culture in 360°, capable of creating a tourist experience that is realistic to visit before Sanja Village. The digitalization of Sanja village ecotourism can create sustainable development of Tosari village.</p>	<p><b>ARTICLE HISTORY</b></p> <p>Submitted:20-12-2023          Revised: 23-12-2023          Accepted:28-12-2023          Online first:30-12-2023</p>
	<p><b>KEYWORDS</b></p> <p>Sanja Village, Tosari, Virtual Exploration</p>

## 1. Introduction

Tosari is a village in the highlands of Pasuruan Regency, East Java. The physiographic and topographic conditions of Tosari village create a variety of natural tourism, one of which is the Bromo Tengger Semeru National Park (TNBTS) which has become an icon of Pasuruan district [1], [2]. On the one hand, Tosari village becomes a buffer for the TNBTS area, so that it becomes a tourist village [3]. The existence of this tourist village is able to introduce the potential of Tosari village with its cultural diversity and local wisdom as well as its environmental conditions in supporting the economy of the local community [4].

The tourist village in Tosari is known as Sanja Village. The orientation of Sanja Village as a tourist village in Tosari is the implementation of sustainable tourism development [5]. The development of Sanja Village cannot be separated from the role of the community through Community Based Tourism called Baladaun as a tourism pioneer by paying attention to the social, cultural and environmental aspects of Tosari.[6]. Sanja Village Tourism is a form of ecological conservation, which utilizes the potential of the land with the presence of various vegetation supporting the land, so that this potential is used as an ecotourism area [7].

Sanja village has the potential to be developed into sustainable tourism (eco-tourism). The concept of eco-tourism is tourism that aims to enjoy natural views, study, understand and comprehend the environment, flora and fauna and the unique culture of local communities [8]. Sanja village ecotourism applies various types of ecology, one of which is that there are various types of vegetation that have carrying capacity and there are eco-enzyme activities as soil conservation as a substitute for pesticides in fertilizing the soil. Apart from that, there is air conservation as a means of irrigation for the vegetation. In this way, Sanja village tourism is able to provide environmental management and education.

Sanja village eco-tourism also includes aspects of local wisdom and culture as the identity of the Tengger tribe. Tourists who come to Sanja Tosari Village will be given a Lawe Bracelet (a welcome bracelet), Udeng (a form of respect for guests and are considered family members of the Tengger community, Kaweng (Kawengkon/protected) [9]. With these facilities tourists can learn and have experience culture and environmental interaction of the Tengger Tribe. In this way, Sanja village eco-tourism provides education and travel experience for tourists, so there is a need for branding to introduce the Tosari landscape as eco-tourism environment sustainability.

Branding in tourism is the initial step in advancing and promoting tourist destinations. Eco-tourism Sanja Desa already has various promotional platforms on various social media, but many tourists still don't know about it. Based on the results of observations and needs analysis with Sanja Desa management, there is still a lack of packaging of tourism content and branding in the current digital era, so that tourists can be interested and know about the types of Sanja Desa eco-tourism destinations. Therefore, there is a need for technological innovation that is in accordance with current tourism trends, namely Virtual Exploration which is able to fully explore tourist destinations virtually [2].

The development of virtual exploration can build smart eco-tourism in Sanja village. The concept of smart ecotourism is an innovation related to the application of technology and the development of smart ecotourism [10], [11]. The aim of Sanja Desa smart eco-tourism is to fulfill the needs and branding of tourists by combining ICT and environmental education to improve the quality and enlarge the scale of the tourism industry more widely in the current digital era [12].

Through virtual exploration and vegetation conservation, Sanja Village can support the smart eco-tourism development of Tosari Village. The development of virtual exploration is a form of digitalization by exploring the diversity of vegetation conservation, and ecology and culture in 360°, able to create a realistic tourism experience before visiting Sanja Village [13], [14]. With the digitization of Sanja eco-tourism, the village can create sustainable development of Tosari village.

The results of previous research conducted by Khalidy et al., (2023) explained that virtual reality media developed in the Sanja Village area was able to provide a real picture for tourists. The results of similar research conducted by Hanum (2020) explained that the existence of smart tourism technology through virtual exploration makes the development of the tourism economy smart and can support and support the development of the region. This shows that virtual exploration interventions can advance and benchmark tourism concepts and provide realistic experiences for tourists. The latest research is developing virtual exploration media through smart eco-tourism in building sustainable environmental tourism development in Tosari village.

Based on this background, the aim of this research is to develop virtual exploration media for Sanja Village vegetation conservation to support smart eco-tourism development of Tosari Village.

## 2. Method

The research implementation method was carried out on Friday, 27 October 2023 and Saturday, 28 October 2023. The location of the activity was in Tosari Village, Tosari District, Pasuruan Regency. The stages of this research are as shown in Figure 1 below:

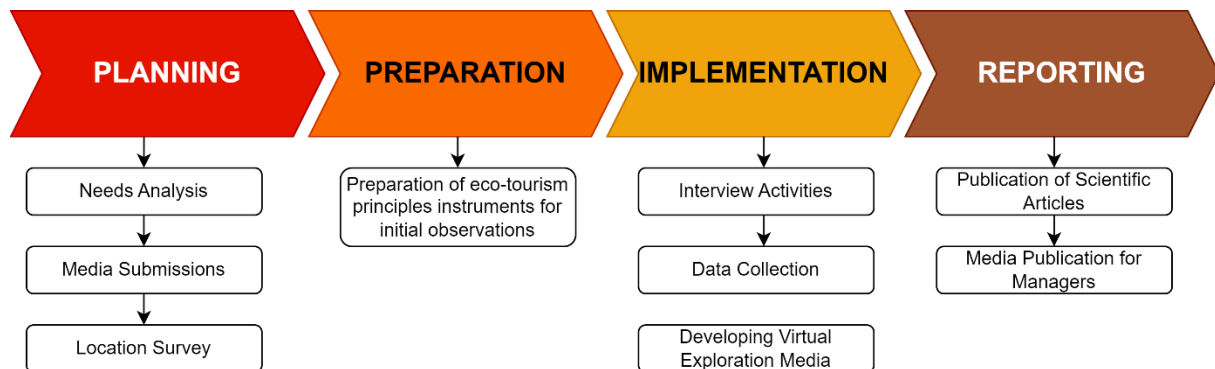


Figure 1. Research Stage Diagram

Based on the description of the stages of implementing research activities above, there are five stages that are followed. First, identifying problems or needs analysis, this is done through interviews with tourism managers. Second, namely planning, where at this stage the researcher plans research activities by forming instruments.

The third stage, namely preparing tools and materials such as a 360° camera for making Virtual Reality (VR). The fourth stage, namely carrying out interview activities, taking materials for VR, and making VR media. Then, the final stage of this research activity is carrying out reporting by creating research articles and publishing VR media to tourism managers.

## 3. Result and Discussion

### 3.1 Conservation of Vegetation and Ecology of Sanja Tosari Village as Eco-Tourism

The results of research through interviews with Sanja Village managers explained that the formation of this tourist village was the result of illegal logging or large-scale deforestation in Tosari village, so that the surrounding community formed a community called "Baladaun". The role of the Baladaun community is being able to make Sanja Village a representative solution to the problem of drought in the Sin Tosari area. The results of research conducted by A'inun, Krisnani and Darwis, (2015) explained that Community Based Tourism (CBT) is a tourism concept that is managed by the community and for the community, so that it refers to local wisdom in every tourist village that is built to offer tourism which has become a culture

of the region itself. Thus, Baladaun's role as CBT is able to develop tourist attractions and realize sustainable tourism development.



Figure 1. Interview with Sanja Village Tourism Manager

Source: Research Data, 2023

Sanja Village is a tourist village in Tosari which has various types of environmental conservation. There is a variety of vegetation such as toga plants (family medicinal plants) and ornamental plants which are neatly arranged and arranged. On the one hand, Sanja Village provides environmental education for tourists with tour guides who explain the exploration of various types of vegetation and ecological conservation that exist there. Without abandoning its regional identity, Sanja Village tourism has local wisdom destinations such as displays of batik cloth decorated as the identity of the tengger tribe, and various other typical handicrafts. This makes Sanja Desa an eco-tourism that is able to convert environmental resources into education and interpret culture as a form of preserving the lives of local communities. This is in accordance with the results of research on eco-tourism indicators through interviews in the following table 1.

Eco-Tourism Indicators	Interview result
Nature-based with a focus on biological, physical or cultural uniqueness.	Sanja Desa was started by the Baladaun community in 2014 and was inaugurated in 2018. Sanja village is a natural tourist attraction with a mountainous background in the Bromo Tengger Semeru National Park (TNBTS)

---

	<p>Sanja Village has various environmental conservation efforts as an effort to preserve the ecology and maintain the culture of the Tengger Tribe community.</p>
Sustainable Ecology	<p>There is ecological conservation, namely eco-enzyme which is the conservation of waste from tourists and local communities that is processed into mixed soil which has an impact on soil fertility.</p> <hr/> <p>In maintaining sustainable ecology, Sanja Village managers collaborate with the government and local communities by forming Pokdarwis.</p>
Environmental education	<p>There is a tour package for the younger generation with the term local champion, so that later in this package tourists can plant environmental conservation plants as agents of change in preserving Sanja Tosari Village tourism.</p> <hr/> <p>With various vegetation conservation in Sanja Village, it is able to reduce greenhouse gas emissions in the Tosari area.</p>
Local Benefits	<p>Tosari Village Sanja Tourism provides benefits to local communities by opening UMKM such as tourism souvenirs, batik, homestays, food, and others. On the one hand, in terms of local wisdom, Sanja Desa is a supplier of rupiah coffers with the Tengger traditional ceremony.</p>
Visitor Satisfaction	<p>The village sanja service provides eye-pleasing tourist services and facilities, facilitating tourist mobility with jeep facilities that take tourists around the village sanja area. So visitors' impressions of village twilight tourism tend to be good.</p>

---

Source: Research Data, 2023

Based on table 1, it shows that Sanja Village is a tourism based on environmental education or what is known as eco-tourism. Sanja village's eco-tourism concept includes various vegetation conservation destinations so that visiting tourists have education and environmental conservation. This is in line with the results of research conducted by Angela, (2023) that environmental education and awareness are important components in the development of eco-tourism. So, tourists need to be given information about the importance of environmental conservation in maintaining and being responsible for the natural beauty they visit [17].

Sanja Village Tourism has 31 types of vegetation which have benefits for environmental conservation, one of which is cypress plants which are cultivated because they have tunggang roots so that water channels on the cliffs or slopes of Mount Bromo can withstand landslides. Apart from that, tourists can directly see the process of conserving organic waste and household waste which is processed into a liquid substitute for organic fertilizer pesticides to fertilize plants and soil. There are pig farms as pets for the Tengger tribe because most of the people are Hindus and Buddhists. In this way, environmental and cultural conservation can be interwoven into one destination and tourism facilities can create sustainable eco-tourism development [18].

In general, Sanja village tourism holds natural riches that are very interesting to be developed as eco-tourism. There are various factors that strengthen why this tourist attraction is relatively protected from natural damage, namely:

1. Local people are still resistant to making the Sanja Village area a conventional tourist attraction, this means that the Tosari village area still maintains its authenticity.
2. Access to enjoy the Sanja Village tour is not easy to get through because the tour is on the slopes of Mount Bromo which is in the highlands and approximately 2 hours' drive from the Pasuruan district area.
3. Sanja Village Tourism is an implementation of ecological conservation, so it has won various awards in the environmentally sustainable tourism village development program.

With tourism potential, the concept of eco-tourism is an appropriate tourism development strategy. Various forms of conservation, whether ecological, vegetation, and preserving local wisdom, can attract and educate the environment for tourists. This is what

supports the creation of eco-tourism because Sanja Village tourism can provide efforts and education in realizing sustainable environmental development.

### 3.2 Development of Sanja Village through Virtual Exploration to support Smart Eco Tourism Development of Tosari Village

The development of Sanja Desa's virtual exploration through a virtual reality approach which is structured into a website framework, namely users (tourists). Users in this case are tourists who access the Sanja Desa social media website in the form of 360° photos. The existence of virtual exploration can be used as tourism branding and promotion in the current digital era. This development certainly cannot be separated from the stages of designing the content that will be embedded on the website, the process of editing the content through 3D vista virtual tour software.

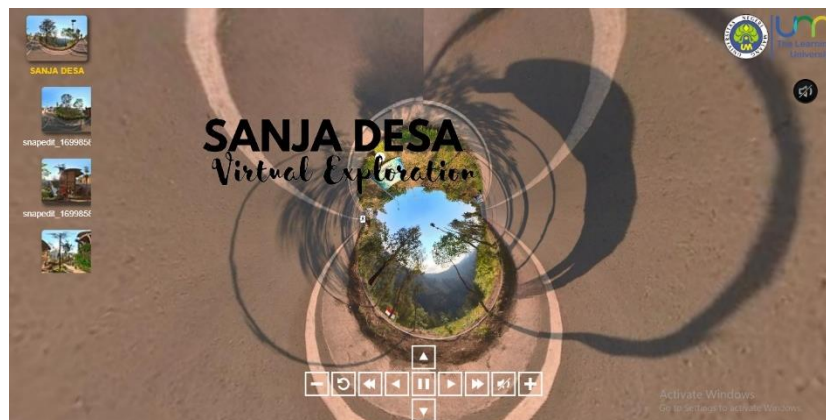


Figure 1. 360° photo of Sanja Virtual Exploration Village

Sanja Desa virtual exploration development by exploring existing natural and cultural potential so that it can provide realistic experiences to tourists. On the virtual exploration website there are infographics that support information related to forms of ecological and vegetation conservation. Apart from that, in the virtual exploration there are musical instruments typical of the Tengger tribe, so that tourists can enjoy the realistic atmosphere of local wisdom and culture of the Tengger tribe.





Figure 2. Eco-Enzym Ecological Conservation Information

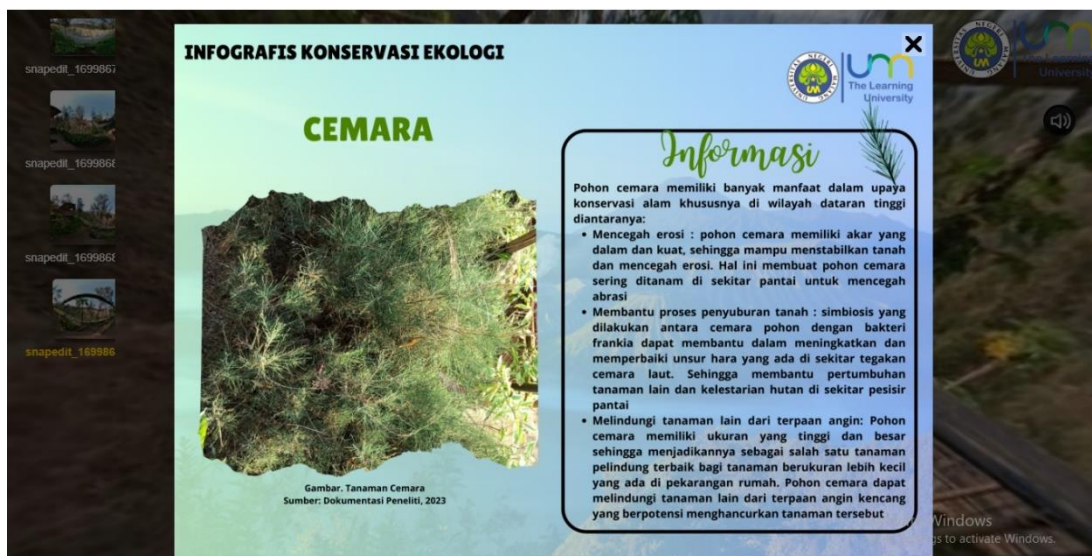


Figure 3. Cypress Vegetation Infographic

This virtual exploration can support smart eco-tourism in Tosari village. Smart eco-tourism can be the main driver in building sustainable village development. This is in line with research by Priyambodo & Artianingsih, (2022) that through the application of information and communication technology (ICT) in the tourism sector, villages can increase efficiency, tourist attraction and service quality. The implementation of Sanja Desa smart eco-tourism is the right step towards the sustainability of the Tosari tourist village, apart from that, the digitization of tourism takes advantage of the potential of Tosari's natural resources with its variety of tourism.

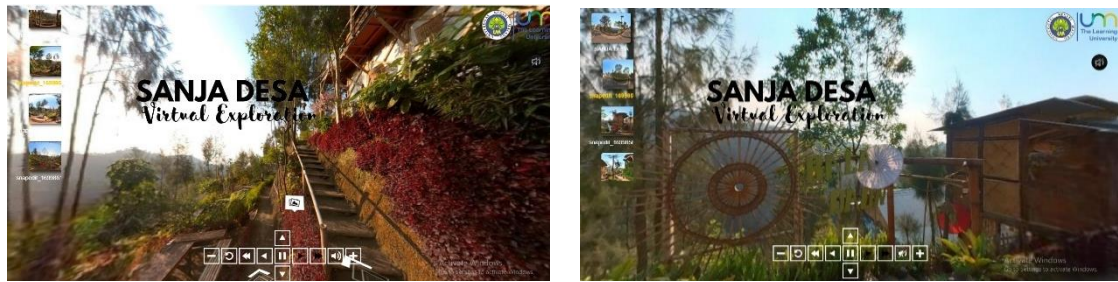


Figure 4. Virtual Exploration of Sanja Desa

The implementation of Sanja Desa's virtual exploration certainly provides satisfaction and services that suit the current needs of tourists. In fact, tourists expect the content presented to contain the local potential of the tourist village, both community activities and folklore that developed in the tourist village. The results of research conducted by Rudwiarti et al., (2021) explain that the existence of smart tourism will preserve rural nature well, so that the transformation from a tourist village to a smart tourist village in Sleman Regency provides community participation and awareness of the sustainability of local communities in developing tourist villages. Sanja Desa virtual exploration can support the development of smart eco-tourism in Tosari village in a sustainable manner.

The existence of virtual exploration at Sanja Desa allows tourists to share their travel experiences in Tosari through digital media. This will have a positive impact on the trustworthiness of the travel experience as a promotional force and tourist satisfaction [21], [22]. By utilizing smart eco-tourism, Tosari village can build local community involvement in tourism development.

Through virtual exploration, Sanja Desa with educational content and community involvement can increase understanding of the importance of preserving local culture, nature and heritage [23]. Thus, the role of smart eco-tourism and the principles of sustainable development can create an environmentally friendly environment for the Sanja Tosari Village tourist village, reduce the carbon footprint, and provide sustainable economic benefits for the local community.

#### 4. Conclusion

Sanja village is a Tosari tourist village which was originally a response to the illegal logging problem in Tosari. Through the Community Based Tourism (CBT) approach, the Baladaun community makes Sanja Village an eco-tourism with a superior strategy in developing tourist destinations because environmental conservation, integration of local

wisdom, and environmental education support sustainable development. The potential of Sanja Village as eco-tourism needs to be developed to support Tosari village's smart eco-tourism as sustainable tourism, one of which is through virtual exploration.

The development of Sanja Desa's virtual exploration through 360° photo virtual reality technology aims to branding and promote tourism in the digital era. This initiative supports the concept of smart ecotourism in Tosari Village, providing a satisfying experience in line with tourists' expectations, as well as increasing expectations before the actual visit. Tourists' positive reactions to VR-based tourism village promotions show great potential in strengthening their trust and satisfaction with their tourism experience.

## 5. Author's declaration

### Authors' contributions and responsibilities

Write the contribution of each author here, or mark the following column.

The authors made substantial contributions to the conception and design of the study.

The authors took responsibility for data analysis, interpretation and discussion of results.

The authors read and approved the final manuscript.

### Funding

Write down the research funding, if any.

### Availability of data and materials

All data are available from the authors.

### Competing interests

The authors declare no competing interest.

## 6. References

- [1] T. I. Pratiwi, T. Muttaqin, and M. Chanan, "Pengembangan Desa Wisata Edelweiss di Desa Wonokitri Kecamatan Tosari Kabupaten Pasuruan (Resort PTN Gunung Penanjakan Taman Nasional Bromo Tengger Semeru)," *J. For. Sci. Avicennia*, vol. 2, no. 1, pp. 16–28, 2019, doi: 10.22219/avicennia.v2i1.8369.
- [2] T. I. Pratiwi *et al.*, "Strategi Pengembangan Desa Wisata Di Kawasan Hinterland Gunung Bromo Jawa Timur," *J. For. Sci. Avicennia*, vol. 01, no. 1, p. h. 36, 2016, doi: 10.22219/avicennia.v2i1.8369.
- [3] D. Al Khalidy, A. K. Putra, H. Fuddin, and J. R. Rafani, "Innovation of Virtual Reality : Pendampingan Pengembangan Tengger Heritage Journey sebagai Promosi Desa Wisata Berkelanjutan di Tosari," *Jati Emas (Jurnal Apl. Tek. dan Pengabd. Masyarakat)*, vol. 7, no. 3, pp. 75–82, 2023.
- [4] E. B. Santoso, V. K. Siswanto, and A. F. Larasati, "Sustainable Rural Infrastructure Development in Tosari District, Pasuruan Regency, Indonesia," *IOP Conf. Ser. Earth Environ. Sci.*, vol. 1186, no. 1, 2023, doi: 10.1088/1755-1315/1186/1/012006.
- [5] M. N. Fatanti, D. S. Rozakiyah, S. S. Pratiwi, N. Hadi, L. A. Perguna, and A. A. Widiyanto, "Kajian Potensi Sosial Budaya dan Strategi Pengembangan Pariwisata Berbasis Rapid Rural Appraisal di Desa Ranupani Kabupaten Lumajang, Jawa Timur," *J. Komunitas J. Pengabd. Kpd. Masy.*, vol. 5, no. 1, pp. 98–105, 2022, doi: 10.31334/jks.v5i1.2007.
- [6] Sumarmi, S. Bachri, A. W. Sholeha, E. Kurniawati, A. R. Hakiki, and T. M. Hidiyah, "Development Strategy for Special Interest Tourism (Sit) Through Community-Based Ecotourism (Cbet) in Perawan Beach To Promote a Sustainable Economy," *Geoj. Tour. Geosites*, vol. 48, no. 2spl, pp. 695–708, 2023, doi: 10.30892/gtg.482spl03-1069.
- [7] S. Sumarmi, A. Z. Ensiyawatin, I. K. Astina, E. Kurniawati, and R. P. Shrestha, "the Management of Bangsring Underwater As Conservation - Based Ecotourism for International Tourism Destination," *Geoj. Tour. Geosites*, vol. 41, no. 2, pp. 393–399, 2022, doi: 10.30892/gtg.41208-842.
- [8] P. Prayudi and H. Herastuti, "Branding Desa Wisata Berbasis Ecotourism," *J. Ilmu Komun.*, vol. 16, no. 3, p. 227, 2020, doi: 10.31315/jik.v16i3.3204.

- [9] A. E. Sejati, S. Sumarmi, I. K. Astina, S. Susilo, and E. Kurniawati, "the Environmental Conservation Value of Tengger Tribe'S Traditional Ceremony in Supporting the Mount Bromo Tourism Area," *Geoj. Tour. Geosites*, vol. 46, no. 1, pp. 315–326, 2023, doi: 10.30892/gtg.46135-1029.
- [10] M. Damayanti, H. Wahyono, M. Rahdriawan, W. P. Tyas, P. C. Sani, and J. Riptek, "Penerapan Smart Tourism Di Kota Semarang," *J. Riptek*, vol. 14, no. 2, pp. 128–133, 2020, [Online]. Available: <http://riptek.semarangkota.go.id>.
- [11] F. Hanum, "Konsep Smart Tourism sebagai Implementasi Digitalisasi di Bidang Pariwisata," *Tornare*, vol. 2, no. 2, pp. 14–17, 2020, doi: 10.24198/tornare.v2i2.25787.
- [12] S. Chai-Arayalert, "Smart application of learning ecotourism for young eco-tourists," *Cogent Soc. Sci.*, vol. 6, no. 1, 2020, doi: 10.1080/23311886.2020.1772558.
- [13] M. H. I. Abbas, H. Sumarsono, F. Rahmawati, I. N. Dwiputri, and J. Kustiandi, "Evaluating the Sustainability of Local-Based Ecotourism in Tulungagung," *E3S Web Conf.*, vol. 444, p. 03015, 2023, doi: 10.1051/e3sconf/202344403015.
- [14] D. A. Suryani, P. Purwanto, H. Purnaweni, and T. Yuniningsih, "Sustainability of Rural Ecotourism," *E3S Web Conf.*, vol. 448, p. 03048, 2023, doi: 10.1051/e3sconf/202344803048.
- [15] F. A'inun, H. Krisnani, and R. S. Darwis, "Pengembangan Desa Wisata Melalui Konsep Community Based Tourism," *Pros. Penelit. dan Pengabd. Kpd. Masy.*, vol. 2, no. 3, pp. 341–346, 2015, doi: 10.24198/jppm.v2i3.13581.
- [16] V. F. Angela, "Strategi Pengembangan Ekowisata dalam Mendukung Konservasi Alam Danau Tahai," *J. Ilm. Mhs. Pendidik. Sej.*, vol. 8, no. 3, pp. 984–993, 2023.
- [17] I. K. A. Widana, I. G. K. I. P. Darma, I. N. A. Nuriawan, I. P. S. Ariputra, and M. Y. Risadi, "Green Movement di Ekowisata Subak Sembung Desa Peguyangan," *J. Abdi Masy.*, vol. 3, no. 2, pp. 56–64, 2023, doi: 10.22334/jam.v3i2.43.
- [18] H. Asriwandari, S. Tantoro, and R. Nurfahima, "Potensi Alam dan Budaya dalam Pengembangan Ekowisata Pulau Tilan Kepenghuluhan Rantau Bais Kabupaten Rokan Hilir Provinsi Riau," *SATWIKA Kaji. Ilmu Budaya dan Perubahan Sos.*, vol. 7, no. 2, pp. 489–502, 2023.

- [19] T. K. Priyambodo and M. D. Artianingsih, "Strategy for Sustainable Smart Tourism Village Development in Ponggok Village, Klaten, Central Java," *Int. J. Sustain. Compet. Tour.*, vol. 1, no. 02, pp. 1–10, 2022, doi: 10.34013/ijscot.v1i02.835.
- [20] L. A. Rudwiarti, A. Pudianti, A. W. R. Emanuel, V. R. Vitasurya, and P. Hadi, "Smart Tourism Village, Opportunity, And Challenge In The Disruptive Era," *IOP Conf. Ser. Earth Environ. Sci.*, vol. 780, no. 1, pp. 0–9, 2021, doi: 10.1088/1755-1315/780/1/012018.
- [21] L. P. Voronkova, "Virtual Tourism: On the Way to the Digital Economy," *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 463, no. 4, 2018, doi: 10.1088/1757-899X/463/4/042096.
- [22] T. T. Yang, W. Q. Ruan, Y. Q. Li, and S. N. Zhang, "Virtual tourist motivation: the differences between virtual tourism and on-site tourism," *Tour. Rev.*, vol. 78, no. 5, pp. 1280–1297, 2023, doi: 10.1108/TR-07-2022-0331.
- [23] A. Koshim, A. Sergeyeva, Y. Kakimzhanov, A. Aktymbayeva, M. Sakypbek, and A. Sapiyeva, "Sustainable Development of Ecotourism in 'Altynemel' National Park, Kazakhstan: Assessment through the Perception of Residents," *Sustain.*, vol. 15, no. 11, 2023, doi: 10.3390/su15118496.