

doi: 10.52370/TISC26215AA

DRONE TECHNOLOGY IN TOURISM PROMOTION: A FRAMEWORK FOR SUSTAINABLE DEVELOPMENT

Adem Asani¹; Biljana Petrevska²; Aleksandra Terzić³

Abstract

The rapid integration of innovative digital technologies is transforming tourism promotion, creating new opportunities for destination presentation. This paper examines the application of drones (unmanned aerial vehicles) in presenting tourist attractions through high-quality aerial imagery. It proposes a conceptual theoretical model linking drone-generated content (aerial photography and videography) with destination promotion to support sustainable development. The research argues that, by improving how destinations are perceived, drone imagery increases their attractiveness and competitiveness in the tourism market. In addition to contributing to the state of the art, this conceptual paper also provides practical implications. It offers valuable insights for tourism organizations and destination managers seeking to integrate digital innovations into promotional campaigns.

Key Words: *drone technology, tourism promotion, visual tourism, destination presentation, sustainable development*

JEL classification: *L83, O33, Q01*

¹ Adem Asani, PhD Student, Faculty of Tourism and Hospitality – Ohrid, St. Kliment Ohridski University – Bitola, North Macedonia, phone number: +38970982321, adem.asani@hotmail.com

² Biljana Petrevska, PhD, Full Professor, Faculty of Tourism and Business Logistics, Goce Delcev University, Stip, North Macedonia, phone number: +38932550350, biljana.petrevska@ugd.edu.mk

³ Aleksandra Terzić, PhD, Principal Research Fellow, Geographical Institute “Jovan Cvijić” of Serbian Academy of Sciences and Arts, Belgrade, Serbia, phone number: +381642604013, a.terzic@gi.sanu.ac.rs

Introduction

The 20th century witnessed a boom in technological advancement, establishing a reality where robotics, Artificial Intelligence (AI), and remote-control applications have become central to everyday life. A good example of this evolution is drone technology. Originally developed for military purposes, drones developed and expanded greatly in the early 21st century. Firstly, they were applied in environmental protection but also to navigate and assist visually impaired persons by utilizing voice control and sound effects (Chan et al., 2018). They also became widely applicable in the architecture and construction sector (Chan et al., 2018).

New opportunities and solutions emerged with live video broadcasting, particularly for tourism promotion. However, it is important to distinguish between virtual tourism and drone-based visual tourism. While virtual tourism (Virtual Visit Tours, n.d.) creates a simulated digital experience, such as 360° footage or virtual reality, allowing tourists to explore a destination remotely without physically being there, drone-based visual tourism primarily serves as a promotional instrument that supports and encourages real physical visitation to the destination. **Visual tourism is particularly important for the promotion of specific areas such as volcanic landscapes, coastal zones, rural regions, and protected areas,** supporting their visibility and enhancing sustainable growth. It also broadens public awareness and prompts policymakers to integrate innovative promotional tools into tourism strategies (Kandrot & Holloway, 2020; Khotib et al., 2024; Uribe-Montesdeoca et al., 2021). This necessitates innovative approaches that support building resilience while maintaining the long-term sustainability of tourism destinations.

Despite various opportunities, the role of drones in tourism promotion and their support of sustainable development remains underexplored. This research elaborates a conceptual model for visual tourism development through drone technology. Consequently, the main research question of this paper is: How does drone-based visual content influence tourism destination promotion and contribute to sustainable development goals? The research provides a theoretical understanding by linking drone technology with the relevance of the SDGs. Practically, it assists tourism policymakers and destination managers to use drone technology to strategically advance sustainability at the destination level.

Following the introduction, the paper presents a literature review on visual tourism and the role of drone technology in achieving sustainable development. The methodology section introduces the conceptual model, followed by a discussion on how drones may improve destination visibility and resilience. The paper concludes with implications for policymakers and suggestions for future research.

Literature review

Tourists' perceptions of destinations have long been shaped by the use of appealing visuals in communication, with images and films influencing their thoughts before, during, and after travel (Berbeka, 2022; Mirk & Hlavacs, 2014). Templin and Popielarczyk (2020) argue that the spread of digital technology, especially mobile devices and social media platforms, has accelerated this trend. As a result, interactive media has become a key part of smart tourism services and destination promotion.

Within this broader trend in which visuals dominate the world, drones emerged as a distinctive promotional technology, providing affordable and flexible aerial imagery for both professional and user-generated content (Ilkhanizadeh et al., 2020; Vujičić et al., 2022). Aerial perspectives assist destinations in differentiating themselves in competitive markets, intensify viewers' emotional responses, and construct narratives for online platforms and social media (Berbeka, 2022; Ilkhanizadeh et al., 2020; Uribe-Montesdeoca et al., 2021).

Empirical studies on drone-based tourism show diversification of places of visits and creation of new forms of visual co-presence (Ritter, 2024; Vujičić et al., 2022). Thus, destination management organizations can treat drone material as a source of innovative marketing ideas, proactively co-creating promotion strategies (Berbeka, 2022; Vujičić et al., 2022).

Some practical applications of drone technology are further discussed. Khotib et al. (2024) combined GIS and drone technology to develop a strategic promotional framework for the highest active volcano in Indonesia by integrating drone photography, remote sensing, field observations, and spatial analysis. Similarly, Uribe-Montesdeoca et al. (2021) described a five-stage production for aerial drone films in Ecuador, demonstrating how high-quality drone productions can gain international recognition and attract global attention.

Beyond destination marketing, drone technology contributes to the broader concept of visual tourism, in which destinations are experienced, interpreted, and consumed through mediated visual representations. Complex drone imagery can offer exploratory three-dimensional tour of destinations, complemented by educational and promotional information (Mirk & Hlavacs, 2014). Immersive experiences can be further enhanced through virtual technologies, allowing users to enjoy the destinations via web presentations on computers or mobile devices (Rutkin, 2015). Kandrot and Holloway (2020) also emphasize the role of drones in supporting evidence-based decision-making in tourism reinforcing the strategic value of visual data in destination planning and promotion.

Finally, the literature increasingly links visual tourism with sustainable development objectives. This reduces environmental pressure by substituting or complementing physical travel, thereby lowering carbon emissions and mitigating the social and ecological impacts of overcrowding (Rao & Krantz, 2020). Drone-based tourism allows access to remote, dangerous or logistically difficult areas without mass visitation, thereby supporting sustainable forms of heritage and nature-based tourism (Ilkhanizadeh et al., 2020; Mirk & Hlavacs, 2014). In heritage context, this supports long-term tourism development grounded in conservation rather than physical exploitation (Templin & Popielarczyk, 2020).

From a sustainability governance perspective, drones form part of broader smart tourism systems that enhance monitoring, emergency response, immersive services and collaborative destination management (Luo, 2025). However, scholars also highlight critical environmental, ethical and regulatory challenges. Namely, drones can disturb wildlife, raise privacy and security concerns, and demand robust legal frameworks to ensure positive contribution to sustainable tourism development (Berbeka, 2022; Rao & Krantz, 2020).

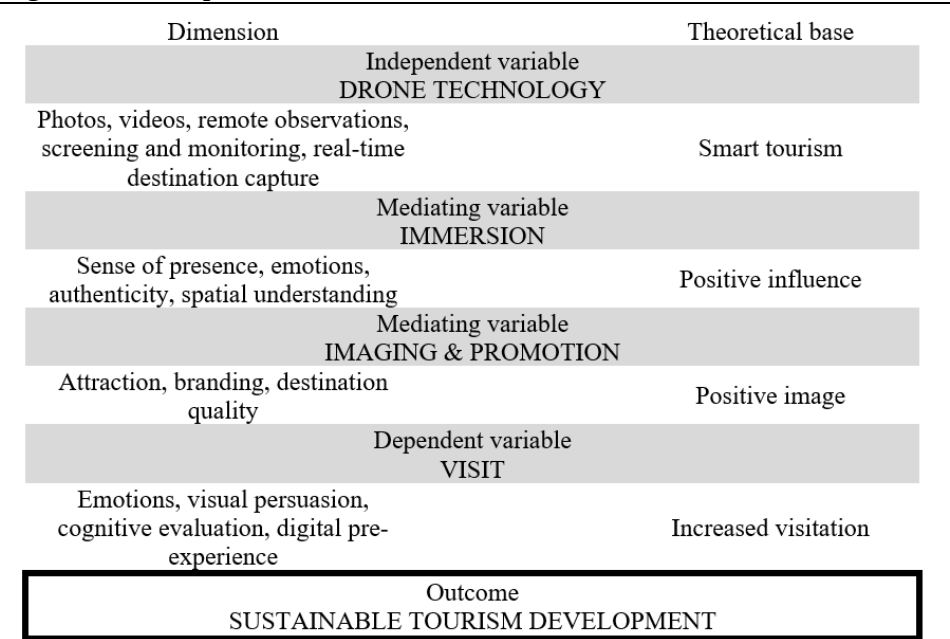
Methodology

Figure 1 presents the theoretical model that enables visual tourism development. The core logic of the model is based on drone technology capabilities as the independent variable, enabling advanced destination visualization and supporting the development of smart tourism. By collecting high-quality aerial photographs and cinematic video content, drones exhibit remote observations of marginalized areas. They also

perform screening and monitoring of the environment by capturing destinations in real-time.

The model incorporates two mediating variables both important for shaping tourism experience. The first mediating variable is immersion, which represents the psychological state in which potential tourists feel mentally transported to a destination. This increases the sense of presence, provokes emotional engagement, strengthens the perception of authenticity, and improves understanding of the location. The key premise is that visual experiences positively influence tourist immersion.

Figure 1: *Conceptual theoretical model*



Source: *Authors*

The second mediating variable is destination image as a predictor for travel decisions. Promotional material assists destinations in representing in a more attractive manner, creating stronger brand differentiation, and increase perceived quality of the sampled destination. Greater immersion is expected to lead to a more positive destination image.

The final variable in the model is the visit intention as a dependent variable reflecting the likelihood that a potential tourist will choose the destination. This construct is shaped by emotional appeal, visual

persuasion, cognitive evaluation of the destination, and digital pre-experience. The starting proposition is that a positive destination image significantly increases visit intention.

The ultimate outcome of the model is sustainable tourism development of the destination linking technological innovation with long-term benefits. Increased visitation to marginalized areas assists to diversify local economies, support small businesses, and reduce spatial pressure. Additionally, drone-generated data enable better resource planning contributing to sustainable development.

Discussion

This section discusses the theoretical model by highlighting how drone technology captures destinations in real-time through digital imaging, screening and monitoring. This provokes a positive influence on the destination image, supporting increased visitation and resulting in sustainable tourism development.

Drones are a new technology in the audiovisual field used for capturing images or videos, serving in many sectors, including tourism, and becoming accessible to any destination. Photos, videos, and remote observations capture destinations in real time, providing a visual screening of different locations that visitors can enjoy (Mirk & Hlavacs, 2014). This real-time capacity enhances the transparency and authenticity of destinations by offering unique, dynamic documentation of landscapes, cultural events, and environmental conditions. Therefore, it is important to understand the benefits of drones when promoting destinations and to integrate their use into official strategic documents.

The practical application of the proposed model is exemplified through the aerial cinematography of Ohrid (Figure 2). It captures a segment of tourist accommodation while providing an expansive spatial context, allowing viewers to perceive the east coast of Lake Ohrid and natural beauty of the district. These types of visuals provide a 'lived sense of place' that intensifies the viewer's emotional response (Uribe-Montesdeoca et al., 2021). They act as a powerful psychological trigger, bridging digital observation and real-world experience.

Figure 2: *Visual drone imagery of Ohrid*



Source: *Authors*

From a marketing perspective, drones immerse tourists in a sense of presence and enhance the spatial understanding of destinations. In particular, aerial perspectives generate emotional and aesthetic appeal, provoking a positive influence on the competitiveness of destinations and their positioning in the tourism market. This adds value and creativity to tourism products, while drone-generated imagery strengthens place branding and stimulates travel motivation. Specifically, the emotional resonance of panoramic and cinematic visuals may translate into increased visitation, which contributes to local development.

Beyond its promotional potential, drone technology aligns closely with the UN Sustainable Development Goals (SDGs) (Kitonsa & Kruglikov, 2018). As part of the 2030 Agenda for Sustainable Development (UN General Assembly, 2015), Goals 8, 11, and 12 provide a framework for linking drone technology and sustainability. By generating visual content that attracts visitors, drones can stimulate local economies and create employment opportunities, contributing to inclusive economic growth (SDG 8: Decent Work and Economic Growth). Visual promotional material represents a source of local revenues, further supporting sustainable tourism development. Simultaneously, the digital documentation of cultural and natural heritage assists in the preservation and sustainable management of sensitive sites (SDG 11: Sustainable Cities and Communities). Drone technology strengthens efforts to safeguard heritage sites by enabling regular monitoring and raising awareness of their value through high-quality visual representation. They

encourage visitation to appropriate areas while reducing pressure on vulnerable locations, contributing to resilient and sustainable destinations. Finally, data collected through drones can inform policy development and strategic planning, supporting responsible tourism practices and sustainable resource use (SDG 12: Responsible Consumption and Production).

Conclusion

The analysis demonstrates that the potential of drone technology in tourism promotion for supporting sustainable development is appreciable. This research highlights that drone technology is an innovative promotional instrument and at the same time, it is a strategic tool for sustainable destination management. When strategically integrated into sustainable destination policies, drone technology can provoke positive destination imaging, increase visitation in a controlled manner, and contribute to long-term sustainable tourism development.

The practical implications of this research are particularly relevant. Drone technology can assist tourism boards, travel agencies, and tourism planners in integrating visual previews into official promotion strategies to enhance pre-visit engagement. Its application may also be of strong relevance to local authorities, especially at the local level where informed planning and targeted promotion directly shape sustainable growth. Yet, responsible integration of drone technology into tourism development policies requires a specific social dimension that balances its use as a highly effective promotional utility with rigorous ethical governance to mitigate existing social concerns. Therefore, local governments need to move beyond technical flight rules to implement specific privacy protocols and participatory mapping strategies, ensuring that aerial documentation serves as a transparent tool for community-led sustainable development rather than a purely commercial instrument.

Although this is a conceptual paper, it provides valuable insights and raises awareness of the potential applicability of drone technology in contributing to sustainable tourism growth. The framework proposed here lays the groundwork for empirical validation and practical experimentation. Future research should test the model in different destination contexts and explore emerging developments such as AI-generated tourism environments which may further transform the relationship between digital visualization and physical visitation.

Acknowledgement

This research is part of the scientific research project “Application of predictive analytics and artificial intelligence for the advancement of tourism in North Macedonia,” funded by the Ministry of Education and Science of the Republic of North Macedonia, under number 15-6171/19 dated August 7, 2025.

References

1. Berbeka, J. (2022). The role of drones in communication and promotion of tourism experiences: A case of Poland. *Menadžment u hotelijerstvu i turizmu*, 10(2), 39–53. <https://doi.org/10.5937/menhottur2202039b>
2. Chan, K. W., Nirmal, U., & Cheaw, W. G. (2018). Progress on drone technology and their applications: A comprehensive review. In *AIP Conference Proceedings*, 203, 20308. <https://doi.org/10.1063/1.5066949>
3. Ilkhanizadeh, S., Golabi, M., Hesami, S., & Rjoub, H. (2020). The potential use of drones for tourism in crises: A facility location analysis perspective. *Journal of Risk and Financial Management*, 13(10), 246. <https://doi.org/10.3390/jrfm13100246>
4. Kandrot, S., & Holloway, P. (2020). *Applications of drone technology for sustainable development of the coastal zone: A literature review* [Project report]. Sustainable Resilient Coasts. https://coast.interreg-npa.eu/subsites/coast/DT2.1.1_Applications_of_drone_technology_for_sustainable_development_of_the_coastal_zone.pdf (26 February 2026)
5. Khotib, S. N., Danardono, Saputra, A., Umrotun, & Putra, M. N. R. (2024). GIS and drone technology are used in the design of tourism development in the Mount Kerinci area. In *VI International Scientific Convention of Universidad Técnica de Manabí: Advances in Basic Sciences, Informatics and Applied Engineering*, 2994, 20102. <https://doi.org/10.1063/5.0183187>
6. Kitonsa, H., & Kruglikov, S. V. (2018). Significance of drone technology for the achievement of United Nations sustainable development goals. *R-economy*, 4(3), 115–120. <https://doi.org/10.15826/recon.2018.4.3.016>

7. Luo, T. Y. (2025). Service model of smart tourism cities integrated with low-altitude technology. *Engineering Management in Production and Services*, 17(1), 92–110. <https://doi.org/10.2478/emj-2025-0008>
8. Mirk, D., & Hlavacs, H. (2014). Using drones for virtual tourism. In *International Conference on Intelligent Technologies for Interactive Entertainment* (pp. 144–147). Springer International Publishing. https://doi.org/10.1007/978-3-319-08189-2_21
9. Rao, A. S. S., & Krantz, S. G. (2020). Data Science for Virtual Tourism Using Cutting-Edge Visualizations: Information Geometry and Conformal Mapping. *Patterns*, 1(5), 100067 <https://doi.org/10.1016/j.patter.2020.100067>
10. Ritter, C. S. (2024). Gazing from the air: Tourist encounters in the age of travel drones. *Tourism Geographies*, 26(4), 618–634. <https://doi.org/10.1080/14616688.2023.2264823>
11. Rutkin, A. (2015). See the sights by air with drone tourism. *New Scientist*, 226(3024), 19. [https://doi.org/10.1016/s0262-4079\(15\)30512-1](https://doi.org/10.1016/s0262-4079(15)30512-1)
12. Templin, T., & Popielarczyk, D. (2020). The Use of Low-Cost Unmanned Aerial Vehicles in the Process of Building Models for Cultural Tourism, 3D Web and Augmented/Mixed Reality Applications. *Sensors*, 20(19), 5457. <https://doi.org/10.3390/s20195457>
13. UN General Assembly. (2015). *Transforming our world: the 2030 Agenda for Sustainable Development* (A/RES/70/1). Retrieved February 26, 2026, from <https://www.refworld.org/docid/57b6e3e44.html>
14. Uribe-Montesdeoca, S., Arias-Flores, H., Ramos-Galarza, C., & Jadán-Guerrero, J. (2021). Using drones for tourism: Exploring exciting places in Ecuador. In D. Russo, T. Ahram, W. Karwowski, G. Di Bucchianico, & R. Taiar (Eds.), *Intelligent Human Systems Integration 2021* (pp. 786–791). Springer. https://doi.org/10.1007/978-3-030-68017-6_117
15. *Virtual Visit Tours*. (n.d.). Retrieved February, 26, 2026, from <http://www.virtualvisittours.com>

16. Vujičić, M. D., Kennell, J., Stankov, U., Gretzel, U., Vasiljević, Đ. A., & Morrison, A. M. (2022). Keeping up with the drones! Techno-social dimensions of tourist drone videography. *Technology in Society*, 68, 101838. <https://doi.org/10.1016/j.techsoc.2021.101838>