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Ecotourism and Wildlife Monitoring: Technological Innovations and Business Opportunities

Md. Shihab Hossain
Discipline of Physics, Khulna University, Sher-E-Bangla Rd, Khulna 9208.
**Corresponding Author: shihab18ku@gmail.com*

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ABSTRACT

"Ecotourism" is a relatively new travel phrase that describes a travel strategy that aims to provide tourists with an up-close and personal look at nature without putting the local ecosystems at risk. Especially in areas where hunting and wildlife watching are popular hobbies, they play vital roles in maintaining social human values and protecting biological diversity. Ecotourism thereby reduces the negative effects of human activity on the ecosystem and is crucial to ethical travel, leaving resources unexplored for future study. To paint a comprehensive picture of how current technology advancements are influencing conservation and ecotourism in the future, this essay aims to examine the benefits and drawbacks of contemporary devices. The purpose of this essay is to illustrate the potential for innovation and the effects of sustainable tourism. The effects of artificial intelligence, machine learning, remote sensing, camera traps, GPS monitoring, drones, and other technologies on animals will be examined. It looks at how these developments might boost sustainable practices, assist conservation efforts, and improve visitor experiences. The technique also covers collaborations, community participation, entrepreneurs, and innovations, as well as the commercial potential of ecotourism. Technological developments have greatly increased the documenting and observation of animals, which has increased ecotourism. Drones, GPS tracking, and artificial intelligence are examples of tools that enhance data collecting and conservation tactics. Technologies like blockchain and IoT are upcoming advances.

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1. Introduction

In terms of success, the employer of ecotourism must include wildlife monitoring because it is instrumental in efforts to conserve wildlife. Wildlife monitoring can be defined as the scientific process of gathering information about the status of animal species, the activities they undertake, or the ecosystem they live in (Ortega-Álvarez & Calderón-Parra, 2021). It is thus crucial in managing natural resources to conserve the Earth's endangered species, administer protected zones, and comprehend the impacts of human interference on the animals. It enables one to identify threats against species, evaluate the effects of conservation measures being put in place, and gain an understanding of the ecosystem (Palmberg, 2004). The facilities and services needed by the majority of eco-tourists won't be offered if eco-tourism is not financially feasible, and there won't be any chance to realize the industry's and the community's potential economic advantages (Reza et al., 2009). Ecotourism is a rapidly expanding sector of the global tourism industry that offers a variety of viable options from an ecological, socio-cultural, and commercial standpoint. These options can be used to promote sustainable tourism development in a region with diverse ecological features (Santarém et al., 2020). Ecotourism's foundational resources are destroyed if the environment and its riches are neglected. Locals will be antagonistic toward ecotourism if it is not accepted in their culture and they do not profit from it. The current state of affairs necessitates the implementation of effective marketing strategies and sustainable infrastructure to make these aspects of sustainable eco-tourism development more effective. This can be achieved by integrating environmental concerns into all socio-economic development practices throughout the nation.

With the rise in sustainable tourism, plenty of business opportunities have come up. Enabling experiences incorporating environmental protection with wildlife

*Corresponding author: shihab18ku@gmail.com (Shihab Hossain)

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interactions targets travelers committed to sustainability. It presents significant business opportunities across diverse sectors, including sustainable accommodations, technology-driven tourist attractions, and sustainability tourism. Ecotourism and wildlife ecotourism are emerging as new business models and services, with startups like Wildlife Drones and Ecolodge Solutions offering eco-friendly travel, tourism, and conservation solutions (Cavoukian, 2012). This sector offers significant investment growth due to increased customer interest in sustainable tourism and technology. Collaborations between information technology industries and conservation entities are crucial for promoting sustainable tourism and protecting wild animals (Kannamudaiyar & Chellasamy, 2023). Partnerships like Microsoft and the World Wildlife Fund use technology to gather data and manage ecosystems, while public-private cooperation between national parks and ecotourism firms focuses on environmental protection issues. Examples include Panthera and Wildlife Conservation Society, which use satellite tracking for big cat conservation (Allan et al., 2013). Incentivizing local communities to participate in ecotourism projects is essential for sustainable development, conservation, and economic return. Engaging residents in planning and operations allows for projects that address their needs and increase their appreciation for the environment. Examples include the Community Baboon Sanctuary in Belize, which allows communities to protect wildlife, generate employment, and enhance local revenues. Cambodia's Cultural Survival project sustains ecotourism businesses, raising incomes and positively impacting the environment. These public-spirited methodologies also create new economic models where local communities are active members in creating a new economy and playing a proactive role in the sustainability of natural and cultural assets (Eddyono et al., 2021).

Ecotourism and wildlife conservation face several challenges, including the conservation of wildlife for tourism purposes, technological limitations, and funding issues. This research endeavors to investigate the connections among eco-tourism, technology, and innovative thinking through the use of destination management strategies (Ali & Frew, 2014). These challenges require innovative strategies to achieve sustainable environmental and economic management without compromising ecosystems and communities' capacity to support themselves. Technological limitations in ecotourism include high costs, lack of physical infrastructure, and staff with the necessary skills. Solutions include infrastructure development, training local staff, and developing links with high-tech performers. Targeted investments and professional skills development can improve technological integration and outcomes in conservation and tourism. Ethical and privacy concerns arise as technology in monitoring species grows. One main ethical issue is the interference of natural actions due to invasive behavior analysis. Advanced technologies like drones and GPS trackers should not stress or disturb wildlife, and data collection must be secured against assaults, data leaks, and other intrusions. Regulatory and compliance issues are crucial for drone and GPS monitoring in wildlife conservation (Dafallah, 2014). Various countries have jurisdictions regarding drone usage, height restrictions, and aerial imaging licensing. GPS tracking devices must adhere to local and international legal frameworks related to interference with other technology applications and wildlife conservation. International conservation laws also play a role in monitoring work. Organizations must comply with treaties such as CITES and other regional or global conservation treaties, which prescribe specific standards for technology use to avoid interference with species and structures (Shrestha & Lapeyre, 2018). To remain legally compliant, knowledge of local and global laws and obtaining necessary permits and permissions for monitoring technologies are essential.

The ongoing technological improvements bode well for the field of wildlife monitoring in the future (Shasha et al., 2020). Modern artificial intelligence algorithms, miniature sensors, and remote sensing equipment will improve data collection accuracy and dependability, offering a deeper understanding of animal behavior and the need for protection (Shrestha & Lapeyre, 2018). This will result in the growth of ecotourism, a type of sustainable travel. Animal tracking and ecotourism are two examples of emerging technology in animal conservation. In addition to enhancing accountability and guaranteeing accurate information on endangered species, ecotourism can establish an effective system for monitoring conservation efforts and the trafficking of wildlife. By offering thorough information on wildlife activities and changing habitats, technology will elevate wildlife monitoring to a new level. More precise information on ecosystems will be available thanks to technological advancements like bioacoustics monitoring, AI analysis of animal sounds, and upgraded satellite technology. Information and communication technologies (ICT), augmented reality (AR), virtual reality (VR), and artificial intelligence (AI) are being used more often in the ecotourism industry as a result of the industry's growing emphasis on sustainability (Chai-Arayalert, 2020). Policymakers must devise a formula that strikes a balance between environmental preservation efforts and tourism growth to achieve sustainable tourism. This entails encouraging modest mobility impacts, aiding the local populace, and making sure there are no negative effects on biomes. Sustainable development objectives (SDGs), including resource utilization and biodiversity conservation, depend heavily on technology. Utilizing wildlife monitoring equipment can enhance animal conservation efforts, manage scarce resources, and handle concerns related to tourism (Shrestha & Lapeyre, 2018). This technology has the potential to grow the ecotourism sector and provide long-term benefits to the environment. This

study aims to introduce ecotourism concepts, examine its application in America's tourism sector, investigate its possibilities in natural and cultural heritages, assess its effects, evaluate the way policies are put into place, and examine its function in sustainable development.

2. Literature review

About the origins of ecotourism, Blamey notes that Hetzer coined the term in 1965 while writing his book Environment, Tourism, and Culture. Hetzer identified four principles of responsible tourism: minimizing adverse effects on the environment, honoring host cultures, maximizing benefits to the local population, and raising visitor satisfaction (Blamey, 2001). Born "within the womb" of the environmental movement in the 1970s and 1980s, ecotourism is a highly significant alternative concept to mass tourism, which has resulted in negative social and environmental effects as well as a sense of dissatisfaction (Honey, 1999). Conventional tourism consistently prioritizes expansion and profits over the preservation of the local ecology and culture. Numerous issues have surfaced across the world as a result of tourism, including widespread deforestation, several types of pollution, cultural deterioration, and other issues. Mass tourism, which exclusively values quantity over quality and quantity above sensible economic advantages to the destination and its people, has left many nations grappling with severe environmental and social issues. Sea beach pollution in America, Asia, and Africa is a major concern of mass tourism byproducts that contribute to the loss of many valuable species of an ecosystem and the eviction of many Indigenous people from their homes (Honey & Rome, 2000). Massive devastation of wildlife habitats and forests has occurred in Brazil, Indonesia, and several African nations. Wearing and Neil (2008), however, believe that an ecotourism model that aims to be consistent with natural, social, and community values can be broadly characterized as alternative tourism. This type of travel contributes to a greater understanding of conservation, appreciation of the environment and culture, and maximum satisfaction for both hosts and guests (Wearing & Neil, 2009).

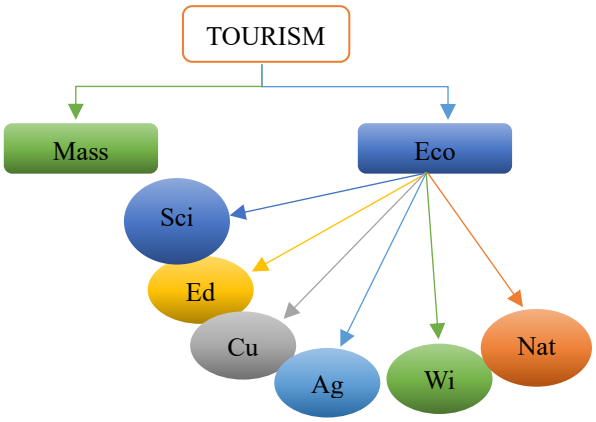

Fig 1. Types of Tourism.

Fig. 1 shows some types of Tourism. Nature-based tourism, which honors the inherent worth of the environment via pursuits like hiking, mountain climbing, and adventure travel, is a subset of alternative tourism. The arts, music, dance, language, songs, cultural and religious heritages, traditional practices, talents, and handicrafts of the indigenous and local people are just a few of the factors that make up cultural tourism. Recognizing the importance of numerous wild species to the planet's ecology, wildlife tourism focuses on them. A key component of educational tourism is the support of environmental protection from knowledgeable travelers. Natural features on private farms, together with customary and indigenous farming practices, are all part of agritourism. Scientific tourism is centered on scientific research and study, gathering data to provide insight into the field's present situation and encourage advancements (Yogi, 2010).

Since the tourist business does not fit neatly into the categories of production, forestry, or other industries, there are a lot of ways to estimate its size. The tourism industry is made up of several industries and offers tourists a vast array of goods and services. Additionally, these companies supply the local populations with goods and services (Westcott, 2020). The tourism and hotel industries (H&T) have grown to be the fastest-growing segments of the global economy since the COVID-19 pandemic. Simultaneously, it was accountable for noteworthy ecological consequences such as the strain on resource preservation resulting from water usage, an elevated carbon footprint, and waste production. However, tourism is now one of the least developed businesses when it comes to the adoption of sustainable practices, even though eco-friendly travel and accommodation are becoming more and more popular among tourists and are crucial to the industry's future success. The development of sustainable tourism is crucial, especially in the post-pandemic phase, given the extreme economic hardships it is presently facing, the environmental disaster, and the global climate change that is being experienced (Loureiro & Nascimento, 2021). In today's world, an internet connection is essential, particularly in the tourist sector, where eco-tourism is expanding quickly. Destinations need to improve environmental integrity, social capital, and teamwork to support sustainable growth. The sustainability of a location may be improved by technological applications such as smart apps, internet systems, and environmental management systems. The adoption of effective eco-process innovation has a significant influence on promoting the sustainable growth of the tourist industry (Firman et al., 2023; Ojogiwa, 2021).

Countless individuals find work in the industries and tea gardens. Further boosting the local economy is the employment generated by the booming betel nut industry. For local consumption, several crops are primarily farmed. Travelers from both local and foreign areas frequent the region's many national parks and

animal sanctuaries. Consequently, the region has a large employment base and contributes significantly to the economy. A flourishing export-import industry has emerged in Dooars since it is the entry point to Bhutan. There are sizable hubs for the export-import industry at Jaigaon, Siliguri, Alipurduar , and Phuntsholing (Chanda et al., 2023). Expanding ecotourism in the research zone has great potential to boost the local economy. Through ecotourism, job opportunities have also been created. Every year, it creates a sizable number of direct and indirect jobs. The natural woodlands in the region are attracting more and more outdoor enthusiasts, and the Forest Service currently runs a Nature Interpretation Centre (NIC) near to them (Chanda et al., 2023). Today, responsible use of our natural resources is essential, with a focus on lowering pollution and depletion. It is important to keep in mind that the health of human society is closely related to the sustainable use of resources. While ecotourism is widely used in the travel and tourism sector, in order to support the development of sustainable tourism in the research area, it is crucial to incorporate environmentally friendly innovations into corporate and managerial strategies, organizational behaviors, workplace enhancements, and relationships with stakeholders (Firman et al., 2023). Considering that sustainable resource usage is correlated with the well-being of human civilization, responsible resource management is essential for lowering pollution and depletion. To promote sustainable tourism growth, ecotourism, a prominent travel and tourist business, needs to implement environmentally friendly innovations in stakeholder interactions, workplace upgrades, organizational behaviors, and corporate strategy.

3. Methodology

Current techniques and methods used in wildlife monitoring include drones, GPS tracking, and remote sensing, which have only been embraced recently. All these tools have improved the prospects of collecting accurate and real-time information, especially in the far or hard-to-reach areas. Technological achievements have significantly impacted how and how wildlife is monitored and studied with higher accuracy and improved methods of tracking animal species. While one may use equipment as essential as the camera traps, there are modern solutions, the application of which is hardly foreseeable, like drones or GPS trackers.

3.1. Drones (unmanned Ariel Vehicles)

UAVs, commonly called drones, are fast-improving technologies that have tremendously influenced methods used in monitoring wildlife. Forward-facing with powerful cameras and GPS navigation devices, drones let observers have aerial footage of the landscape, thus enabling easy and close observation of wild creatures. These flying apparatuses can observe broad ground space at once and reach inaccessible locations, so they help spy on animals' motions, monitor conservation zones, and conduct research. Wildlife surveillance is one of the uses of drones; the other uses are surveillance of animal status, surveillance for poaching, and the general surveillance of the environment. They can be employed in surveying nesting sites and migration and detecting the changes in habitat that would not have to interfere with the wildlife. They are cheaper than other monitoring forms, like using human-crewed aircraft or performing ground surveys, hence lowering the cost of labor and the required resources. Drones also allow easier access to remote or hard-to-reach areas and the invasion of wildlife, thus reducing reconnaissance data collection time and achieving better results for conservation.

3.2. GPS Tracking

GPS technology involves using satellites to provide accurate points that are vital in determining the seriousness of wildlife issues. Collars and tags are outfitted with GPS devices to transmit information on animal locations, which researchers can monitor in real time. These devices are top-rated in studying giant and nomadic animals' movements, behavior, and relations with the environment. GPS collars and tags are generally attached to animals in such a manner that could not impact the animal so much. Biologists can monitor parameters like geographical position, traveling speed, and altitude. So, the devices can deliver a lot of information about wildlife and its preferences for the environment. It is possible to determine the species' movements, the extent of their ranges, and the spatial distribution of individual species from GPS information. The benefits of GPS tracking are significant: in accomplishing its aims and objectives, it provides real-time information, leading to better accuracy of the observations of wildlife. Through this technology, the routes used by the migrants can be studied and used to understand the habitats they require, thereby aiding in the protection of such areas.

3.3. Camera Traps and Remote Sensing

Camera traps are common in wildlife surveillance. They film or photograph animals in their natural habitats without human interference. These devices are motion- or movement-sensitive, offering significant information about species' existence, activities, and densities due to these characteristics. Although camera traps have their advantages, other ways of remote monitoring, such as satellite imagery and thermal cameras, have a broader spectrum of observations. These tools help researchers track wildlife within a large area, monitor changes in environmental conditions, and even identify heat-emitting animals.

3.4. Artificial Intelligence and Machine Learning

Artificial Intelligence and Machine Learning are great technological advancements useful in identifying and monitoring wildlife. The two technologies can analyze

imagery data derived from flying drones, and the GPS location of the animals to determine their movement or monitor their health. Real-life applications indicate how useful AI is in tracking endangered species, identifying poaching patterns, and suggesting the best strategies to implement, making these tools more crucial in conserving the Earth's natural resources and improving the methods used in tracking animals. On the other hand, Technological changes in wildlife tracking have significantly impacted the ecotourism market. These innovations, therefore, improve the chances of observing and conserving wildlife and add value to the ecotourism experience and profits. In this section, I examine how advanced technologies define sustainable tourism in the future.

3.5. Enhancing Visitor Experience

Augmented Reality (AR) and Virtual Reality (VR) technologies are useful in ecotourism since they help visitors see wildlife hard to see physically. AR superimposes digital content on the physical environment. One can use a smartphone or AR glasses to discover information about animals and habitats in natural spaces such as parks and gardens. AR overloads the real world with information, which helps get an additional understanding of the phenomena. At the same time, VR transports users to digital environments that mimic the characteristics of wildlife and various habitats by providing learning opportunities that improve the accessibility of wildlife to guests without interfering with these creatures' lives. For example, AR apps that inform about animals' behavior and living environment during an outdoor tour could be applied.

3.6. Promoting Sustainable Practices

Using solar power and electric cars are practices that promote sustainable ecotourism. They reduce using non-renewable energy like fossil fuels by using renewable energy for sustainability. For instance, the eco-resort "In Katerra Reserva Amazonica" in Peru partially uses renewable energy sources such as solar power and takes measures to dispose of waste sustainably. Likewise, incorporating electric automobiles into different ecotourism locations helps minimize pollution and noise that interferes with wildlife interactions. Other steps in encouraging sustainable ecotourism practices include eco-tourism technologies such as solar power facilities to avoid high carbon emissions and using electric cars, among others. Since they minimize the use of non-renewable resources, such as fossil fuels, while incorporating renewable energy, these technologies lower carbon footprints and promote sustainability. For instance, the eco-resort "In Katerra Reserva Amazonica" in Peru partially uses renewable energy sources such as solar power and takes measures to dispose of waste sustainably. Likewise, incorporating electric automobiles into different ecotourism locations helps minimize pollution and noise that interferes with wildlife interactions. Such programs exemplify how the changes in green technologies in the tourism sector support environmental sustainability while providing a benchmark for sustainable tourism.

3.7. Improving Conservations Efforts

Technology greatly enhances the anti-poaching solutions defined by real-time tracking and fast-action capabilities. Real-time video broadcast through infrared cameras and GPS enables the rangers to monitor poachers' movements and other unlawful activities from a comfortable distance. For instance, the SMART (Spatial Monitoring and Reporting Tool) system enhances data gathering to guide the approach to addressing illicit activities. In India, they have started GPS collars and satellite tracking projects called 'Tiger Track' that have eliminated chances of killing them and also stopped human interference. These have improved the enforcement capability, improving the fight against Illegal trade in endangered species and their products.

4. RESULTS AND DISCUSSION

The yearly arrival of tourists in America from 2009 to 2020, as indicated in Table 1, has been displayed in a table. We may determine the number of persons who arrived at a tourist destination in America via air and land by examining a certain location. We also examine from Table 1 how long visitors typically remain at the tourist attractions. There were 510,283 tourists overall in 2009; by 2010, that number had risen to 720,610.

Table 1. Annual Tourists Arrivals in America, 2009-2020.

Year	Total No	Arrival by land	Arrival by Air	The average length of stay	Average growth
2009	510283	131,571	378,712	12.1	2.0
2010	720610	260108	460502	13.5	3.8

2011	902103	312803	589300	14.0	4.5
2012	920300	325000	595300	13.2	5.3
2013	935001	335069	599932	13.8	4.9
2014	945200	343900	601300	14.1	5.4
2015	960600	354820	605780	14.6	5.7
2016	1000300	380738	619562	14.9	5.9
2017	1010600	390280	620320	15.2	6.1
2018	1164005	523075	640930	15.4	6.5
2019	1193010	525356	667654	15.8	7
2020	613040	248025	365015	14.5	6.4

The table indicates that the overall number of visitors is rising annually. However, 613,040 visitors visited the area in total in 2020. Out of this, 365,015 people traveled by airplane to the tourist destinations, while 248,025 people traveled by land. The COVID-19 virus was the cause of this outbreak. Owing to COVID-19, all offices and enterprises were closed. The tourism firms are facing a great deal of challenges due to this lockdown situation. The number of visitors arriving by air from a few main destination countries in 2019 is depicted in Fig. 2. In 2019, India, Spain, Canada, Argentina, South Korea, France, China, Germany, Bangladesh, Japan, Brazil, Australia, the United Kingdom, and other countries were the top travel destinations for travelers visiting American tourist destinations. With 120,000 travelers, India was the country with the largest number of visitors visiting the United States in 2019. France ranks second. The third place belongs to South Korea. China is the country with the fewest tourists visiting American attractions and the number is 29,540.

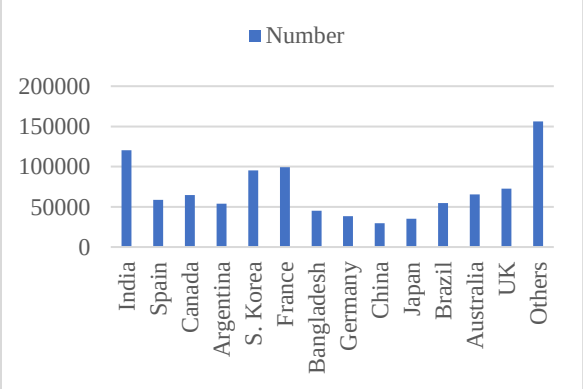

Fig. 2. Tourists Arrivals from Major Destination Nationalities by Air, 2019.

The number of visitors arriving by air from a few main destination countries in 2019 is depicted in Fig. 2. In 2019, India, Spain, Canada, Argentina, South Korea, France, China, Germany, Bangladesh, Japan, Brazil, Australia, the United Kingdom, and other countries were the top travel destinations for travelers visiting American tourist destinations. With 120,000 travelers, India was the country with the largest number of visitors visiting the United States in 2019. France ranks second. The third place belongs to South Korea. China is the country with the fewest tourists visiting American attractions and the number is 29,540.

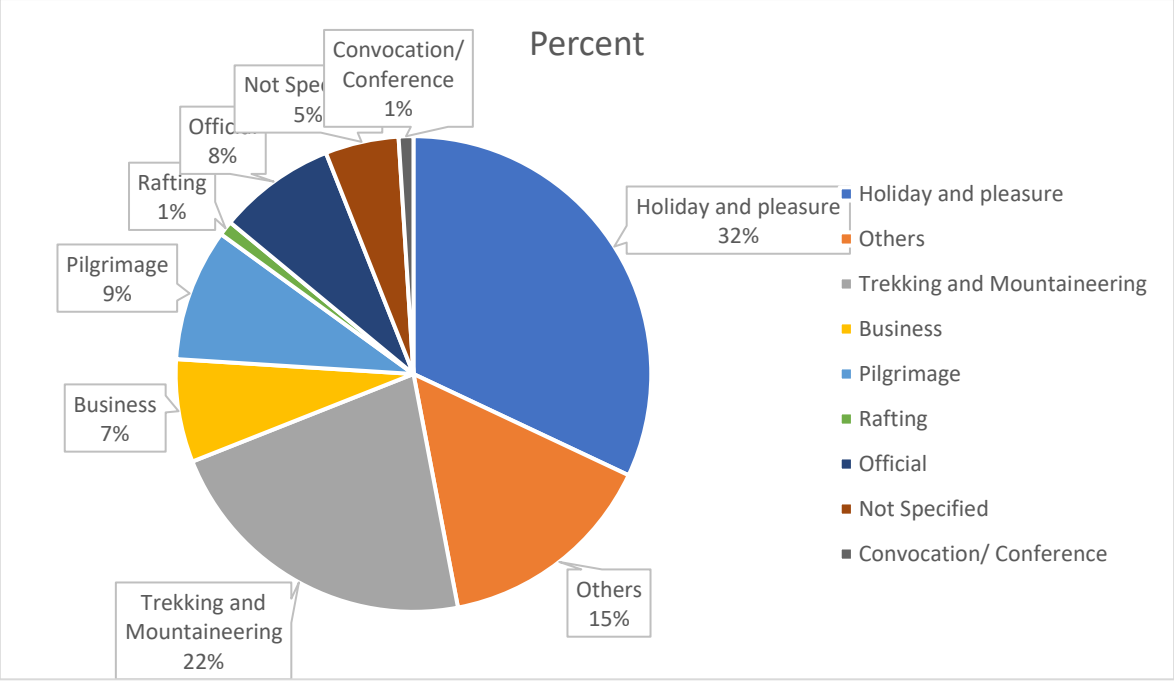

Fig. 3. Tourist Arrival by Purpose of Visit, 2019.

The percentage of visitors in 2019 is displayed in Fig. 3. The primary reasons for visitors' arrivals are shown in this chart: leisure and vacation, trekking and mountaineering, business, pilgrimage, rafting, official purpose, convocation/conference, and others. This figure shows that 32% of visitors go to tourist destinations for fun and vacation. Tourist destinations for trekking and mountaineering are visited by 22% of the population. 9% of visitors are there on pilgrimage, while 7% are there for business. One percent of visitors go rafting, eight percent come for official reasons, five percent come for unknown reasons, and fifteen percent come for other reasons to the tourist attractions.

5. CONCLUSION

In conclusion, technological advances have played a pivotal role in influencing the methods by which wildlife is observed and documented, as well as the growth of the ecotourism industry. Some of the tools used in wildlife monitoring include drones, GPS tracking, camera traps, and artificial intelligence, to name but a few; these gadgets in wildlife management have brought significant changes, leading to precise data collection and, hence, proper strategies for conservation. GPS collars have also helped track animal movement and utilization of spaces, thereby providing better animal protection. These innovations enhanced the learning processes in ecotourism by serving as fun and engaging touchpoints. AR and VR have recreated the traditional eco-tour concept into an innovative educational form where travelers can access a virtual environment or view wildlife up close without disrupting natural habitat features. Implementations of AR/VR, as shown earlier, such as a virtual safari in Kenya or an AR-guided tour in the Amazon rainforest, have demonstrated that this technological intervention enriches the beneficiary with the educational value of ecotourism, while also being eco-friendly. From a future perspective, there are numerous opportunities for further development of technologies. Technologies such as blockchain and the Internet of Things (IoT) are expected to improve the monitoring and even the protection of the species. Blockchain can only maintain a record of conservation activities, which are verifiable and secure. On the other hand, IoT will comprise interconnected real-time devices to cater to environmental conditions and animal activities. These will further enhance wildlife management and provide the eco-tourist with better and enhanced encounters.

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