

Applications of Big Data for Management & Planning of Nature-Based Tourism Destinations in Bangladesh

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Abstract

The main purpose of this study was to explore the issues raised by visitors (positive & negative) to guide the effective management and planning of NBTs. This study adopted qualitative and desk research approach. A total of 17 thousand (17K) data (Big Data) were collected from the Google Review sites of 17 NBTs in Bangladesh. Big Data was analyzed by applying the Text Mining approach. This study also applied a thematic analysis technique to develop themes and sub-themes based on Big Data.

The study found that the visitors highlighted the words beauty, adventure, transportation & wildlife of Nature Based Tourism Destinations (NBTs). The visitors used these words to express their opinion about the scenic beauty and facilities offered. In the context of positive aspects, visitors highly responded to the peaceful environment, peace of mind, and seasonal beauty of NBTs. In the context of negative issues, visitors are highlighted their disappointments with the service qualities, accessibility, safety & security, transportation, destination management, and amenities of different destinations. This study proposed management guidelines to solve the detrimental issues that may act as the foundations for policymakers and Destination Management Organizations (DMOs) to effectively manage and plan NBTs.

Key Words: Big Data, Destination Management and Planning, Nature-Based Tourism, Text Mining Approach, Thematic Analysis.

1. Introduction

A new era of big data is being brought in by the quick growth of computer science and Internet tools, which produce, record, store, and gather vast amounts of data in both structured and unstructured formats (Kambatla et al. 2014). In this era, a wide range of big data has been applied in many fields, including research, engineering, healthcare, management, business, tourism, and more, along with conceptual and technical advancements (Hashem et al., 2015). The phrase Big Data refers to huge, diverse, and complicated data sets that are challenging to store, analyze, and visualize for use in subsequent procedures or outcomes (Sagiroglu & Sinanc 2013). Big data analytics is the study of vast volumes of data to uncover hidden patterns and relationships. Big Data brings new opportunities to modern society and challenges to data scientists. It holds great promises for discovering subtle population

patterns and heterogeneities that are not possible with small-scale data (Fan et al. 2014). These facts can assist businesses or organizations in obtaining deeper and more profound insights and acquiring a competitive edge (Sagiroglu & Sinanc 2013).

Nature-based tourism which refers to travel and recreational activities that primarily focus on experiencing natural environments and landscapes. In terms of both employment and spending, tourism is the world's largest industry. Approximately 12% of the world's population, or over 800 million individuals, travel abroad each year, with many more traveling inside their own nations (Kuenzi & McNeely, 2008). Among them, a growing number of people are interested in visiting popular Visitor, destinations like beaches, national parks, and other protected areas (Balmford et al., 2015; Puhakka & Saarinen, 2013). Specifically, this type of tourism often involves visiting areas of ecological or natural significance, such as national parks, wildlife reserves, forests, mountains, rivers, and coastal regions. It is also called cultural service where people get non-material benefits from ecosystem through spiritual enrichment, cognitive development, recreation, and aesthetic experiences. Also, it provides the experience of the different advantages of the ecosystems through the mediation of human-ecosystem relationship.

The destination managers oversee nature-based tourism destinations to make them sustainable and to improve visitor experiences in the destinations. The use of big data in this instance can be quite prominent, bringing much positive improvement to destination management and planning. It enables the stakeholders like the National Tourism Organizations (NTOs) businesses and governments to examine large volumes of information produced by travelers in the form of online bookings, social media, reviews and relocation services. This information can be used to understand the Visitor behavior, preferences and patterns which can be used to tailor their services and market strategies to the destinations. Big data in destination management aids in crowd control, identifying peak travel seasons, and providing real-time insights into Visitor satisfaction. It also aids in the implementation of sustainable tourism practices and the monitoring of environmental effects. By analyzing patterns and preferences, big data also makes personalized marketing possible, enabling places to provide tailored suggestions to prospective Visitors. Whatever is considered, big data gives stakeholders the ability to make data-driven decisions, guaranteeing effective administration, improved guest experiences, and sustained growth for travel destinations. This study is an attempt to analyze Big Data and draw pathways to manage and plan nature-based tourism destinations.

Research Questions

1. Which words do visitors mostly mention when visiting nature-based tourism destinations in Bangladesh?
2. What are the issues visitors raise when visiting nature-based tourism destinations in Bangladesh?

Research Objectives

1. To identify and analyze the mostly mentioned words of the visitors visiting nature-based tourism destinations in Bangladesh.
2. To synthesize the raised issues by the visitors visiting nature-based destinations.

2. Literature Review

This study focused relevant literature on Big Data including its applications and Nature-Based Tourism including its planning and management aspects. The literature is synthesized and discussed focusing on Keywords.

Big Data

The term Big Data refers to enormous data collections with a complex, diverse, and huge structure that are challenging to store. But with big data analysis researchers get a better finding. Sagiroglu & Sinanc (2013) defined Big Data analytics as a method of analyzing vast amounts of data to uncover hidden relationships and patterns. Lyu et al. (2022) identified the fact that there haven't been many thorough literature studies on big data research in the travel and hospitality sector to yet emphasize how important the topic is. Similarly Fan et al. (2014) found that Big Data presents obstacles for data researchers as well as new opportunities for contemporary society. Wu et al. (2024) discovered that big data has influenced a variety of time series models, econometric models, AI-based models, and other sophisticated prediction methods in the tourism and hospitality forecasting industry. Fan et al. (2014) also reported that Big Data has the potential to reveal subtle population heterogeneities and patterns that small-scale data cannot. Ardito et al. (2019) found that big data has become a key factor in the transformation of international travel, offering both new and established businesses in the tourism sector both potential and challenges. Additionally, George et al. (2014) identified that big data comes from a growing number of sources, such as user-generated material, social media, mobile transactions, Internet clicks, and intentionally created content from sensor networks or commercial transactions like purchase and sales inquiries. Similarly, Line et al. (2020) added that big data also comes from website activity. The pervasiveness of big data is further increased by the fields of genomics, healthcare, engineering, operations management, the industrial Internet, and finance. Li et al. (2015) also presented that it is a new type of economic asset that is very competitive in the financial aspects, comparable to gold or currency.

Applications of Big Data

The huge volume of Big Data makes it difficult to apply in the research. For this reason, the applications also become quite a time consuming and takes more focuses. In this context of application of big data, Fan et al. (2014) found that high dimensionality introduces unintentional uniformity, misleading correlations, and noise accumulation. However, researchers identified that big data and analytics are becoming increasingly important in the travel and hospitality sector as well as in firms' efforts to undergo digital transformation (Yallop and Seraphin, 2020; Avi and Sardar, 2021). Similarly, Berdiyrov (2022) found that numerous manufacturing developments, including digitalization, automation, heightened dependency between physical and cyber systems, and improved managerial efficiency due to the extensive use of big data analytics and cloud computing. The researchers discovered that the vast amount of data generated will have a significant influence on how intelligent transportation systems are designed and implemented, making them safer, more effective, and more lucrative. Sun et al. (2016) also identified that big data analytics could facilitate the transition from IoT to the real-time control. Additionally, Nuaimi et al. (2015) reported that in many business-related and service industries, success is greatly dependent on the efficient analysis and use of big data.

Nature Based Tourism Destination

On a global scale nature-based tourism is growing, and with it comes the chance to encourage and assist the preservation of natural environments (Moore et al., 2013). Kuenzi and McNeely (2008) discovered that the form of tourism that is expanding the fastest is Nature-Based Tourism, which frequently includes trips to wilderness and national parks in developing nations. Again, Fossgard and Fredman (2019) identified that divergent resource interests across NBT system stakeholders highlight the significance of evaluating important resources and determining their relevance for product development, visitor experiences, and service delivery. Also, Fredman et al. (2012) found that public infrastructure, access policies, sustainable resource management, and environmental preservation may all help the nature-based tourism sector. Fredman & Tyrväinen (2010) reported that as a result of high demand, nature-based tourism has the potential to grow as a tool for economic diversification. Additionally, Winter et al. (2019) reported that Nature-based tourism and outdoor recreation offer vital advantages to people, communities, and society as a whole, which supports sustainability. Active recreation, being outside, and going to natural sites give people the chance to learn about natural systems and form bonds with locations that promote positive spillover.

Management and Planning of Nature-Based Tourism Destination

The science of planning and operating Visitor destinations while making effective use of material, financial, and human resources is known as Visitor destination management (Mezei, 2009). Also, Halmi and Severović (2016) found that the objective of destination management is to apply theoretical knowledge to the tourism destination which presents opportunities for the growth of tourism industries. Similarly, Dwyer et al. (2009) reported that research can be quite helpful in helping the tourism destination and business, which are the suppliers of the tourism product, formulate their strategies. Lew and McKercher (2006) identified that planning destinations, developing new attractions, developing infrastructure and transportation, and managing the social, environmental, and cultural effects of tourism all benefit from an understanding of how Visitors travel through time and space and the factors that affect their movements. Additionally, Alan Fyall & Brian Garrod (2020) stated that Destinations tend to be the center of tourism activities thus contributing to tourism research. However, their intricate systems of stakeholders make them notoriously challenging to administer. This intricacy suggests that a variety of factors in both the internal and external environments influence destinations (Sardar et al., 2025; Mondal et al., 2025). In terms of funding, governance, resource management, and policy agendas, this can present major obstacles for destinations. Similarly, Pearce (2015) reported Addressing the operationalization of the concept of destination management has become more crucial as tourism development has been complimented by a more recent concern with managing tourism growth and making sure destinations are sustainable and competitive.

3. Methodology of the Study

This research combinedly followed desk research and qualitative research approach. In Total 17000 data points from 17 NBTs were collected from the Google Review site. Sample respondents were the Visitors, visitors, and local tour guides who provided their feedback after visiting the NBT destination. This data was unstructured. Thus, the unstructured data have been processed and cleaned based on the text mining approach. Text mining approaches are crucial for analyzing and processing unstructured data, which accounts for 80% of the world's data. This approach helps the process of transforming unstructured text into a structured format to identify meaningful patterns and new insights. These techniques like removing punctuation, stop words (common words like "the" and "a"), and stemming (reducing words to their root form) enhance the data quality and facilitate analysis. Following the procedure the authors analyzed the word frequency and extracted the keywords mentioned by the visitors. Later, a thematic analysis was also conducted to develop themes and sub themes. The developed themes and sub-themes aligned with the research objectives. In thematic analysis, researchers read the reviews and initially develop a theme code. After that the similar codes were grouped under one theme. Two researchers coded the theme separately and cross-checked the final themes or sub-themes against the raw reviews which ensure the validity of the themes.

4. Findings & Discussion of the Study

The main objective of this study was to analyze the Big Data to draw pathways for management and planning of nature-based tourism destinations. The study found that most of the Visitor who have visited nature-based tourism destinations have shared their opinions in recent famous online platforms like google review. It is also found that the Visitor has faced both positive and negative experience while their tour in Bangladesh. Through their shared opinions this research has analyzed most mentions words in their opinions and their positive and negative experiences that they have faced during their tour in nature-based tourism destinations. The details of the finding are discussed below:

Mostly Mentioned Words by Visitor

This study identified the mostly mentioned words by the Visitor and categorized through thematic analysis. Those themes are Natural Beauty & Attractions, Adventure, Transportation, Information, Accommodation & Amenities, Seasonal Factors, Cultural & Manmade Attractions, and Security & Management.

In this modern era, Visitors are getting more attracted to the natural beauty attractions like forest, clouds, sunrise, sunsets, wildlife and nature beauty which brings peace in them. They mentioned that they go to places which attract them. While travelling to NBTs, a Visitor said about natural beauty of the destination. Visitor destination features greatly attract the Visitor that is highlighted by several researchers. Hasan (2000) found that often border zones rich in biodiversity and cultural exchange can become unique Visitor attractions. The natural beauty and natural landscapes acts as a powerful tension factor for domestic and international Visitors (Sharpley and Telfar, 2015). The lush green hills and tea gardens enhance cultural and ecological value, making it a high-interest area for Visitors (Islam & Carlson, 2016). Transportation also emerged as a significant thematic word in the Visitors' narratives when reflecting on their experiences at the nature-based destination. The visitors noted the diversity of transport routes and transportation modes that provided easy access as well as enhanced the general aesthetic and emotional experience of the journey. Among visitor, the water route modes such as boats have also ranked highest in the responses. Visitor also didn't forget to mention about ships which gives an amazing view. Not just long route modes have caught the attention of Visitor but also the local travelling modes. The use of CNGs, taxis, and motorbikes was frequently mentioned by Visitors. These vehicles were noted for their convenience and ease in travelling, suggesting that accessible and flexible transport options are crucial in improving visitor satisfaction, especially in semi-urban or peri-urban areas. Among the Visitor who travel in groups referred safe travelling mode like minibus which made them feel safe. Jangra et al. (2023) highlighted that how transport infrastructure is often described as the "blood vessels" of any region, it is necessary for the image of a destination and tourism effectiveness. The authors mentioned that the condition of the weak road infrastructure can significantly hinder tourism development. Loi et al. (2017) discussed that the quality of transportation services by facilities, safety, reliability and comfort on Visitors' satisfaction and revisit intention is well-established.

Visitor also mentioned about both the quality of facilities and the opportunities they get in hotel, motel, resort, cottage for thrilling outdoor activities. It is natural to get attention to that which offers the best. Among the Visitor some said that they get positive result in this matter. The popularity of an accommodation comes from its services. Several visitors noted that the service quality was good, which they receive. Suggesting a generally satisfactory level of hospitality and guest care. The seasonal variations significantly impact the experience of visiting any Visitor destination which is reflected in the opinion of the visitors. According to visitors, among the different seasons, the rainy season is considered the most favorable time for a visit. During this period, the water flow is at its peak, enhancing the scenic beauty and allowing visitors to fully appreciate the natural surroundings. Many visitors prefer this seasonal beauty due to the immersive experience it provides. Visitors stated that another appropriate season to visit the site was during winter, especially to those who were interested in birds. The period also attracts a large number of migratory birds that flock the island and provide a distinct touch of charm to the place. Conversely, the dry season is not recommended for travel by the visitors. The lack of water flow diminishes the overall aesthetic appeal. Making the experience less fulfilling. In general, the best time to visit depends on the traveler's preferences. Each season provides a distinct view of the location, and visitors can choose the ideal time based on their interests. Seasonal variations are strongly influenced by Visitor experience and destination appeal, especially in nature -based tourism destinations. Previous studies mentioned that the monsoon often enhances the natural beauty by increasing the flow of water and lush vegetation, which further enhances the satisfaction of the Visitor. During the monsoon season, the water features and the dramatic changes in green have increased the praise of the natural landscapes of Visitors (Murshed et al. 2023).

Visitors also posted about the places that offers a rich mix of cultural and man-made attractions and make attractive destinations. Among the notable highlights is the local cuisine, particularly the seafood platters, which are highly praised for their taste and freshness for the visitors. Additionally, mentioned about coconuts as a must-try after a refreshing swim in the sea which provides a perfect tropical experience. The combination of fresh seafood and natural refreshments enhances the overall culinary appeal of any tourism destination. Manmade attractions also contribute to the charm of the place that is also highlighted by visitors. The area is also rich in culture, which contributes to the experience of the visiting people and is also present in their review. The moonlit sky, coupled with the rhythmic sound of waves, offers a serene and magical ambiance that visitors cherish. Overall visitors

reviewed about the destination that seamlessly blends natural beauty, cultural richness, and unique manmade structures and offers travelers a diverse and immersive experience. Whether it is through food, scenic spots, or cultural encounters, every aspect of this place leaves a memorable mark on visitors. Gnanapala and Sandaruwani (2016) discussed that the cultural and heritage attractions are considered as an important area for future tourism developments. The studies by Cetin and Bilgihan, (2016), Ismagilova et al. (2015), and Nair et al. (2014) also supported the discussed findings of the Cultural & Manmade Attractions factors. Visitors also offer a wealth of information through their comments in Google review sites, making it easier to plan an enriching visit. Visitors mentioned about the suitable time to visit any NBT destination, the exact location of any destination, the cultural and historical significance of any destination. Such information enriches the understanding of visitors and provides visitors with a deeper appreciation of culture and heritage of any NBT destination. UNWTO (2001) revealed that Information plays a critical role for the competitiveness of tourism organizations and destinations as well as for the entire industry.

Table 1: Most Mentioned Words by Visitor in Google Review Sites

Themed Words	Keywords (Sub-theme)	Total Number	Grand Total
Natural Beauty & Attractions	Beauty/Beautiful	2939	
	Attractive	105	
	Feel/Mind	302	
	Clouds	229	
	Forests	90	
	Fountain/Waterfall	155	5576
	Sunrise & Sunset	393	
	Hills	877	
	Wildlife & Biodiversity	296	
	Nature	190	
Adventure	Jungle	96	
	Hill	158	
	Adventure	502	1147
	Climb	73	
	Risky	61	
	Horror	16	
	Rail	55	
Transportation	CNG/Auto-Rickshaws	67	
	Minibus	17	1126
	Boats	924	
	Ship	63	
Information	Month &	222	
	Year/Population/Country/Location		358
	Area/Border Area/Visitor	136	
Seasonal Factors	Destination/Visitor Spot		
	Winter Season	86	
	Rainy Season	174	347
	Dry Season	31	
Cultural & Manmade Attractions	Season	56	
	Food/Fruits	213	
	Watch Tower	62	314
Accommodation & Amenities	Culture	39	
	Resort/Hotel/Motel/Cottage	241	241
Security & Management	Deforestation/Security	68	
	System/Management/Authority/Visitors		68

Raised Issues by the Visitors (Positive)

Peaceful Environment & Natural Beauty

In review sites, Visitor responses strongly emphasized the appeal of the peaceful environment and breathtaking natural beauty of NBT destinations. A Visitor described that,

The interconnected fountains, mountains, and sea create an awe-inspiring natural spectacle. Such destinations as Cox's Bazar have beautiful, serene settings, picturesque view of hills and Kaptai Lake is a jewel nestled in the beauty of nature. The exclusive wetland ecosystem of Tangar Haor and the perfect

beauty of Lalakhal Natural Park offers people a refreshing break of the busy city life, where the forests and the wetlands are full of biodiversity, with rare birds and wildlife. Nature and its various mountains, zigzag roads, mind-blowing waterfalls such as Khoiachora, etc. are something that cannot afford to be described and appeal to all who value peace and beauty. Remote islands such as Nijhum Dwip, and remote areas bordering the Indian border have peaceful rivers, forests, and ecosystems, which create a rural atmosphere and leisurely attraction to all ages.

In addition, large numbers of visitors were in awe of clean and green surroundings. A Visitor said that,

We are the fans of the clean and environmentally friendly atmosphere and the Sal Forest, a classic coppice, which is predominant in the mainland Bangladesh.

Visitors also recognized any natural areas like tropical rainforest as a serene escape surrounded by lush greenery, which is a source of national pride. In review sites, forest enthusiasts' visitors also adore the tranquil ambiance and the thrilling jungle sounds that enhance the hiking experience. A visitor mentioned that

A scenic rail line cuts through the forest, adding a unique dimension to the landscape, with the Dhaka-Sylhet railway passing through parks, allowing travelers to enjoy breathtaking views as trains glide over forested areas.

According to Visitor the peaceful coexistence of mountains, rivers, wetlands, and wildlife created what is they referred as natural paradise. Fan et al. (2014) by the study emphasized that Visitors are attracted to the environmental environment of inter-associated natural elements such as mountains, forests, wetlands and reservoirs, which simultaneously create immersive and memorable experiences. Nature-based tourism destinations that offer peace, biodiversity and landscapes, contribute significantly to their overall satisfaction and well-being.

Warm Hospitality

The feedback of the visitors was also high in terms of satisfaction with the warm hospitality offered to tourists during their trip. Most guests observed that the employees of the resorts and restaurants are particularly hospitable and friendly, and they treated their guests with adequate care and attention. A Visitor said that,

We feel very welcome in the resorts and restaurants, the employees are very helpful and accommodating. The natives are well behaved and this makes the place a closed community without any problems particularly in islands where we can share food, and accommodation with the tribal people. The kindness, knowledge and great behavior of the tour guides make our experience rich with historical facts, which are combined with friendly attitude and the smile on their face which makes each contact with them heartfelt.

Such interactions were seen as enriching and memorable. Visitors also appreciated the cultural and historical insights shared during their trips, which added depth to their overall experience. The role of the local community in encouraging the welcome environment is especially real based and cultural tourism settings, where the Visitors who shared the food, accommodation and cultural activities with indigenous or tribes enriched the experience (Ramkissoon et al., 2011). The social exchange deepens the local heritage of Visitors and the traditions deepens the understanding, which enhances satisfaction and encourages the positive words of the mouth.

Quality Time & Peace of Mind

The theme of Quality Time and Peace of Mind is still deeply resonated with the experience of visitors at the adventure tourism destinations. According to a visitor,

The destination embraces the motto of time and peace through its unique mixture of adventure and adventure. The semi-fiery landscape of the Lachara National Park and the thrilling caves of Alutilla provide both the feeling of mental refreshment and achievement. The quietness found in the sun is beautifully contradicts with the adrenaline of nature-based challenges with breathing along the marine drive with breathing in the sea or breathing in the marine air. Being on the bamboo cottage, the heeltap wakes up to sunrise or the experience of floating peacefully in a boat allows visitors to reconnect to themselves and their loved ones.

According to another respondent-

Semi-evergreen forests and adventures of Lawachara National Park like cave explorations in Alutilla provide a surreal connection to nature, leaving visitors refreshed and victorious after conquering challenges. This destination is perfect for spending quality time with family and friends, offering a serene escape that rejuvenates the soul.

Again, a visitor reviewed that

The stunning Bay of Bengal sunsets from Himchari Beach or marine drives, coupled with the fresh air, offer a peaceful break from urban chaos. The thrilling yet calming experiences-whether watching sunrises from hilltops, feeling the ocean breeze, or staying in bamboo houses evoke pride and joy, as seen at Cox's Bazar.

Another of the respondents said,

The mind- invigorating nature of the stay here is further enhanced by well-decorated resorts and relaxing boat rides, and even the dangers are insignificant in comparison to the sheer happiness and horror-laced adventure of caverns and heights.

Quality time and peace of mind have become important metrics in the Visitor behavior and experience. Tourists are discovering not only destinations, but also experiences that enable them to relax, relieve stress, and have significant experiences with their loved ones (Uysal et al, 2012). These psychological and emotional consequences are directly related to the idea of wellness tourism, in which the peace of mind is one of the key driving factors (Voigt et al, 2011).

Appreciation of Wildlife

The commentaries of the visitors also come to have a collective enjoyment of the outstanding biodiversity and immersive wildlife encounters. The rich flora and fauna can always intrigue the visitors through their practical experience and the reserve forests accommodate the endangered tree species and other most recognizable animals like the Asian elephant. Such natural sanctuaries are not merely used as ecological resources, but also as places to explore and wonder. The first one is always the chance to have close experiences with the grand Royal Bengal Tiger, the national pride and the attraction of wildlife lovers. Giving the wildlife offering another dimension, the existence of deer reserves in such places as Nijhum Dwip can give a visitor an opportunity to interact with the innocent species in serene environments. It could be the excitement of seeing a tiger or the beauty of a parrot talking like a human being, these things make unforgettable impressions and create a stronger liking toward the nature. Respondent said that:

Ecotourists are enchanted by the abundance of wildlife such as rare species of trees and Asian elephants in the forests which are under protection.

Another respondent said that

Open safari tours enable viewing the impressive Royal Bengal Tiger which is a national treasure in close proximity, and the peacock cages and aviaries of African Macaws and parrots keep away visitors entertained all day long.

Another visitor stated that:

The deer reserves of Nijhum Dwip contribute to the variety of exciting experiences of wildlife that make these places ecologically more attractive.

The study by Fan et al., (2014) highlighted that the primary appeal of the Visitors who go to nature-based places is biodiversity and immersed wildlife experiences. Secured woodlands and reserves also offer valuable ecosystems to endangered and iconic species such as Asian Elephant and Royal Bangla tigers that become a major attraction of wildlife tourism and national pride Berdiyrov and B. S. (2022). Ardito et al. (2019) also talked about the fact that these flag ship species not only enhance the work to preserve but also provide powerful sensitive and educational experiences to Visitors.

Raised Issues by the Visitors (Negative)

Poor Service Quality & Management

Respondents complained of poor infrastructure and poor management of the facilities that impacted largely on their experience. Others of the Visitors particularly stated that

The infrastructure is not very good as the internal roads are in poor condition which is aggravated by rain and the foot paths are submerged.

There were also many mismanagement cases recorded in the national parks and beaches which were usually dirty and blocked by illegal vendors by the visitors. Visitor also faces problem with restaurants. Some Visitor mentioned that,

Restaurants and washroom facilities are substandard, offering poor-quality food from nearby eateries, and maintenance is visibly neglected.

Despite visible infrastructure projects, visitors mentioned that maintenance was largely neglected. Incidents such as fatalities at Madhabkunda were cited as consequences of poor oversight and for swimming, the procedure is also making everything more complicated for them. Many Visitors fear of their own safety in this matter. A Visitor said in frustration that,

Swimming restrictions, low-quality boats, and a chaotic ticket counter system reflect poor oversight.

Visitors are also upset with the amenities of the NBT destinations. One visitor posted that

Amenities like electricity and water are unreliable, diminishing the overall experience despite natural beauty. For this the natural beauty of the destination risks being overshadowed by discomfort and quality concerns.

Fan et al., (2014) highlighted that poor infrastructure and inadequate facilities management nature-based destinations are widely recognized as a significant barrier to the positive Visitor experiences. Visitor often explain internal roads, inadequate signatures, and displeasure on the pavement that are poorly maintained, especially during adverse weather conditions, which limit accessibility and reduce the application of these sites.

High Cost

Visitors frequently raised concerns about the high cost of visiting NBT destinations, citing it as a major drawback. Many noted that foreigners are often charged inflated prices, and resort rates are considered excessively high for the level of service provided. One Visitor mentioned that

Everything from food to beach products and boat rentals is overpriced. Coconuts and fish items are shockingly expensive despite the coastal setting.

Visitor always have some fixed budget for something. For these reasons many Visitor destinations become unaffordable for some Visitor. That's why a Visitor mentioned that

Entry fees and transportation costs are unreasonably high, making the destination less accessible and frustrating for budget-conscious travelers who expect affordability in such a resource-rich area.

Visitor also suggested that better pricing transparency and affordability are essential for enhancing our satisfaction and promoting a long-term relationship. Avi et al. (2021) mentioned that high costs and price transparency is often identified as an important factor that affect the satisfaction and accessibility of Visitors in nature -based tourism. Studies showed that inflated prices especially for foreigners create the idea of injustice and reduce the attractiveness of the destination, especially when the quality of service is not adjusted with the cost of service. Balmford et al., (2015) also discussed that the imbalance of this price can discourage budget conscious travelers and restrict equitable access to natural and cultural resources.

Insufficient Facilities

This theme highlighted that the pressing issue of insufficient facilities in nature-based tourism destinations. Visitors feel that experiencing any major discomfort often negatively affects their overall experience. The lack of mobile network coverage in forested areas poses a serious challenge for communication and safety. Compounding this area poor sanitation systems and the absence of reliable electricity essentials for any overnight stay. Tourists often complain that they find it hard to find appropriate accommodations like hotels or motels, and there is the lack of appropriate restaurants or food services. Respondent mentioned that

Infrastructure is deplorable as there is no mobile network in the forest, and there are no good hotels, motels or restaurants where they can stay over.

Another respondent said that

There is poor sanitation and basic visitor facilities such as food services and electricity are either missing or of low quality.

Also, a respondent told that

There is a lack of accommodation and infrastructure and Visitors find it difficult to find comfort and even convenience and this negatively affects the overall experience in these remote natural areas.

Destinations cannot be attractive without basic amenities even though they have some relevance ecologically. This does not only discourage repeated visits, but it can also destroy the image of such sites in the long run. By the studies, Fan et al. (2014) found that the lack of proper facilities is a fairly cited issue that adversely impacts the satisfaction of visitors in nature -based Visitor destinations. Inadequate sanitation and unbelievable power supply will help to minimize the attraction of these sites particularly to visitors staying overnight.

Overcrowded

Based on the review of the visitors, it is evident that overcrowding is becoming a major issue in nature-based tourism destinations. According to the reviews of the visitors, the large number of Visitors especially during holidays and peak seasons is a major contributor to compromising the desired experience of serenity and nature. The most popular places such as watchtowers and beaches are flooded and end up becoming dirty and unattractive. The problem indicates that there is a pressing requirement towards efficient visitor management plans. A respondent said that:

The overcrowding of the tourist spots, particularly during holidays and peak Visitor seasons, has left the beaches dirty and unsafe at night because of the effects of Rohingya refugees, as well as the large-scale congregations.

Another visitor reviewed that

Popular places and watchtowers become flooded, destroying the natural beauty and tranquility of the places where people visit, transforming calm holidays into food court-laden, overcrowded disasters.

Excessive numbers of people in natural tourism do not only destroy the essence of natural tourism peace, tranquility and closeness to nature but also results in environmental pollution and jeopardization of the population. As Kainthola et al. (2021) talked about, the impact of COVID-19 on the perceptions of Visitors concerning the crowding and how this shift will influence their decision in selecting a destination. As Namberger et al. (2021) discovered, overtourism has various manifestations, and the process is more complicated than the term implies. Another point made by the authors was that the distinction between the various types of urban tourism based on the amount of Visitors, character, and spatial and temporal distribution is significant.

Inappropriate Behavior of Service Providers

Inappropriate behavior of service providers was also posted by the visitors and which significantly influence the quality of the tourism experience. It is seen that negative actions of service providers and locals like photographer fraud and hawkers make the environment hostile. This improper behavior is an indicator of more profound problems in terms of controlling tourism staff and service quality. Respondent said that

There may be a deficiency in local hospitality and antisocial attitudes and behavior of the photographers and hawkers such as fraud.

Among the travelers, one said that

There is lack of professionalism in boat services and communication with locals is hard to achieve and this gives the Visitor the feeling of not being at home and being dissatisfied.

The Visitors experience unwelcome cases or being deceived. This directly affects their perception of the destination and prevents return visits or positive word-of-mouth. Choi and Sirakaya (2020) mentioned that the conduct of the services providers is paramount in the establishment of Visitor satisfaction and destinations in general. The local vendors, photographers, and transport operators with fraud, rudeness and non-profitlessness as a major hindrance to the experience of positive Visitors.

Pollution Concerns

The NBT destinations have a significant challenge of pollution in relation to the natural environment that is captured in the Google review sites. Tourists hiked the poor water and air quality, including untidy drainage of waste, hunting and noisy boat motors. In addition, they said that coral walls which forms a crucial part of the ecosystem bear the negative impacts of over fishing and over exploitation. Not only does this toxic environment not share the natural beauty of the area, but it also produces a fear of eating the local water by the Visitors who tend to be all too concerned with the apparent destruction of the environmental health. One traveler noted that,

Pollution has become a menace and too much cutting of forests is depriving places such as Bhawal Ghar of their heritage.

Another visitor testified that,

The poor water and air quality are the victims of garbage, quarry mining, and loud boat engines, whereas coral reefs are destroyed by overfishing and exploitation.

Moreover, one of the travelers points out that,

The poor ecology, with rubbish and commotion, destroys the natural beauty, and the visitors are worried about consuming the water and get disappointed with the deterioration of nature.

The environmental pollution brought about by tourism is an essential factor that brings more focus among the research fraternity. Carbon footprints in transportation and aircraft travel in particulars are one of the major issues, which have contributed to the elimination of greenhouse gas (Gasling et al.2010). In addition, tourism tends to create waste and poor waste disposal mostly in the places where there exists an appropriate infrastructure deficit (Becken, 2007).

Lack of Information

A serious deficiency of centralized information has also impaired experience by the visitor. The lack of a structured platform or detailed guide like revised maps, expenditure breakdown or logistical support gave information to travelers inadequately. Consequently, they tend to encounter difficulties in route directions and budgeting which ultimately impacts on the overall experience of their travel. A Visitor highlighted that

The lack of information contributes to the misfortunes, as there were no detailed maps and websites that provide information on pricing and logistics, leaving Visitors without expectations and not knowing how much they would spend and which paths to follow, which made organizing trips and enjoying the experience even more troublesome.

According to Coromina and Camprubi, (2016), lack of centralized and reliable information, including updated maps, pricing and logistical advice, will severely impact Visitor planning and decision-making, generating more confusion and less satisfaction. Similarly, Lu et al. (2023) touched upon the issue of Visitors being subjected to the problem of choice, a mental state that is identified by choosing and disillusionment as a result of the lack of information or as a result of simultaneous information.

Lack of Safety & Security

Along with the positive issue, absence of safety and security also became a negative one among the visitors. Feedback on the review websites indicated that there were serious safety and security issues that would impact on their satisfaction in the visit. A Visitors reported that,

The safety issues are also huge as there are no direction signs in the jungles and ambition of some thieves and burglars hiding there makes it dangerous to explore the jungles either alone or in small groups. The fact of the existence of refugee camps of Rohingya has changed the ecological balance in certain areas and infected fears of increased crime, such as robbery and hijacking, Visitor to some extent.

One of the answers made emphasized the fact that,

It is turning parts of it into camps and ramping up crime such as robbery and hijacking.

Visitors are also concern about their physical safety while travelling or staying. A Visitor posted that

Security is notably weak, with insufficient measures at parks and waterfalls, exposing us to dangers like mosquitoes, snakes, and unsafe boats.

The visitors also commented on the safety security of nature. They are also concerned about the environmental conservation. For instance, a visitor mentioned that

The deer population has dwindled due to deforestation and poaching, and pollution both environmental and noise-related poses huge ecological risks. Steep slopes and sharp rivers add physical hazards, especially for those with height phobias, while scams and stone quarrying near borders further compromise safety and beauty, leaving visitors wary and unprotected.

Safety and security problems are important factors that can negatively affect Visitor satisfaction and destination reputation, especially nature -based and remote areas destination. Adequate signage and weak infrastructure deficiency in the forest or jungle region often increases the risk of crime and physical damage, preventing the search for single or small groups (Gossling & Hall, 2019). Fan et al., (2014) by the study also found that who are insufficient security measures such as uncontrolled boat services or poorly maintenance trails, increase the weaknesses of visitors for accidents and emphasize wildlife -related dangers.

Guidelines Based on the Findings

From the comments (reviews) of the visitors, it is crystal clear that nature-based tourism destinations in Bangladesh faces a range of interconnected challenges that threaten their sustainability and appeal. Visitors faced safety and security issues particularly in remote areas where Visitors may be vulnerable to crime or accidents. To solve such issues, UNWTO (2021) recommended deploying CCTV, drone surveillance, mobile safety apps, and increasing trained security personnel to ensure real-time monitoring and response. Visitors also report frustration with insufficient facilities, especially electricity problems, clean toilets, and waste management systems. Previous researchers (Elysia & Wihadanto, 2020) proposed several solutions to address these issues that include implementing regular inspection and maintenance programs to ensure the proper functioning of sanitation facilities. Also prioritize the construction and maintenance of adequate toilet facilities, sewage treatment plants, and waste disposal systems, including accessible facilities for people with disabilities. Also, some organizations (ADB, 2021) suggest installing solar-powered mobile sanitation units in remote areas to improve accessibility and expanding mobile network coverage through satellite technology in forested tourist zones (ITU, 2020). Similarly poor infrastructure quality and poor hygiene regarding food further hinder visitor experiences. It creates a bad impression about the destination on the visitors. Previous researchers proposed several solutions to handle issues like this that includes actions like the government must make significant investments in road network infrastructure in order to maintain, repair, and renovate all roads and routes that lead to visitor destinations, supplying the requisite expertise and capability for constructing better cutting-edge road infrastructure, establish a multi-stakeholder forum on transportation issues for providing better transportation mode and routes to the visitors, also using GIS-based road quality monitoring to prioritize maintenance in Visitor-heavy zones. Furthermore, introducing eco-friendly paving materials to improve road durability in flood-prone areas. For maintaining food-hygiene, researchers proposed to conduct regular inspections of food establishments to monitor compliance with hygiene

and sanitation standards. It is also recommended to provide training for food handlers, chefs, and restaurant staff on food safety, hygiene, and culinary techniques including implementation of regular maintenance schedules for wash facilities, including cleaning and sanitizing (Odeku, 2020; Lee et al., 2015; UNWTO, 2019).

High costs remain a barrier for many visitors, which can be addressed through tiered pricing, local discounts, ride-sharing incentives, and dynamic pricing models powered by big data analytics to match seasonal demand (Pitana et al., 2022; Gössling & Hall, 2019). Visitors also report frustration with insufficient facilities, especially electricity problem, clean toilets, and waste management systems. Previous researchers proposed several solutions to address these issues that includes installing solar-power, proper maintenance & monitoring of hygiene and sanitation, introducing innovative waste management protocols such as return the waste & get incentives, penalty system, and extending mobile connectivity to improve access and comfort in rural zones (Elysia & Wihadanto, 2020; ADB, 2021; ITU, 2020). In this research it is also found that overcrowding during peak seasons strains both infrastructure and natural resources. It may lead to soil erosion, area pollution, road congestion, habitat destruction, etc. To solve the overcrowding-related issues, previous researcher (Buhalis, 2020) suggested a number of solutions, including using predictive analytics to forecast peak visitor times and adjust capacity limits accordingly. Also, several organizations (Chan, 2023; Leung et al., 2018; ADB, 2022) suggested limiting the number of daily visitors to a nature-based tourism destination and developing alternative destinations to reduce pressure on popular ones along with informing visitors through mobile apps and online platforms to divert their attention to alternative destinations at peak times. Furthermore, motivating visitors to off season visit through promotional offers and promoting virtual reality (VR) tours of overcrowded sites to reduce physical visits is also recommended by UNWTO (2018). Moreover, misconduct by untrained vendors and locals further erodes Visitor experience in a nature-based tourism destination. Past investigations put up a number of strategies to deal with these misconduct-related problems, such as clear regulations coupled with effective enforcement, arranging community tourism programs to train locals in etiquette and visitor handling, implementing certification system for local vendors and hawkers, allowing only registered vendors to operate in the destination, licensing boat operators and enforcing service standards, using technology and multilingual tools for overcoming language barriers, establishing a Visitor feedback portal for report misconduct which enables swift action by authorities, and offering incentives for certified operators to maintain high service standards (World Bank, 2025).

Air, water, and noise pollution as well as waste threaten environmental integrity, calling for reforestation, electric boats, stricter emissions control, real-time pollution sensors, and public awareness campaigns to promote zero-waste tourism behaviors (UNEP, 2021). In this research visitors also reported that seasonal limitations such as floods or extreme heat reduce year-round accessibility for visitors. Earlier studies put out a variety of solutions to deal with these seasonal limitation-related problems, such as promoting lesser-known destinations. Also construct elevated walkways, floating piers, and flood-resistant facilities in Haor regions. Along with creating shaded rest areas, misting stations, and water refill points for summer comfort. Furthermore, develop seasonal itineraries using weather data to guide Visitors to optimal destinations and install climate-adaptive infrastructure like retractable roofs over key sites. Again, inefficient transportation systems further restrict mobility, especially to remote ecotourism destinations. To overcome these problems with inefficient transportation systems, previous researchers suggested various types of strategies including implementation of reliable and affordable public transportation options like buses, trams, or trains, implementation cashless payment systems for streamlined ticketing. Also establishing shuttle services from urban hubs to rural attractions with real-time tracking apps (Bokhari, 2023; Sardar et al., 2021, UNWTO, 2020). In addition, poor management practices undermine destinations' quality. That's why, in order to overcome these problems, previous researchers recommended several types of solutions, including implementing robust monitoring systems to track tourism activities and identify problems early, investing in training tourism professionals to enhance service quality and sustainability, creating a centralized tourism management dashboard using big data to oversee operations, and partnering with universities for ongoing staff training in ecotourism best practices (Hall, 2009; Ritchie et al., 2003). Lastly, a lack of information leaves Visitors unprepared. It results in time and financial waste, the loss of a well-known location. Therefore, previous researchers proposed several solutions to address these issues that include establishing well-equipped Visitor information centers, creating a dedicated website or mobile app with up-to-date information, integrating Augmented Reality (AR) guides into apps for interactive site information, and lastly providing multilingual chatbots on platforms to 24/7 Visitor assistance (Mariani et al., 2014; Buhalis & Amaranggana, 2015).

5. Conclusion

This pioneer study on Big Data aimed to identify the keywords that visitors mentioned in Google review sites of Nature-Based Tourism destinations of Bangladesh. The authors also analyzed both positive and negative raised issues by the visitors through thematic analysis techniques. Based on the findings the authors proposed some guidelines that has already established as good practices for management and planning of NBTs. The research found that visitors mostly mentioned about the Natural Beauty & Attractions (5576), Adventure (1147), Transportation (1126). They usually mentioned the related words to express their excitement, feelings, and opinion about different attributes of the NBT destinations. The researchers also analyzed both positive and negative expression of visitors in Google review sites. In positive opinion, visitors mentioned about peaceful environment

and breathtaking natural beauty. They also appreciated the warm hospitality of hotel and restaurant staffs. Visitors mentioned that they can spend quality time in NBT destinations. They also emphasized on gaining peace of mind visiting the NBT destinations. Visitors admired the wildlife encountering opportunity in different national parks of Bangladesh.

Visitors also posted the several negative issues in Google review sites. This study highlighted the poor service quality and poor management condition of NBT destinations of Bangladesh. They also expressed their disappointment on high price of different products and services in NBT destinations. They also upset for the insufficient facilities and overcrowd. Many visitors are dissatisfied for the inappropriate behavior of the service providers. This study also found that some visitors are also concerned about the environment as they posted about the water, air, sound pollution and waste management systems of NBT destinations. Visitors asked for several information about the NBT destinations as there have lack of information about how to go, cost, appropriate season to visit, cost, helpline etc. The visitors also expressed their concern about the safety security situation of NBT destinations.

The major contribution of this study is to suggest several management and planning guidelines for NBT destinations to solve the issues derived from Big Data. Based on the findings, multiple evidence-based practical guidelines are proposed, including tiered pricing techniques, infrastructure investment (e.g. road maintenance, restroom, waste management), enhanced security system, crowd-control system, community busyness program, pollution-control system, and advanced audience information systems. The guidelines are proved as the good practices as those are implemented in different tourism destinations around the world. This study expect that such guidelines may also solve the management issues of NBT destination of Bangladesh and similar developing countries.

6. Limitations and Future Research Directions

Despite its valuable insights, the study is limited by certain limitations. A major limitation is the exclusive dependence on Google reviews, which are wide, but other platforms such as TripAdvisor, Facebook or other local social media networks cannot perfectly capture the width of Visitor response available. Furthermore, geographical opportunities for study only focus on Bangladesh. It illuminates the generalization of its search in other countries or tourism forms such as cultural or urban tourism. Future research goals include multiple review platforms and the opportunity to expand the tourism context and exploration of the geographical region area. It will provide a more overall understanding of how to get big data in the management of tourism worldwide. Extending the data pool and adopting a comparative analytical approach will also increase the reliability and enforcement of the insights, ensuring that data-driven decision making in Visitors is further included and effective throughout various settings. Further, longitudinal study can also be implemented by tracking reviews. Advanced machine learning techniques can also apply to analyze the secondary data. Researchers can also integrate multiple platforms such as Google Reviews, Instagram, TripAdvisor, Facebook for modeling visitor flows and crowd management through forecasting modeling and predictor analysis.

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