

DIMENSION IN SOILS AND LAND RESOURCES MANAGEMENT IN NIGERIA

A Festschrift in Honour of

**PROFESSOR EMMANUEL
OKUNOLA ORIOLA**

Edited by

- Ifetokun Paul Ifabiyi, Ph.D
- Bolaji Abdulkadir Usman, Ph.D
- Kayode Ademola Iroye, Ph.D
- Ismaila Oloyede Orire, Ph.D
- Lanre Tajudeen Ajibade, Ph.D

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It's a great honour bestowed on me to write this acknowledgement on behalf of Professor E.O Oriola. This festschrift is a huge amount of work and would not have come to reality without the invaluable contributions of a number of wonderful and supportive people. These people indeed contributed and assisted in the whole process from conceptualization to publication by providing insight, encouragement, commendation, useful and highly intelligent suggestions.

I wish to express my profound gratitude to numerous individuals who in one way or the other contributed greatly towards publishing this festschrift. The festschrift was conceptualized and organized by Department of Geography and Environmental Management to celebrate the occasion of his meritorious service in the university system. Particularly as a teacher, mentor, author and as a sincere academic in the field of Geography. Also, to acknowledge his huge and undeniable contributions to the research in Biogeography with focus on soil and land resources management.

I am forever grateful for the hard work, willingness, efforts, hours devoted by all authors and reviewers of the chapters in this festschrift. These people were incredibly helpful in making this festschrift extremely more readable than it otherwise might be.

This festschrift would not have seen the light of the day if not for the extraordinary hours, steadfast support, sharp vision and matchless care of the editorial committee and the publisher.

Special acknowledgement goes to Professor Olorunfemi John Funsho, a renaissance academic man and erudite scholar who doubles as a teacher of Professor Oriola for being a source of support and inspiration. Also, for his counsel, immense contribution, expert advice and encouragement towards making this festschrift a success.

This festschrift put forward to celebrate Professor Oriola would not have been fulfilled without the financial and moral supports of some family members, academic colleagues, a number of friends and students of Professor Oriola who were magnanimous through donations and useful suggestions for the vision to be actualized. I would like to acknowledge with gratitude all the staff members of the Department of Geography and Environmental Management for the good working relationship with Professor Oriola.

Lastly, I give accolades to Professor Emmanuel Okunlola Oriola, our teacher, mentor and supervisor whose commitment, career and scholarly track provided the footing for our constant efforts to manage our environment with special preference to soil and land resources management.

Dr. Ajewole Ojo Davies

Ag. Head

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FOREWORD

Writing a foreword on the book entitled "Dimensions in Soils and Land Resources Management in Nigeria" written in honour of Prof. Emmanuel Okunola Oriola (EO) presents to me, an opportunity to contribute to the discourse on the relevance of Geography to national development. It is my pleasure to warmly accept to write the foreword on the book put together to honour a former student; a colleague in the department; and my contemporary in retirement.

Prof Oriola had his first degree (B.Sc.) from the Department of Geography, University of Ilorin in 1982; master in Geography (1985) from the University of Ibadan, Ibadan. He had earlier in 1995 acquired an MBA qualification from the Obafemi Awolowo University, Ile-Ife. Prof Oriola's training as a teacher (Grd II) in 1976 and in business administration in 1995, capped with a Ph.D. (2004), from the University of Ibadan, prepared him adequately to excel as an efficient university teacher and lecturer with specialisation in Soils and Land Resources Management.

A book on Dimensions in Soils and Land Resources Management edited by Professors I. P. Ifabiyi; B. A Usman; and K. A. Iroye is a venture in the right direction to honour a deserving academic.

There are seven sections and thirty five chapters in the book. The veterans section covered the expanding frontiers of fluvial geomorphology and variability of soils in protected areas of South West Nigeria. Geographical Information Systems (GIS) that has become a widely accepted tool in geographical studies is contained in section two, while land resources is featured in section three.

Mobility and distribution of farm produce with respect to food security are contained in section four. The understanding of hydrological processes and water resources are in chapters 15 to 21 that constitute section five.

As it is natural with human development, conflicts are inevitable. Section six of the book focused on conflicts and environmental management, while the longest of the sections, section seven that has nine chapters addressed environmental conservation and health.

The book contains materials for research students, environmentalists, and policy makers as well as other stakeholders in Soils and Land Resources Management in general.

May I seize this opportunity to commend the efforts of the individuals who contributed to the book, and the initiators of the project in particular, and the Department of Geography and Environmental Management, University of Ilorin for this Festschrift in honour of a worthy alumnus of the Department and the "Better By Far" University of Ilorin, Prof E. O. Oriola.

Prof. J. F. Olorunfemi

(a retired Professor, Department of Geography and Environmental Management, University of Ilorin. Ilorin).

Veteran Section

Geographic Information Systems

Review of the Application of Geographical Information System (GIS) In Tourism Development

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Introduction

The application of geographical tools in tourism development has seen significant growth. Largely driven by the impact and effective use of spatial representation and analysis, allowing for the automated management of tourist information. This encompasses the use of Geographical Information Systems (GIS), which connotes a computer-based application for mapping and analyzing data (Erdin & Akbaş, 2019), in enhancing tourist services and expands the tourism market, particularly in the realm of scenic matters.

Tourism according to United Nations World Tourism Organization UNWTO (2014) is a social, cultural and economic engagement which entails the movement of people to places outside their usual environment for personal or professional purposes. These socioeconomic engagement counts among the main economic activities in many countries and one of the fastest growing industries across the world (Adeniyi & Iroye, 2020). Contributing over ten per cent (10%) to global GDP and generating employment for over 200 million people, according to the World Travel & Tourism Council (WTTC, 2001). Indeed, tourism remains a primary source of foreign exchange earnings in 46 out of 50 of the world's least developed countries (UNWTO, 2014).

Consequently, GIS can provide the necessary quantitative and qualitative form of information for tourism development. This includes surface characteristics, regional arrangements, tourist demand, as well as protection and exploitable information for scenic spots. To refine tourism market, it is important to offer potential tourism customers detailed information that aligns with their interests. The automatic, visual, and positional representation of spatial information, especially tour routes and service-related information, effectively serves potential tourists and captures their attention.

For instance, location of tourist site in Nigeria can be done using google images or maps. This identification techniques, defines area's capabilities and size which are mainly used for nature-based tourism development (Abou-Elnour, Pallathucheril, & Abou-Elnour, 2015). In addition, GIS can enable tourist developers to learn about the tourism resources and information of any location they are interested in. Thereby building a robust information service system, supported by numerous computerized images and/or maps to assist tourists and management personnel within the sector.

It is therefore on the basis of this technological trend, this research seeks to explore the application of GIS in tourism development and by extension, expanding the scope of tourism research through the presentation of empirical studies on GIS and tourism development.

Tourism Development

Tourism according to the World Tourism Organization (1995), is the movement of people to and stay in places outside their usual home for at least twenty-four hours but not more than one consecutive year for leisure, business and other purposes not related to any form of employment from within the place visited. In the same vein, Cook, et al., (2006), considers tourism as the temporary movement of people to destinations outside their normal places of work and residence, the activities undertaken during their stay in those destinations and facilities created to cater to their needs. This means, tourism entails the movement of people from a generating region to a destination region with a motive of adventure or relaxation (Adeniyi & Tunde, 2024). Although, within the organizational framework, tourism is observed as a collaborative service sector that relies on network management for effective organization (Volgger & Pechlaner, 2014).

Nevertheless, Siakwah (2018), emphasized tourism as a composite of activities, facilities, services and industries that deliver a travel experience to tourists in terms of attraction, transportation, feeding among others. The concept of sustainable tourism development involves balanced economic, social and cultural development without endangering the environment, which enables the development of the same or higher level (Joseph, Varghese, Kallarakal & Antony, 2021). The success of tourism development is largely determined by the quality of tourism components that exist in an area. Therefore, successful tourism development will be marked by the increasing of tourist interest and visits, as well as the increasing of regional economic development (Jones et al., 2023).

Fundamentals of Geographical Information System (GIS) in Tourism

GIS uses the theory and methods of systems engineering and information science to collect update, manage, display, query, analyze, cartographic output data. However, Wei Wei (2011), opines that the complete description of the concept of tourism information system consists of the following parts: On the basis of geographic information database for tourism.

Secondly, on the basis geographical information and data, such as transportation, accommodation, entertainment, shopping, cultural characteristics and features. While Jovanović, & Njeguš (2008), emphasized the following procedures in the development of spatial database:

- i. Acquisition of graphical maps covering the Region;
- ii. Converting the paper maps into digital maps by digitizing;
- iii. Creation of topology to establish relationships between the map features;
- iv. Transformation into real world coordinates.

The vector graphic shapes such as paths consisting of lines and curves are used to build maps for tourist. In addition, textual information, and images are integrated such that each object is assigned to a thematic layer. Each layer combines related objects like roads, building, or watercourses. To integrate tourism data, the traditional layer model with layers like roads, buildings, vegetation, watercourses, etc., must be widened with additional tourism layers like hotels, restaurants, sights and further infrastructure layers (Jovanović, & Njeguš, 2008). In this context, Puhretmair et al. (2001), provides an overview of the GIS extended layer (see Figure. 1).

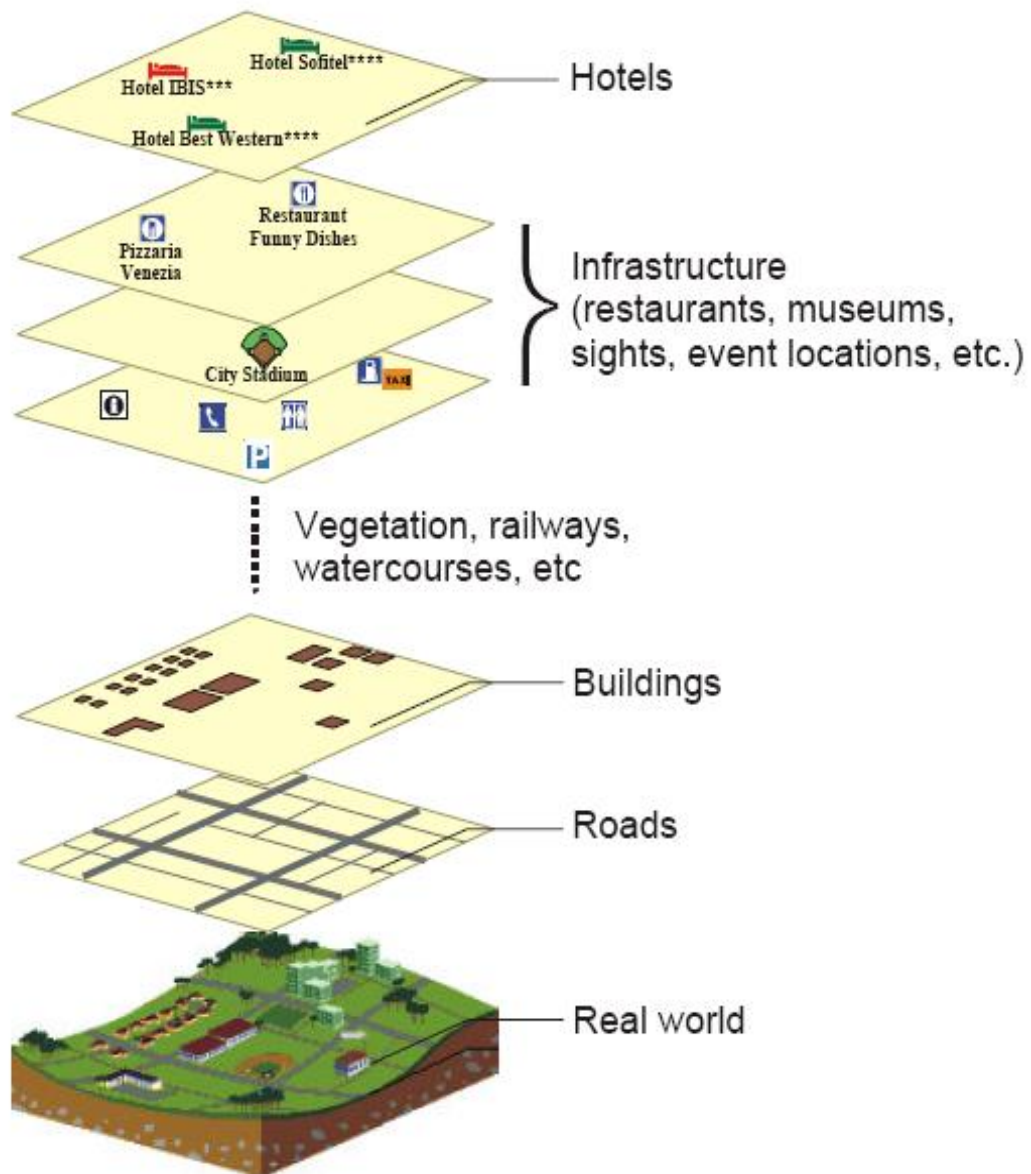


Figure. 1: GIS Extended Layer Model
Source: Puhretmair et al. (2001)

While the attribute information on the various tourism facilities collected from different sources according to Jovanović, & Njeguš (2008), can be linked to their respective spatial features. This involves the following steps:

- i. Compilation and addition of text information to feature locations in tables,
- ii. Development and editing of pictures and images to text labels,
- iii. Hot linking of images to their respective feature locations,
- iv. Audio narrations on some selected features recorded digitally can also be linked to their respective feature locations.

A link to a feature on the map would display an image combined with text in addition to audio description of that particular feature. The audio narrations would generally include a brief history of the feature, available facilities and what a potential visitor could expect to experience from a visit (Jovanović, & Njeguš, 2008).

Relevance of GIS in Tourism Development

Tourism is not only about the attraction, which is the product, but also encapsulates the components of tourism known as the supply within the industry. Tourism components according to Buhalis (2000), are classified as six (6) As, they are, Attractions (natural, man-made, artificial, purpose-built, heritage, special events), Accessibility (entire transportation system comprising of routes, terminals, and vehicles), Amenities (accommodation and catering facilities, retailing, other tourist services), Available packages (pre-arranged packages by intermediaries and principals), Activities (all activities available at the destination and what consumers will do during their visit), Ancillary services (services used by tourists such as banks, telecommunications, newsagents and hospitals).

Therefore, the success in the tourism industry is determined by adequate planning of which GIS provides a highly valuable tool. These technologies according to Bahaire and White (2010), are capable of synthesizing important data for the creation of policies regarding the locations of tourist attractions and services. In supporting sustainable tourism development, GIS can provide a unified tourism information network on varieties of data. For example, it includes maps of and information on geographical locations, topography,

infrastructure, superstructure and kinds of heritage and tourist attractions available (Abdel-Fadeel, Saad, & Omran, 2013).

GIS technology also integrates database operations such as query and statistical analysis and provides the unique visualization and geographic analysis output through maps. It gives users the opportunity to integrate a wide range of different data and, more importantly, allows non-specialists to carry out sophisticated queries (Lynx information systems 2012). GIS users can analyze spatial information, edit data in maps and present the results of such operations (Bunruamkaew and Murayama 2012).

Therefore, managers, entrepreneurs and other stakeholders responsible for tourism development could benefit from GIS in order to locate and analyze the characteristics of potential customers. The synthesizing of environmental, social and economic parameters in GIS format is easily possible, because GIS as an integrating technology capable of working along with other technologies, such as remote sensing, GPS, CAD among many others, which could further facilitate more tools to sustainable tourism planning.

Potential of GIS for Sustainable Tourism

The development of GIS applications in tourism closely parallels the three phases of GIS application development by Masron, Mohamed & Marzuki, (2015). Initially, there were inventory applications for compiling and organizing interesting features, which primarily performed simple data queries such as location and status queries. This led to the development of analytical applications that performed more sophisticated analysis processes. The final phase involved the development of more comprehensive management applications that aided decision-making. Thus, GIS has enormous potential to support sustainable development approaches to tourism planning, development and management, also referred to as sustainable tourism. Unfortunately, most GIS management applications in tourism focuses mainly on identifying suitable locations for tourism development. Other critical issues, such as the contribution of GIS to destination management and the implementation of sustainable tourism principles, have rarely been emphasized.

Furthermore, tourism is a complex phenomenon with social, economic and environmental impacts in addition to the geographical dimensions of its data. Tourism interacts with visitors and residents and generates income, which is often the main source of income in many places. The tourism industry relies on the use of natural resources and the quality of the environment. Hence, GIS technology allows for the integration of both qualitative and quantitative data sets into a single system (Karimi & Iordanova, 2021; Shan & Sun, 2021). All geographical, economic, social and environmental data can be stored and generated in GIS for various analyses. This integrative capacity is particularly important in the context of sustainable tourism, which requires a balance between economic development, environmental costs and social benefits. GIS provides the local and national governments and also sustainable tourism planners with a robust tool to manage all the necessary data (Alhamwi, Medjroubi, Vogt, & Agert, 2019).

Empirical Evidence of GIS in Tourism Management

Blasch, Pellechia, Deignan, Palaniappan, Dockstader & Seetharaman (2011), viewed Geographic information systems (GIS) as an essential tool that enable the representation, storage, management, analysis and visualization of geographical and non-spatial data on an integrated platform. This spatial and non-spatial data is called geographically referenced information. This includes spatial data that describes the location and characteristics of a geographical phenomenon (Jones, 2014; Jovanovic, 2016). These are highly effective tools because they integrate geographic and attribute analysis, resulting in a more accurate interpretation of data that can be used in various disciplines. Tourism development is a geographical phenomenon that requires collecting and analyzing spatial data (Jones et al., 2023) to explicitly discover and understand the feature relationships in a spatial context. Therefore, geographic information systems can be considered an important commercial tool for tourism.

Although tourism has expanded significantly from 1950-1960, its contribution to visitor distribution census of mountain gorillas and other species was conducted using GIS in

arrivals and earnings in developing and developed nations has not been equal. According to the United Nations World Tourism Organization (UNWTO, 2019), global international tourist arrivals was around 1.4 million in 2018, an increase of approximately 5% over the previous year while international visitor arrivals to Africa rose by 7%, reaching 67 million tourists. In Asia and the Pacific, international visitor arrivals increased from 14 million to 348 million, their numbers rose from 13 million to 181 million in the United States in 2018. Until recently, tourist activities worldwide lagged and growth stagnated due to the COVID-19 pandemic. However, on the other hand, developing nations have been accelerating their economic progress through domestic tourism (Nhamo et al., 2020). As a result, GIS applications, such as Google Maps, are increasingly being used in the tourism industry to facilitate communication and travel. This is because tourism involves travelling between local and distant areas; thus, maps are crucial for locating destinations (Asero et al., 2016).

According to Abou-Elnour et al. (2015), GIS can be used in various applications, including tourism information management systems, tourist decision support systems, visitor impact assessment studies, tourism facility inventory studies, and tourism-based land management systems. Although GIS is widely used in the developed world, its use in developing countries is still in its infancy (Bui et al., 2016). A survey of GIS applications in several countries in the Global North found that it was used for scenario analysis in North America and for tourism planning in South Carolina (Merem et al., 2015). Similarly, GIS has been used to collect, analyze and plan the inventory of tourism resources in Canada. In the United Kingdom, GIS has been used for planning and policy-making, leading to the development of the Tourism and Recreation Information Package (TRIP) (Johnson & Chen, 2021).

In Africa, geographical information systems in the tourism sector are recognized in Nigeria, Malawi, Zambia, Uganda, Kenya, Madagascar and Rwanda, among others. For example, Nigeria's National Tourist Development Corporation (NTDC) has established a spatial tourism database through GIS and other multimedia platforms (Uluocha, 2018). A Bwindi Impenetrable National Park in Uganda (Robbins et al., 2011). Additionally, Malawi

has created a bird atlas using GIS (Lee et al., 2022). While the Environmental Support Program (ESP) carried out environmental intervention and management in Zambia using GIS (Lungua & Njobvu, 2009). Additionally, in Kenya, the Laikipia Predator Project monitored lions, hyenas, wild dogs, and other known African predators using radiolocation and GIS. Similarly, GIS has been used in Rwanda to identify conservation value areas (Nzeyimana et al., 2014).

In the Nigerian context, it is an important sector that has not fully developed, though it is one of the country's fastest growing industries (Oladipo, 2010). The Nigerian Government in her quest to diversify her mono-cultural economy, which is heavily dependent on petroleum export, has decided to take some bold measures to develop and promote culture and tourism. These measures include the establishment of the National Commission for Museums and Monuments (NCMM) and the Centre for Black and African Arts and Civilization (CBAAC) in 1979, the adoption of the National Tourism Policy (NTP) in 1990, the birth of the Nigerian Tourism Development Corporation (NTDC) in 1992, the founding of the National Institute for Hospitality and Tourism (NIHOTOUR), in Baganda, Kano, and the National travel Bureau (NTB), a tour operating company of NTDC, (NTDC, 2001), the adoption of a Tourism Master Plan and the inauguration of the National Tourism Council with the President as chairman. The aims of these measures is to make Nigeria the ultimate Tourism destination in Africa and; to make Tourism one of the greatest foreign exchange earners in an oil dependent economy.

Advantages of GIS in Tourism Management

- i. **Spatial Analysis for Destination Planning:** Geographic Information System offers a strong foundation for spatial analysis which enables tourism managers to design destinations with confidence and by analyzing geographical data such as topography, climate and cultural monuments, stakeholders may determine the best places to build new hotels, tourist attractions and infrastructure. By doing this, it is ensured that investments are made wisely to increase visitor happiness and engagement.
- ii. **Route Optimization and Navigation:** GIS facilitates route optimization and navigation and in the tourism sector, efficient transportation is essential. Tourism managers can improve travel routes to reduce congestion and enhance tourists' overall travel experience by combining real-time data on traffic patterns, road conditions and areas of interest. Reducing environmental effects, not only raises visitor happiness but also supports sustainable tourism practices.
- iii. **Marketing and Targeted Campaigns:** By enabling focused advertising based on spatial data, GIS is essential to the marketing of tourism where tourism managers can target audiences or specific locations with their marketing plans by studying tourist preferences and demographic data. By taking a customized strategy, marketing campaigns are more successful in drawing in more visitors and strengthening the local economy.
- iv. **Visitor Management and Experience Enhancement:** Providing a seamless and customized experience requires a thorough understanding of visitor behaviour and GIS makes it easier to track visitor movements inside a location which aids tourism administrators in identifying popular sites and high-traffic zones. This data makes it possible to better control crowds, protecting guests' safety and happiness. Furthermore, interactive maps and applications that offer up-to-date information on services, events and attractions can be created using GIS. These tools improve the entire experience of visitors.
- v. **Environmental Impact Assessment:** GIS is essential for evaluating and reducing the environmental effects of tourism which is becoming a more and more important global issue where tourism managers can reduce the ecological footprint of tourism operations by using spatial data analysis linked to biodiversity, land use and ecological sensitivity. This encourages ethical tourism, guaranteeing the long-term sustainability and appeal of travel locations (Jovanović, 2016).

Applications of GIS Techniques in Effective Tourism Management

Maggie et al. (2020) investigated the uses and capabilities of GIS in the travel and tourism industry. The goal of the project is to illustrate how GIS and satellite remote sensing imagery are used to evaluate changes in the ecosystem, their causes, and their significant effects on Nairobi National Park and Maasai Mara Game Reserve. According to the research, utilizing Landsat satellite picture data between 2000 and 2017, the Mau Forest Complex's coverage has decreased as a result of regions being converted to farms and urbanization. The Kitengela animal migration route has been entirely overrun by mining operations and human habitation, according to an analysis of Nairobi National Park. This has a significant negative impact on the ecosystem's ability to function.

Khwanruthai & Murayama (2012) assessed land use and natural resource planning for sustainable ecotourism using GIS in Surat Thani, Thailand. They proposed that mapping the pressures of human development on the ecosystem using GIS technologies can be used to assess and manage the potential for tourism resources in conjunction with biodiversity conservation as a critical element in improving wildlife as a tourism destination product. The study is based on 2007 land use, land cover, and ecotourism suitability data that are then integrated with other GIS datasets to evaluate the land use and natural resources at a district level in Surat Thani Thailand province. The last step of this study was the prioritization of the area that is best suited for ecotourism in order to assess the sustainability of ecotourism in Surat.

In order to create a general framework for assessing the appropriate land use systems and infrastructure in the Welipenna area through Bentota and Meegama River, Sri Lanka, Pushpakumara & Peris (2020) used a GIS-based analysis. In order to monitor the development and expansion surrounding the heritage sites in Uttarakhand, India, within a specific buffer area encompassing its management zones, namely, prohibited and regulated boundary, Sudha, Vidya, Parul & Uday (2017) also made use of multi-temporal high resolution satellite images, namely, Landsat ETM+ (2000-2001), Cartosat-1 &

LISS IV (2009-10) and other ancillary data. Additionally, Miltiades and Demos (2020), considered GIS as a useful tool for modeling relationships, evaluating environmental conditions, determining whether a place is appropriate for a proposed development, and finding competing interests. Therefore, based on the aforementioned, it can be concluded that the application of GIS techniques is essential to tourism planning because the industry is centered around places and a large amount of the information needed for planning and development is by its very nature spatial.

Challenges in the Application of GIS in Tourism Development

Despite the plethora of benefits and potentials of GIS techniques, its application in tourism development is not completely devoid of some accompanied challenges. This can be attributed to some factors that challenge its effective utilization. These factors comprise but not limited to the following:

a. Farsari and Prastacos (2003), identified the level of GIS managers' awareness, training and qualified personnel as important challenges facing GIS. Researchers usually assert that in order to develop a GIS system, organizations need a skilled teamwork that consists of GIS managers, analysts and employees for system administration (Tomlinson 2007). Nevertheless, the availability of skilled teamwork does not ensure the effective application of GIS. Examples of outer factors that could threaten the success of GIS are coordinating with and receiving support from top managers and decision-makers (Abdel-Fadeel, Saad, & Omran, 2013). Decision-makers need to be involved in drawing GIS strategies (Tomlinson 2007) as well as advising, supporting and informing employees throughout the implementation of GIS (Gatali 2006).

b. Another challenge that plagues the effective application of GIS technique in tourism development is the lack of adequate funding. Although the financial costs of hardware and software of GIS have declined through the last decade (Elwood, 2006), funding according to Asligül and Ventura (2010) plays a pivotal role, cost of suitable trained staff (Hester 2008) and availability of Geo-information infrastructure (Alenka, 2010) are still considered fundamental challenges

especially for developing countries (Kyem 2002, 2004b; Sawicki and Peterman 2002; Elwood and Ghose 2004; Elwood 2006).

Further, the collection of spatial data and information for GIS databases creation can constitute a challenge for GIS managers or practitioners. As relevant and comprehensive information are vital to GIS effectiveness. This is because quality content and information needs to be offered by GIS to assist managers take informed business decisions. Thus, the lack of tourism databases and limitation or inconsistencies in data collected is a considerable challenge facing the effectiveness of GIS application (Kushwaha et al. 2011). In addition, Zhao (2010), acknowledged the possible negative influence resulting from the lack of appropriate regulations to intellectual property rights. Emphasizing that the lack of such regulation makes GIS intangible assets like digital mapping, attributes, electronic compilation of data and other GIS related works vulnerable to insecure practices and thus organizations may lose their financial rights (Zhao, 2010).

Conclusion

Geographical information system (GIS) is a rapidly expanding field that enables the development of applications that manage and use spatial information in combination with other media. This paper attempted a review of the application of this tool (GIS) in tourism development. It establishes the pivotal role of GIS in promoting the importance of combining information (spatial and attributes) and technology in sustainable tourism planning. As well as emphasizes the plethora of benefits and potentials of GIS in tourism development if properly harnessed. It is however, important to note that many of the recent GIS and tourism studies are geared towards investigating the benefits and potentials of GIS applications, while the challenges and reasons for the limited development of GIS in tourism, especially in developing countries, needs to be more emphasized on.

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