

## **HOW GIS COULD BE USED AS A TOOL TO ENHANCE THE TOURISM SECTORS? A CASE STUDY OF ERITREA**

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### ***Abstract***

#### **How GIS could be used as a tool to enhance the tourism sectors? A case study of Eritrea**

The tourism phenomena have attracted not only Eritrea, but almost the entire world. Tourism is being recognized as a source of economic benefits to a country by a way of gaining foreign exchange and employment generation on a truly international scale. It also makes a tremendous contribution to the improvement of social and political understanding. Though, Eritrea's tourism industry is currently rated as one of the lowest foreign exchange earners in the country, the potential of tourism industry to become a leading source of foreign exchange earnings in Eritrea has not been far realized. It is evident that the country's tourism potential has not been fully explored and marketed. Though several attempts have been made to enhance its rapid development, but these efforts have suffered some major drawbacks due to lack of a comprehensive spatial database of tourism facilities and destinations. By using GIS, a common platform can be defined to provide a spatial databank with integrated multimedia features. This paper discusses the use of GIS as a tool for archiving, analyzing, and displaying of tourism information to enhance the tourism sectors in Eritrea.

### ***Keywords***

GIS, Tourism, Eritrea

## **1. Introduction**

Eritrea is a land of startling contrast from sweltering heat of the Danakil Depression to the cool but stark mountains of the highlands. Although Eritrea possesses tourist attractive natural landscapes, archaeological and historical sites, it gets little benefits from the tourism sector. She offers most distinctive destination for the discerning tourists.

Eritrea is a beautiful country with fascinating treasure of history comprises most of the Axumite Kingdom, which was one of the great four world powers of ancient time, where one can visit the evidence of ancient civilization. It is a wonderful land of nature and culture, a land that has a heritage that stretches back to the far distant days of human history. The legacy of Eritrean history, monasteries, ancient sites and monuments, dense archeological sites, material culture of various type and rock art sites are reminders of glorious past that goes back to three millennium years. Eritrea owns a divers natural features, Forest of Semenawi Bahri (green belt), Danakil depression (300 feet below sea level), big trees like Ficus Vista, off shores Islands, coral reefs and beaches along the coastal line which extends 1216 kms. The above mentioned histo-geo-archaeological sites of this country have great potentials for the development of tourism industry.

The Government efforts are underway to support effective exploitation of these tourism potentials endowed by nature with the appropriate use of GIS and multimedia tools.

## **2. Background**

In the discovery of the tourism potentials in Eritrea, many attempts have been made to enhance its rapid development. However, these attempts have experienced some major drawbacks because of the followings:

1. Difficulties in updating graphical tourist guides and maps.
2. Lack of digital spatial database of tourism facilities and destinations.
3. Inadequacy of transportation and access routes to the tourist sites.
4. Most of the hotels and restaurants are found in the big towns and such facilities are almost non-existent in remote tourist centres.
5. Lack of comprehensive information base on the Internet.
6. Lack of skilled manpower and inadequate motivation for effective marketing.

It is against this background that a tourism GIS was designed to investigate how a dynamic spatial data library of tourism facilities with integrated graphical displays could be provided. GIS was chosen as the suitable platform because the location of tourism destinations provided a common denominator to link all information related to the tourism industry. This result was not just a simple digital tourist map but also a multidimensional model of tourism information that could be made available on the Internet.

## **3. Objectives of the study**

The present study aimed at generating a qualitative database for the tourism industry of Eritrea using GIS as a tool. The study has many fold objectives, such as:

- To identify the entire tourist attractive natural and man-made sites in the country and their potential capacity to attract tourists.
- To increase public awareness about the social and economic importance of tourism.
- To identify and analyze the constraints and obstacles that influence tourism development.
- To assess the professional qualification of workers in tourism sector, and
- Finally to provide correct and reliable information base so that it could encourage the scholars, eco-tourists and wildlife specialists to make a further investigation of tourism potentials.

#### **4. Data base and methodology**

The present study is mainly based on secondary data. The compiled data on different subjects have been tabulated. Synthesis, perusal, and analysis of data have been carried out wherever it can explain the trend with the outcome of results and facts. Besides, tourism GIS database have been structured to follow a relational database model format. The core of the database, the spatial component was developed by using ESRI ArcInfo software while ArcView software has been used as a front-end development platform for enhanced cartographic presentation and visualization. Multimedia capability has been included by utilizing Avenue programming.

#### **5. The study area**

Eritrea is one of the countries in the horn of Africa which covers an area of about 1, 24,000 sq. kms, lies in the north of equator. It sprawls between 12° to 18° north and 36° to 44° east. Eritrea shapes like a hatchet and the handle of the hatchet is on the Red Sea in the east. She is bounded by Sudan in the north and northwest, Ethiopia in the south, Red Sea in the northeast and east, and by Djibouti in the southeast (Fig.1).

Eritrea is a young country with complex series of landscapes and climatic features. Basically, in Eritrea almost there was no tourism industry in the last hundred years. Officially, the first tourism branch office was opened in 1966. Between 1966 and 1973 arrivals of international visitors were more or less consistent. However, the arrivals decreased during 1973 to 1991 period. In the early sixties Eritrea had flourishing tourist industry by the standards of that time (Department of Tourism, MOTIT 1993, 129). Since 1991, there was a considerable increase in tourist arrivals with 12, 576 in 1991 increasing to 416, 596 in 1996. But starting from 1998 visitor arrivals has dropped due to border conflict with Ethiopia.

In Eritrea, there are many tourism sites in different parts of the country and it is also considered as income generator to the GNP. The tourism sites in Eritrea have great ability to attract tourists. However, they are not as they should be. That is why tourists do not visit all the tourism sites because of some unavoidable circumstances; they visit to only some specific areas – mostly Asmara and Massawa.

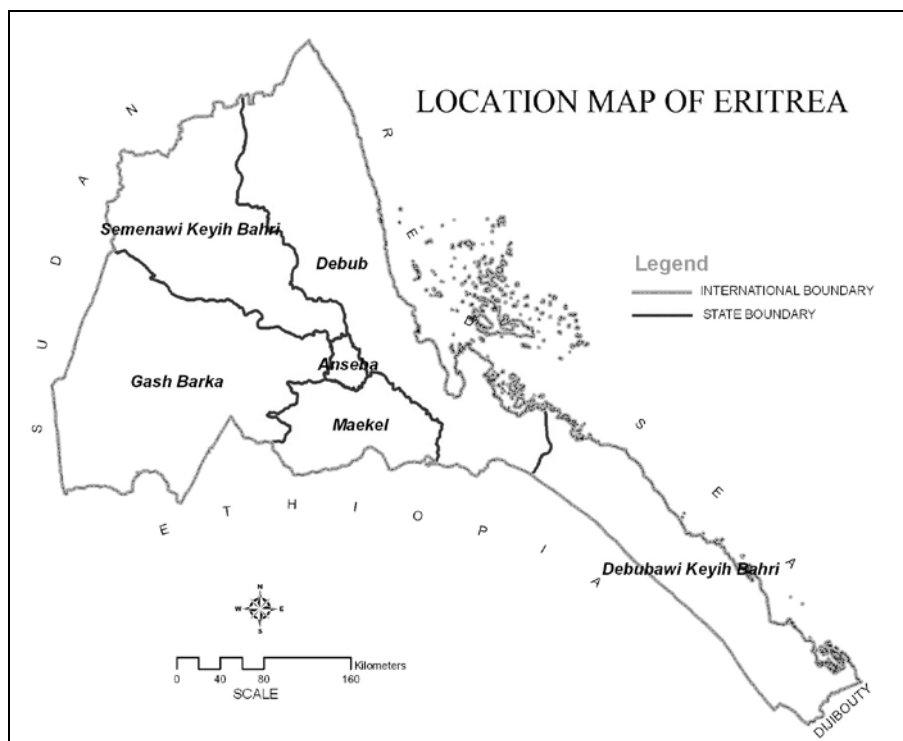


Fig. 1: Location map of Eritrea.  
Source: Ministry of Tourism, Eritrea, 2012.

Tourism sites in Eritrea have a long list that includes Nakfa, Debresina, Dahlak Archipelago, Golj, Adulis, Kohayto, Metera, Denakil Depression, Assab, the viewpoint on the Massawa road, Asmara city Museum, Railway Museum, Archaeological sites at Orota, Fort park, Italian and British Cemeteries, the National zoo, Botanic Garden, Ethnographic Museum, Coastal Beach Resort at Gurgusum in Massawa and other resorts at Ras Artau on Buri peninsula, Semenawi National park which offers some spectacular scenery, Hiking lodge, Industrial Museum, Agro-tourism resort of Elabered farm, Halhal Plateau National park, Hot Springs Spa resort at Akwar and Maiwui white water boating on the Setit river, Halhal Akordat hiking trails and Mount Elit-Kunama cultural centre. For the above mentioned tourism sites, the tourism facilities are not yet fulfilled (Fig.2).

The government has a plan for these tourism sites to upgrade and to fulfill the necessary facilities up to 2020 A.D. The above mentioned tourism sites are among the interesting features that make it a unique destination for the international tourists desiring an eventful trip to Eritrea. Undoubtedly, one of the most attractive aspects of Eritrea's ethno-tourism is the colorful and vibrant cultural events and traditional festivities. It is believed that the full tourism potential of this multicultural and hospitable nation is yet to be fully tapped.

So far as the management and promotion of tourism in Eritrea is concerned, there is large number of factors which influences the tourism development in the country. Some of the important factors include the lack of skilled manpower, insufficient

tourism promotion and marketing activities and border conflict between Eritrea and Ethiopia.

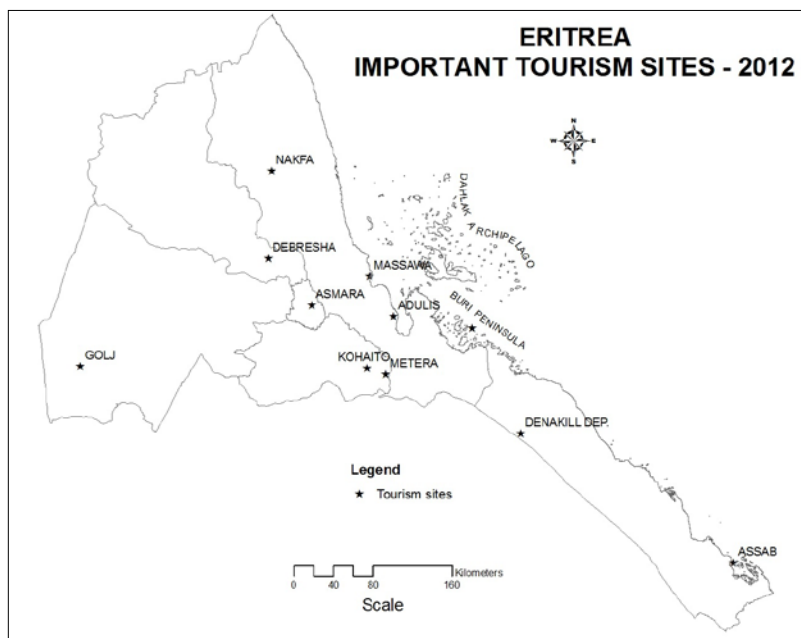


Fig. 2: Eritrea Important Tourism sites.

Source: Ministry of Tourism, Eritrea, 2012.

In Eritrea, the Ministry of tourism had suffered from shortage of skilled manpower. The Ministry had taken some measures to solve this problem. It brought foreign expert from India and Sri Lanka. Moreover, almost all the workers of Ministry were given different informal job training (Tab. 1).

Tab. 1: Educational Qualification of Employees of the Ministry of Tourism.

Level of Education	Number of Employees	Percentage of the Total
M.A.	01	1.923 %
B.A.	12	23.076 %
Diploma	10	19.231 %
12+2	06	11.538 %
12+1	07	13.461 %
9 <sup>th</sup> – 12 <sup>th</sup> grade	15	28.84 %
4 <sup>th</sup> grade	01	1.923 %
Total	51	100.000 %

Source: Ministry of Tourism Personnel Information.

The above table shows that almost one-third of the employees have completed only high school. The number of workers having higher qualifications is relatively few. Most of them have specialization in area (disciplines) other than tourism. However, they took variety of tourism related informal training. Among the informal training courses, which the workers took, includes tourism development, tourism planning,

finance management, travel agency management, human resource management, marketing to tourism, tour planning and management, labour market analysis and public relations etc. Although majority of workers had taken such training, it usually lasted for a short period of time.

Tourism promotion is one of the most important tools for tourism development. The basic function of all tourist promotion is to have an effective communication with the consumer. One of the most important tasks of any national tourist office is the promotion of the country as a destination for the tourists.

Since the starting of the Eritrean tourism sector, Ministry of tourism had employed a variety of promotion techniques. Advertising, sales support and public relations are among the promotion techniques, which were being used by the Ministry. Advertisement of the destinations and tourist products had been carried out by the news papers, magazines, T.V. programmes and Videos. Although it is stopped at this time. The Ministry had been publishing an article of tourism in Haddas Eritrea. Since 1996, Eritrea Horizons, a yearly magazine of the Eritrea tourism industry had consecutively published for three years. This magazine was distributed through the travel agencies, local government offices, Eritrea's Embassies and Councils abroad and by the main office of the ministry. Videos aimed at portraying the Eritrean shipwrecks and other destinations were being displayed on the ERI – TV. In addition to this ministry had also produced three Video films namely Peace at last, the Luul of the Red sea and Journey through Eritrea. These Videos are still kept in Eritrea's Embassies abroad as a means of promotion.

Sales support materials were used as a potential promotional media. The Ministry of Tourism had published around 5,000 brochures. The brochures were mainly aimed at giving general information about Eritrea and particularly Massawa and Asmara. These brochures were distributed through travel agencies, Embassies and Ministry itself.

Although the Ministry had employed different promotional activities, they are yet inadequate for efficient growth of tourism. Because most of them had been used in a limited way. For instance, the magazines and brochures were distributed through some selected institutions. As a result only few people have access to them. In addition to this only local people watched the Video displayed on ERI-TV. These Videos could have been as potential advertising media on popular TV broadcasts such as ALJAZEERA, CNN and BBC. However, such an attempt has not yet been taken place.

Most of the promotional methods were made to convey only mere description of the destinations. Thus, they failed to include detailed information on accommodations prices, communication, transport, health services and other facilities. Since the border conflict with Ethiopia, almost all the promotional activities have been ceased. Moreover, there was no campaign aimed at making the public aware about the importance of tourism welcoming a tourist.

As tourism can prosper only in a peaceful environment, it is highly dependent on peace. Fear is a powerful deterrent to travel. War, unrest and terrorism in the host area (country) create doubt and fear in the mind of the traveler. On the other hand, a peaceful situation of a destination is more conducive for large tourist arrivals. The border conflict between Eritrea and Ethiopia had negatively influenced the trend of

tourist arrivals. Although the wars and security problems were confined to the territories between the two countries, the international tourist arrival had decreased dramatically (Tab. 2).

Tab. 2: Trend of International Visitor Arrivals (2000–2008).

Year	No. of Visitors	Percentage change over the previous years
2000	70354	
2001	113024	60.65
2002	100828	-10.79
2003	80029	-20.62
2004	87401	9.21
2005	83307	-4.68
2006	78678	-55.72
2007	79492	-1.03
2008	69423	-12.66

Source: Ministry of Tourism statistical data.

The above table show the trend of international visitor arrivals from 2000 to 2008. According to the data given in the table, there is great fluctuation in the number of tourists who visited Eritrea from 2000 – 2008. In 2000, the total number of tourist arrivals was 70354, while in 2001, it drastically increased to 113024. But in 2002, the number of tourist arrivals decreased to 100828, which were almost less than 12,196 of the previous year. Again in 2003, the number of tourist arrivals dramatically decreased to 80029 which were almost 20,799 tourists less than the previous year. In the year 2004, there was slight increase in the number of tourist arrivals which was 87401. Again in 2005, the number of tourist arrivals decreased and reached to only 83307 tourists. In 2006, the number of tourist arrivals further decreased and reached to 78678. In 2007, it slightly increased and reached to 79492, and finally in 2008, it again decreased, almost 10,069 tourists declined and reached to 69423.

## **6. Why GIS is used in tourism?**

When making decisions, planning, analyzing the effect of changes, looking for patterns, etc., we may look at maps, tables, charts, lists, graphs and reports, and sometimes it is rather difficult or nearly impossible to pull all these sources of information together and make sense out of them. Geographic Information Systems however, have the capability to handle several kinds of information that can be related to a location or area. For example, hotels and tourist destinations all have one thing in common i.e. location. And since the geographic position of any map feature is unique, it provides a complex link between the different data sets. The result is no longer simple map but a complex multi-dimensional model of information.

Using GIS therefore, it becomes possible to integrate tourism information, visualize complex scenarios, present powerful ideas and derive effective solutions otherwise not possible. Besides, Geographic Information Systems are dynamic, allowing the user to 'enter' the map to explore, enquire and analyze geographic locations and the information linked to these locations. Questions like:

- Where is it? (location)
- What is it? (condition)
- What if (modeling)
- What has changed since? (trends)
- How do they occur? (patterns).

All these questions are easily answered within the context of tourism GIS. And these are the most likely questions a potential tourist or investor may seek answers for in order to plan and undertake a trip or to consider to make a potential investment decision.

Also, the capabilities of GIS have made it possible to answer spatial queries using intelligent maps with integrated images, text, tables, and diagrams; and showing shortest paths, location of hotels, tourist sites, price quotations, and so forth.

## **7. Creation of spatial database**

For the development of spatial database the following procedures have been included:

- Acquisition of graphical maps covering Asmara with the coastal beach resort at Gurgusum in Massawa and Semenawi National Park have been taken in great detail than any other parts of the region.
- Determining the reliability of the source maps through the field checking to verify the existence of features and also their relative positions to each other.
- Converting the simple maps into digital maps by digitizing.
- Editing to remove errors.
- In order to establish relationships between different map features, topology is created and
- Lastly, they have been transformed into real world coordinates (Projections).

## **8. Cartographic development**

In order to provide enhanced cartographic representation, the digital maps were further developed by using Arc View GIS software. Labels and suitable graphic symbols have been assigned to the various features for easy categorization, identification and visualization. Thus, a composite tourist map is produced.

### **8.1 Attribute data creation and multimedia development**

Attribute information on the various tourism facilities that were collected from various sources were linked to their respective spatial features. This involved the following steps:

- Data compilation and addition of text information to feature location in tables.
- Editing and development of pictures and images to text labels.
- Images hot linking to their respective feature locations using Avenue scripts.

Lastly, the map of Asmara with the Cathedral Catholic Church and the Coastal Beach Resort at Gurgusum along the coastline of Massawa and Semenawi National Park



that had been developed independently were not linked to their respective locations on the small scaled map. The following Fig. 3, 4 and 5 show graphic display of information retrieval from the database.

## 9. Potential benefits of a tourism GIS

An information system that is capable of answering questions about where facilities and resources are located represents enormous benefits. A Geographical Information System with integrated multimedia tools of the type described here could provide tourism information in an integrated fashion and will be of immense benefit not only to the Asmara but Eritrea as a whole. Among the many benefits that may be realized through the system includes intelligent mapping capabilities, analytical capabilities, modeling and prediction and also revenue generation.

## 10. Intelligent mapping

Unlike other geographic information systems, there are multiple functions of the tourism GIS. From a planning perspective point of view, intelligent and flexible mapping capabilities are the most attractive. It would be convenient for the user of the system to create maps of their own chosen themes, map features are edited to suit particular requirement and purpose and the available information are updated for tourism features. Thus, the tourism GIS have the capability to keep the maps always up to date on the one hand and to create the historic maps on the other hand that may show the situation at some points in history. Apart from this, new sets of data can be created and the digital data from other sources may be intelligently joined with the existing geographic data. Decision makers would be able to obtain comprehensive information to provide realistic assessment of current situations.

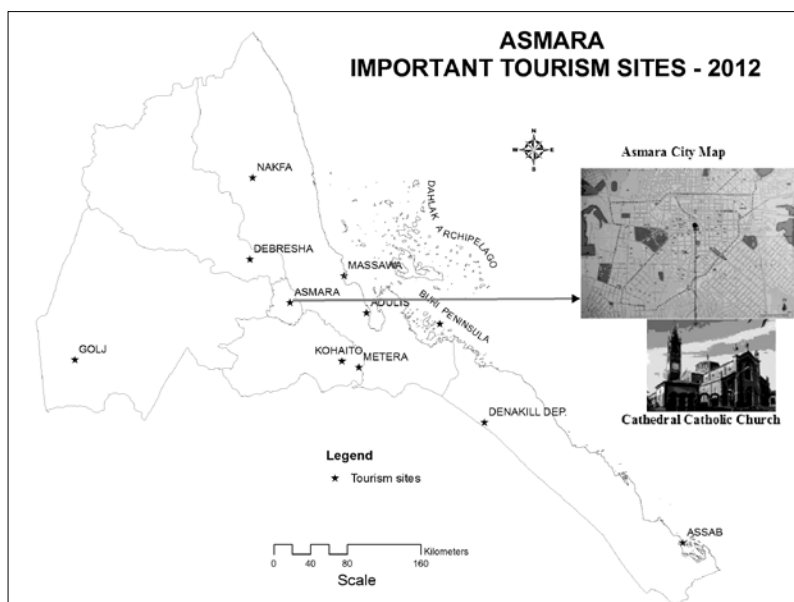


Fig. 3: A Hyperlink showing a concurrent display of graphics and a description of Cathedral Catholic Church.

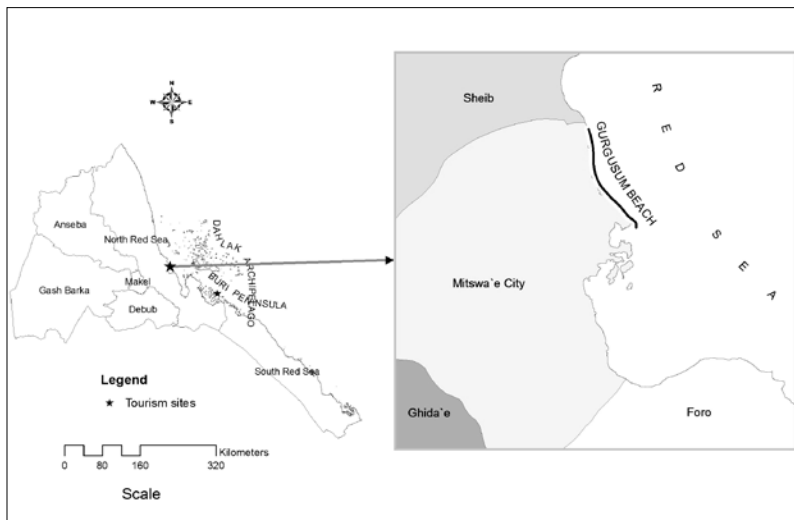


Fig. 4: A Hyperlink showing a concurrent display of graphics and a description of Massawa Gurgusum Beach Resort.

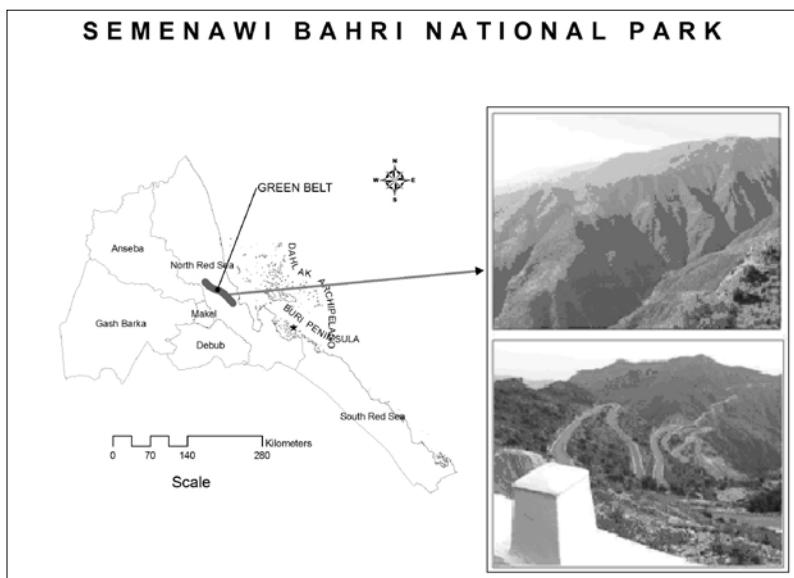


Fig. 5: A Hyperlink showing a concurrent display of graphics and a description of Semenawi Bahri National Park.

### 11. Modeling and prediction

The aesthetic aspects of a tourism GIS is that future plans, projections and expectations which can be modeled and their overall outcomes on the entire tourism industry thoroughly assessed (in time and space), before they are implemented. It

has great capabilities for modeling the tourism sites in the form of database and map queries. A place where either a new facility is to be located or a new tourism plan is to be developed; everything could be assessed from the computer screen before its implementation.

## **12. Analytical capabilities**

The ability to perform analytical operations is what makes GIS unique. It combines all the analytical capabilities of standard database system with powerful geographic information processing tools. Simple analysis such as statistical summaries (minimums, maximums, means, and sums) and analysis of inter-relationships between various tourism related variables could be carried out in a GIS environment. For example, the data sets of historic monuments and roads could help to solve the problem of finding all the historic monuments along a primary road. The other significant advantage of this analytical operation is in derivative mapping. Thus, it is envisaged that these powerful analytical capabilities would constitute the most important use of the tourism GIS for effective planning, marketing and monitoring of tourism facilities.

No doubt, the tourism GIS is a great asset for the tourism industry because it would provide an advanced platform for marketing Eritrea's tourism destinations and facilities while exposing investment potentials and opportunities. Eritrea's tourism industry could be promoted through the effective marketing as most of the tourists come from the foreign countries and would lead to more revenue generation in the form of foreign exchange earnings. Apart from this, there would be other sources such as revenue derived through advertising and publicity offered for hoteliers and other tourism service providers through the distribution of the system.

## **13. Conclusion**

Despite the charming scenery of natural landscapes, attractive coastal zones and welcoming climatic conditions of Eritrea, the tourism sector has not grown yet as much as it should. This is because of number of obstacles and constraints. Lack of skilled manpower is one of the obstacles which have resulted to insufficient market research activities. The insufficient tourism promotion and marketing activities together with the lower roles of travel agencies are contributing to the low growth of the sector. The inadequacy of transportation and access routes also creates inaccessibility problems. Moreover, deficiency of infrastructure has aggravated the lack of necessary tourist products. Thus, absence of water supply system in some attractive sites made them less important. The poor development of other constructed facilities such as highways, airports, roads, railways, parks, resorts, hotels, motels and places of entertainment has influenced the sector negatively.

So far as the use of GIS as a tool to enhance the tourism sectors is concerned, no doubt it has put the required information and critical data of Eritrea's tourism on the desk top to serve the tourism market. It has also revealed that this sort of presentation of tourism information in GIS multimedia environment would offer an unparallel platform for the management and promotion of the tourism industry in Eritrea. Tourism GIS has made easy access for the tourism agencies, policy makers and stakeholders to get detailed information and thus serve as an important source of motivation to encourage the performance of the sector. Thus, for efficient marketing and promotion adequate incentive could be assured. However, the

problems of updating graphical tourist guides and maps now become quite easier. This process is cheap, easier and less time consuming. A comprehensive information base for tourism in Eritrea on the Internet could be seen as an outcome of this research paper.

Until the performance potential of GIS in the tourism industry of Eritrea is critically observed, Eritrea could not stand in the international competitive tourism marketing. If it is so with the help of GIS we can answer so many fundamental questions, such as where is it. And how do I get there? Application of GIS in the tourism industry of Eritrea will strengthen the Zoba wise plan for managing and promoting the tourism industry in the country. No doubt, in the beginning the investment is high, but it is sure that the importance of GIS will increase in the tourism industry at global level. In this context it seems to be very much suitable to say 'first come first serve', because earlier the tourism industry of Eritrea will adopt this technique the better it would be for its future development.

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### ***Summary***

This paper discusses the use of GIS as a tool for archiving, analyzing, and displaying of tourism information to enhance the tourism sectors in Eritrea. The study presents a conceptual geographical information systems (GIS) supported sustainable tourism infrastructure planning framework including attraction, service and transportation facilities. This framework focuses on tourism planning as an integrated approach based on sustainability criteria. It also aims to integrate set of sustainability criteria (i.e. development objectives, visitors experience preferences, carrying capacity standards and resource impacts) into infrastructure planning via GIS. Based on these criteria, the application of GIS provides an insight in the management and promotion of tourism in the most sustainable locations and layout of future infrastructure in Eritrea. Since tourism implies travel from one place to another, each location should be analyzed within a spatial context (Body and Butler 1996). Although GIS are ultimately suited to perform these tasks, a lot of spatial data and analysis is necessary (Beedasy and Whyatt 1999).

It is evident from the preceding discussion that the country's tourism potential has not been fully explored and marketed. In the discovery of the tourism potentials in Eritrea, many attempts have been made to enhance its rapid development. However, these attempts have experienced some major drawbacks because of lack of a comprehensive spatial database of tourism facilities and destinations. In order to overcome these major drawbacks, a tourism GIS was designed to investigate how a dynamic spatial data library of tourism facilities with integrated graphical displays could be provided. GIS was chosen as the suitable platform because the location of tourism destinations provided a common denominator to link all information related to the tourism industry. This result was not just a simple digital tourist map but also a multidimensional model of tourism information that could be made available on the Internet.

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