



APPLICATION OF GIS IN TOURISM PROMOTION IN INDONESIA

TERM PROJECT FOR TERM 112

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Abstract

The success of tourism in any country depends on the ability of the country to sufficiently develop, manage and market the tourism facilities and activities in that country. And nowadays the development of tourism industry is very much benefited from the advancement of GIS, since tourism itself has values in location and spatial information.

GIS would provide tourists with map which they can locate their destination and get a lot of information about it, such as type of tourism, transportation, and accommodation. Tourism authority will be also benefited, since they can save amount of useful database for tourism development which not require much space and can be expanded easily.

The advance development of GIS has not been developed well in promoting the Indonesia tourism. And as an archipelago country, the use of GIS would become very important. How to travel across Indonesia and what is the availability of transportation to get to destination will be the main questions of prospective tourists. Fortunately GIS could provide solutions for the lack of information of tourism facilities and activities in digital form.

In this project, I'll try to map the diversity of tourism destinations in Indonesia by using ArcGIS software application. And then, I hope I could give an overview of Indonesia's tourism and how to travel around Indonesia.

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1. Introduction

After world-war II, the development of tourism industry had shown a significant rebound. According to UNWTO (United Nations of World Tourism Organization); as an internationally traded service, inbound tourism has become one of the world's major trade categories. The overall export income generated by inbound tourism, including passenger transport, exceeded US\$ 1 trillion in 2010, or close to US\$ 3 billion a day. Tourism exports account for as much as 30% of the world's exports of commercial services and 6% of overall exports of goods and services. Globally, as an export category, tourism ranks fourth after fuels, chemicals and automotive products. For many developing countries it is one of the main sources of foreign exchange income and the number one export category, creating much needed employment and opportunities for development. Most of developing countries, including Indonesia, depend mainly on tourism for economic growth and diversity.

The Republic of Indonesia is the largest archipelago in the world comprising 17,508 large and small tropical islands, many still uninhabited and a number even still unnamed. The country stretches 5,500 km along the equator between Australia and Asia and is bordered by the Pacific and Indian Oceans at the Equator. Few countries in the world could match Indonesia's diversity of population with some 490 different ethnics living together. Indonesia is a place of rich and diverse culture that offers many fascinating, colorful and unique objects.

After sustained monetary crisis and political turbulence in 1998 which affected it tourism sector, today Indonesian people have rise up and try to build their country step by step. Beyond its diversity, Indonesia has many tourism objects. Bali and Jogjakarta may be the most well known place in this country instead of Jakarta. Bali already suggested as one of the world's best island resort. Jogjakarta has unique and fascinating culture. But Indonesia still has many unexplored islands with grand mountain views, green rainforests to trek through, rolling waves to surf and deep blue pristine seas to dive in where one can find a colorful underwater view.

1.1. Objectives

Generally, this project try to make a tourism database map based on GIS that might help the prospective tourists to get spatial information about popular and interesting tourist destinations in Indonesia. The objectives can be described as follows:

1. Creating a tourism database map based on GIS along with its attributes and features
2. Creating an inventory of tourist destinations in Indonesia
3. Providing prospective tourists about available transportation to the intended destination

1.2. Limitations

This project was designed with following limitations:

1. The result maps were intended merely to show the position of the destinations
2. The scale of the result maps would be limited up to 1 : 10.000.000
3. Type of transportation provided here is domestic flight mode of transportation
4. Accomodation information were excluded in this project

1.3. Methodology

This project would try to think along with tourist perspectives, which base on 2 questions:

- a. Why I should go there, what kind of tourism attraction that the country offers?
- b. How I get there? How is the transportation availability there?

The project itself was developed in three steps, namely: literature reviews, case studies, and design of map using ArcGIS and it application.

The literature reviews will consist of the definition of tourism, how to develop a better tourist destination and how to build an effective GIS database on tourism. Also there is a short overview about tourism prospects of Indonesia.

The case studies will consist of several countries that already successfully implemented GIS in their tourism development. The study will try to find appropriate information about how it was planned, then how they organize the tourism, what is the strength and the weakness of the project.

Design and application will be presented in three steps, that is conceptual design, data collection, and map digitization. The result of this project is range from some printable maps regarding tourism in Indonesia to several spatial analysis application which can be applied in this project.

2. Literature Reviews

2.1. The New Direction of Tourism Development

Nowadays, tourism has been concerned as an important industry which could boost income of destination countries. The term of tourism can be defined briefly as a willingness of people in spending their money for traveling elsewhere to get leisure, and then beyond this there is a motivation that can be defined as the travel motivation. Travel motivation is interconnected with questions: “why people visit a particular destination”, “why they should go there”, or “are there any other places better”.

Travel motivation build up by two factors; namely the pull factors and the push factors (Goeldner & Richie, 2008). The push factors are intrinsic motivator, while the pull factors emerge due to the attractiveness of a destination, including beaches, recreation facilities, and cultural attractions. Since the push factors are more intrinsic, thus the pull factors must be well managed by tourism organizer. Well managed and interisting tourism promotion will drive prospective tourists to determine their trip to that destinations.

The massive invasion of telecommunication technologies, linked closely with computer technology, has had a dramatic impact in managing and promoting tourism. Recent days, telecommunication technologies become so important because they could represent very specialized elements on both tourism infrastructure and superstructure.

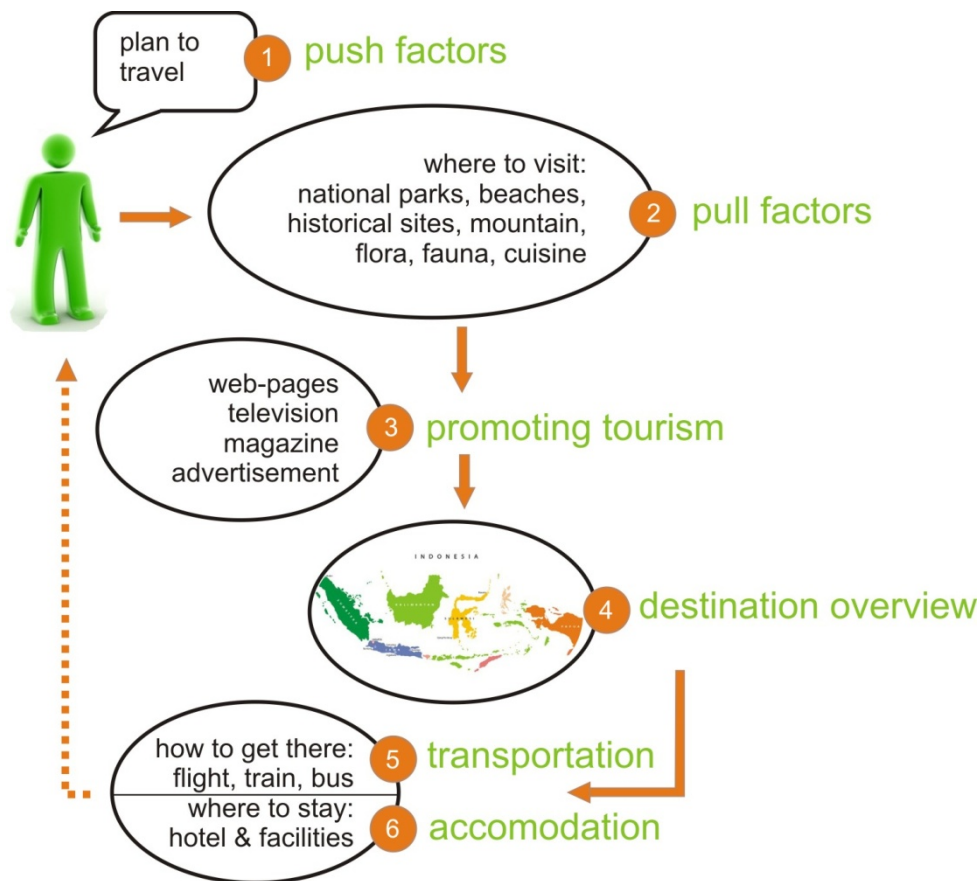


Image 1: travel motivation (author illustration)

The most substantial element in promoting and managing destinations is information. And well collaborating information and technologies in tourism would be the important key, because the success of a destination is determined by its ability to assemble, interpret, & utilize information in an effective manner.

Attractions are the reason people travel. Attractions are the most important component in the tourism system. Attractions can be classified in a number of ways:

1. Cultural attractions: historical sites, archaeological sites, architectures, cuisine, monuments, industrial sites, museums, ethnic, concerts, theaters
2. Natural attractions: landscape, seascape, parks, mountains, flora, fauna, coasts, islands
3. Events: mega-events, community events, festivals, religious events, sport events, trade shows, corporate
4. Recreation: sight-seeing, golf, swimming, hiking, biking, snow sports
5. Entertainment attractions: theme parks, amusement parks, cinema, shopping facilities, performing art centers

Natural and heritage attractions are considered as the mainspring that drive many people travel (Lytras, de Pablos, Damrani & Diaz. 2011). Besides attractions in the destinations there are also two major issues in tourism that affect prospective tourists in determining where to travel; namely: accommodation and transportation. These three factors related each others.

2.2. The Need of GIS in Tourism Industry

The tourism industry in today era is more depending on information rather than before. Prospective tourists must be considerably needed information resources and services before, while, even after traveling. At the meantime, tourism organizer are in the need for better and powerful ways to deliver, aggregate, and consolidate data and services in order to serve up to date, accurate, complete and easy to use information to their clients. The existence of state-of-the-art information systems is increasingly perceived as a quality factor. A remarkable improvement in collecting, managing, analyzing, and manipulating data would have a deep impact that cannot be disregarded. The tourism industry has to exploit this chance for greater development.

GIS (Geographical Information System) is one of cutting-edge computer-based application for digital technology. GIS has capability for managing, analyzing, and displaying geographical data and tourism is a field that highly depends on spatial and non-spatial information from geographic world. Then for tourist, the use of GIS will be a powerful tool since GIS offers interactive, ease to use, useful tools for searching information related to the tourism destinations. The tourism authority also benefited since they can exploit GIS to develop new efficient strategies for communicating territory. The aim is to increase the destination attractiveness by providing informative contents in an exciting and innovative way. In this process, both quality of images and interactive functionalities influence the service quality of delivered touristic contents.

The following tables illustrate the functional capabilities and the tremendous potential of GIS related to the basic applications in tourism; illustrated by Bahaire and Elliot- White (1999).

Table 1: Capabilities of GIS

Functional Capabilities of GIS	GIS Basic Questions		Tourism Application
1. Data entry, storage and manipulation	Location	What is at?	Tourism resource inventories
2. Map production	Condition	Where is it?	Identify most suitable locations for development
3. Database integration and management	Trend	What has changed?	Measure tourism impacts
4. Data queries and searches	Routing	Which is the best route	Visitor management/flows
5. Spatial analysis	Pattern	What is the best pattern?	Analyze relationships associated with resource use
6. Spatial modelling	Modelling	What if ...?	Assess potential impacts of tourism development
7. Decision support			

Source: Bahaire and Elliot-White (1999), p.159 (cited in "GIS Application in Tourism Planning" by Evangelos Christou)

From tourism perspective, according to Bahaire and Elliott-White 1999, p.164 (as cited in "GIS Application in Tourism Planning" by Evangelos Christou), GIS applications can provide at least three different types of information, as follows:

1. *Tourism resource maps* enable planners and stakeholders to analyze the resource set to identify how much is available and where it is; it helps planners and managers determine the capability of an area for the creation of new tourism products or services, identifying locations suitable to tourists or tourism.
2. *Tourism use maps* enable planners and stakeholders to analyze the resource set to evaluate land use options and identify zones of conflict or complementarities, such as access points, water, wildlife habitats etc.
3. *Tourism capability maps* enable planners and stakeholders to analyze the resource set to monitor tourist resources at risk due to management, planning decisions and other sectors

2.3. The Prospect of Indonesia Tourism

The tourism industry in Indonesia has become the third most important sector that contributes to Indonesia national income, after oil and gas field and oil palm commodities. In 2010, the number of inbound tourism travel to Indonesia is amount seven million or increase 10, 74 % compare to the year before.

Nature and cultural diversity have become important attractiveness in Indonesia tourism. Locating in tropical climate, Indonesia has as many 17.508 islands which about 6.000 islands still unexplored. Indonesia is also famously known as the third longest coast line in the world after Canada and Europe. Scattered beautiful beaches in Bali, diving zones in Bunaken, spectacular views in Rinjani Mountain in Lombok,

and many national parks across Sumatra Island, are a row of well-known tourism destinations with amazing nature attractions around Indonesia. Diversity in ethnic, cultural, and heritage also make Indonesia rich of tourism objects. Prambanan and Borobudur temples, Toraja, Minangkabau, and Bali are examples of destinations which have ethnic and cultural attraction.



Image 2: Indonesia Tourism Map (source: <http://www.melali-indonesia-tours.in>)

Data from Tourism Authority of Indonesia shows there are eleven provinces the most visited tourism destinations that are Bali, West Java, Central Java, East Java, DKI Jakarta, North Sumatra, Lampung, South Sulawesi, South Sumatra, Banten, and West Sumatra. About 59% of inbound tourist traveling for recreational reason, while 38% for business.

The most inbound tourism came from Singapore and Malaysia for ASEAN region. For Asia countries, Japan is the largest inbound tourism that visited Indonesia, followed by China, South Korea, Taiwan, and India. Great Britain, France, Netherland, and Germany are in the list of European countries that the most visited Indonesia.

In order to more focus in developing the tourist destination, the central government now develop a program called Destination Management Organization (DMO) that have task to promote and manage several destination to become top destinations for tourists. The DMO targets for 2010-2014 are 15 areas: Sabang, Toba, Jakarta Old-City Area, Pangandaran, Borobudur, Tanjung Puting, Bromo-Tengger-Semeru, Batur Bali Area, Rinjani, Derawan Islands, Toraja, Bunaken, Wakatobi, Raja Ampat, and Komodo-Kelimutu-Flores.



Image 3: a) Bali; b) Komodo; c) Toraja; d) Bunaken (source: <http://indonesia.travel/id>)

3. Case Studies

3.1. GIS in China Tourism

The developing tourism industry in China show significant development in recent years. According to UNWTO, from year 2009 to 2010, tourism industry in China significantly improved. In term of visitor arrivals, China recorded 15, 5% positive increase meanwhile other countries report just one digit improvement or even stagnant. In term of receipts, China occupy fourth rank surpassing some Europe countries such Italy and UK.

China National Tourism Administration (CNTA) was appointed by government as agency in charge of China tourism and affiliated to state council with main task is to plan and coordinate development of tourism industry.

GIS already widely applied in many aspect of China tourism. Many cities and scenic zones established the digital management system to make the management to be more scientific and highly effective. GIS mainly applies in the following aspects:

- Investigation of tourism resources and the development of tourism product
- Tourism landscape planning include landscape mapping
- Spatial analysis
- Tourism information management

- Tour guide system; and so on

In China, application of GIS combine with hand-held GPS for data collection, then the data would be evaluated and integrated by the function of data management with spatial analysis of GIS. And by using statistical analysis, the development of potential of tourism resources can systematic analyzed and assessed. The result of GIS technology would be:

- Direct result that is static map. In the official web site of China National Tourist Office, one can be easily found amount of China map either general or thematic map, such as location of attraction maps, railway maps, even there is map which display clothing recommendation for travel in China, since is a very large country with different climate
- Indirect result, where GIS provide amount of database and information to be displayed on other application such as internet

Collaboration of GIS and internet significantly generate powerful tool in managing China tourism, and Chinese intensely utilized this to promote their tourism. This two collaboration create interactive ways in promoting tourism would provide prospective tourists with tourism guide system such as tourism self-service which prospective tourists can get overviews about the destination, such as the humanities, the geography, the climate, the transportation, the characteristic and so on. GIS combined with multi-media technique would provide prospective tourist with real and excellent pictures along with descriptions in a quick and convenient service, so then they can choose the best touring route.

Tourism management based on GIS already established in China, and would be developed from time to time. The multi-functional tourist service system based on GIS+GPS +GSM was established according to the new features and the new trends on the present tourist market

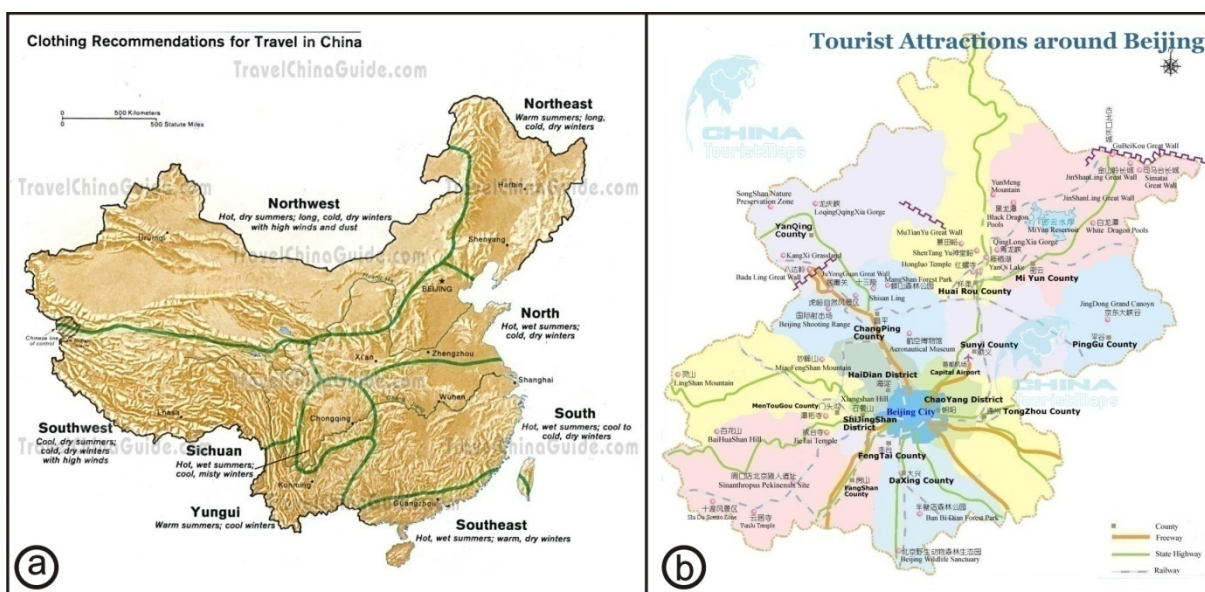


Image 4: a) clothing recommendation for travel in China (source: <http://www.travelchinaguide.com>)
 b) Tourist attraction around Beijing (source: <http://www.tourismchina.org>)

3.2. GIS in UK Tourism

The United Kingdom is one of the world's biggest tourist destinations. According to UNWTO, year-on-year UK consistently in the list of the top ten country destination in term of arrivals and receipts. Tourism in UK has a lot to benefit from using GIS technology. Management, planning, and promotion of UK tourism largely utilized GIS as the highly efficient and effective tool.

Tourism self-service geographic information system was developed using web technology combining with GIS itself. And this combination provide tourist an interactive way for inquiry and browsing scenic site. Through internet it is very convenient for tourist in inquiring information, browsing detailed landscape of scenic spot, and predetermining tourist track.



Image 5: Interactive map, combination of GIS and internet web

(Source: <http://www.visitbritain.com>)

In building GIS database, UK tourist authority focused in three fundamental sectors that very important in tourism, namely tourism destination, accommodation, and transportation.

Tourism destination in UK was classified into two categories that are by region and by tourism attraction. By region category consist of country location and cities and town location where each country or city has overviews of their tourism activity. In term of tourism attraction, they classified the destinations into three major categories which prominent in UK that are:

1. Historical and heritage destination: offering landmarks from time past such as palaces, fairytale ruin, formidable castles and ancient monuments

2. Beaches and coastal areas; including beach resorts, coastal walks, islands, coastal line
3. National parks and scenic areas; parks and areas with natural beauty like New Forest and Loch Lomond

Accommodation type in UK classified into: hotel and guest accommodation, hostel and campus, holiday villages and campsites, self-catering accommodation, and serviced apartment.

In providing information about transportation around UK, UK tourist authority coordinates and cooperates with each related transport authority. Therefore, inbound tourism can get a lot of information about many type of transportation for getting around UK.

To achieve positive growth in value, year-on-year, over the next decade, British now have a project that is Strategic Framework for Tourism in England 2010-2020. This framework and its associated Action Plan are the extensive consultation and collaboration with England tourism industry. Along with this project, the need of GIS technician and expert become very important since tourism cannot apart from spatial information and it attributes.

4. Design and Application

Generally the process of design and application will be in three steps:

1. Conceptual design
2. Data acquisition, collecting spatial and non-spatial data
3. Map digitization and creation of attribute data

The result of process:

1. Direct final products, such as thematic maps, database reports
2. In-direct final products, that would be useful for another application

4.1 Conceptual Design

Tourism destination in Indonesia can be categorized into four classes, as follows:

- Beaches and coast areas
- Cultural attractions
- National parks and scenic sites
- Historical and heritage sites

Each destination will be linked to the nearest city where airport located. Airports will be categorized into international flight airports and domestic flight airports.

The hardware that were employed for this study are mobile PC with Intel(R) Core 2 Duo @ 2,40GHz processor, Memory (RAM) of 2047 MB, Graphic Card Nvidia GeForce 8600M GT. And the software used is ArcGIS 9.3, including ArcMap and ArcCatalog.

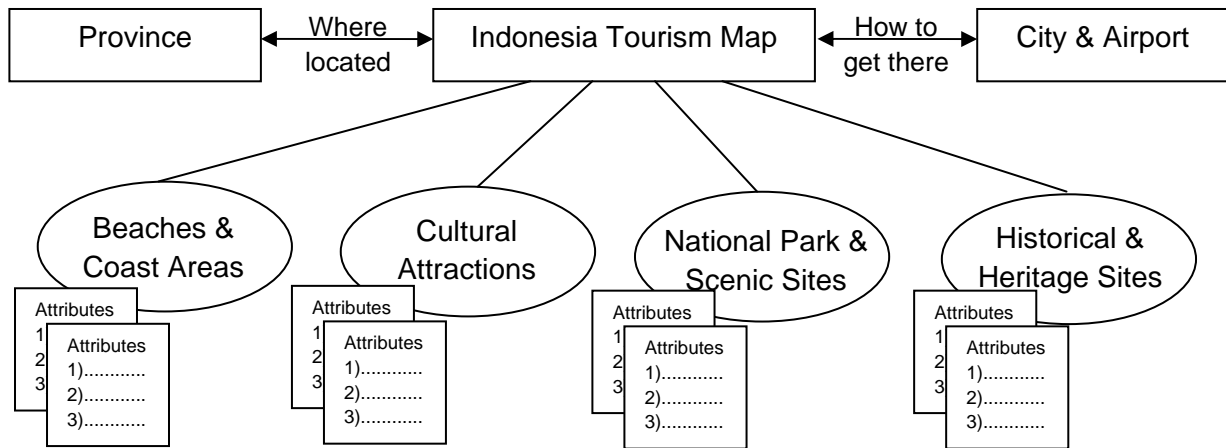


Image 6: Conceptual Design (Author)

4.2 Data Acquisition

Indonesia map as basic map of this project was taken from ArcGIS tutorial, province boundaries and airport location was primarily digitized from the image (JPEG file extension) of Indonesia Administrative Divisions Map taken from http://images.nationmaster.com/images/motw/middle_east_and_asia/indonesiadivisions.jpg (accessed on April 2012). Information about tourism destination was primarily taken from Indonesia official web-sites for tourism and other internet web sites which provide information about Indonesia tourism.

4.3 Map Digitization and Creation of Attribute Data

Digitization process:

1. The source map is a digital world map taken from “*Getting to Know ArcGIS Desktop*” CD tutorial
2. From this map, Indonesia territory was divided into provinces that structure the country, Indonesia provinces was displayed on polygon feature class
3. Determination of airport which have international and domestic flight access, displayed as point feature
4. Determination of tourist destinations, displayed as point feature. The destinations divided into four layers related to its attraction

Creation of feature layers:

No	Feature Name	Shape	Source	Attribute
1.	South East Asia Countries	Polygon	ArcGIS Tutorial	Name, Main _capital
2.	Provinces	Polygon	ArcGIS Tutorial	Name, Capital, Airport
3.	Province Boundaries	Polyline	Map from internet: http://images.nationmaster.com	Name, Capital, Airport
4.	Airport City	Point	Map from internet	Name, Type
5.	Flight Route	Line	Map from internet	Distance, From,To

6.	Beach Destinations	Point	Wikimapia web site	Name, Province, Nearest_airport, Main_attraction, Other_attraction, Transportation, Top_destination
7.	Cultural Destinations	Point	Wikimapia web site	Name, Province, Nearest_airport, Main_attraction, Other_attraction, Transportation, Top_destination
8.	National Parks	Point	Wikimapia web site	Name, Province, Nearest_airport, Main_attraction, Other_attraction, Transportation, Top_destination
9.	Historical Sites	Point	Wikimapia web site	Name, Province, Nearest_airport, Main_attraction, Other_attraction, Transportation, Top_destination

4.4. Application and Results

Indonesia is an archipelago country and this make traveling around Indonesia not easy and simple. The GIS application in tourism would be very helpful for prospective tourists to plan their trip before it begin. GIS application also might help tourism authority to manage and develop the destinations. Below are some application and result maps of the project:

Application:

- Hyperlink function to give short overview about the destination
- Determination of top destinations
- Determination of destination that accessible and connected with international airport
- Analyzing for several top destinations with limited access
- Analyzing the distribution of tourist destinations
- Flight route map, to get information of interconnection between cities

Map results:

- Tourism map of National Parks & Scenic Sites
- Tourism map of Beaches & Coastal Areas
- Tourism map of Cultural destination
- Tourism map of Heritage and Historical Sites
- Tourism map of top destinations in Indonesia
- Airports & Flight route map

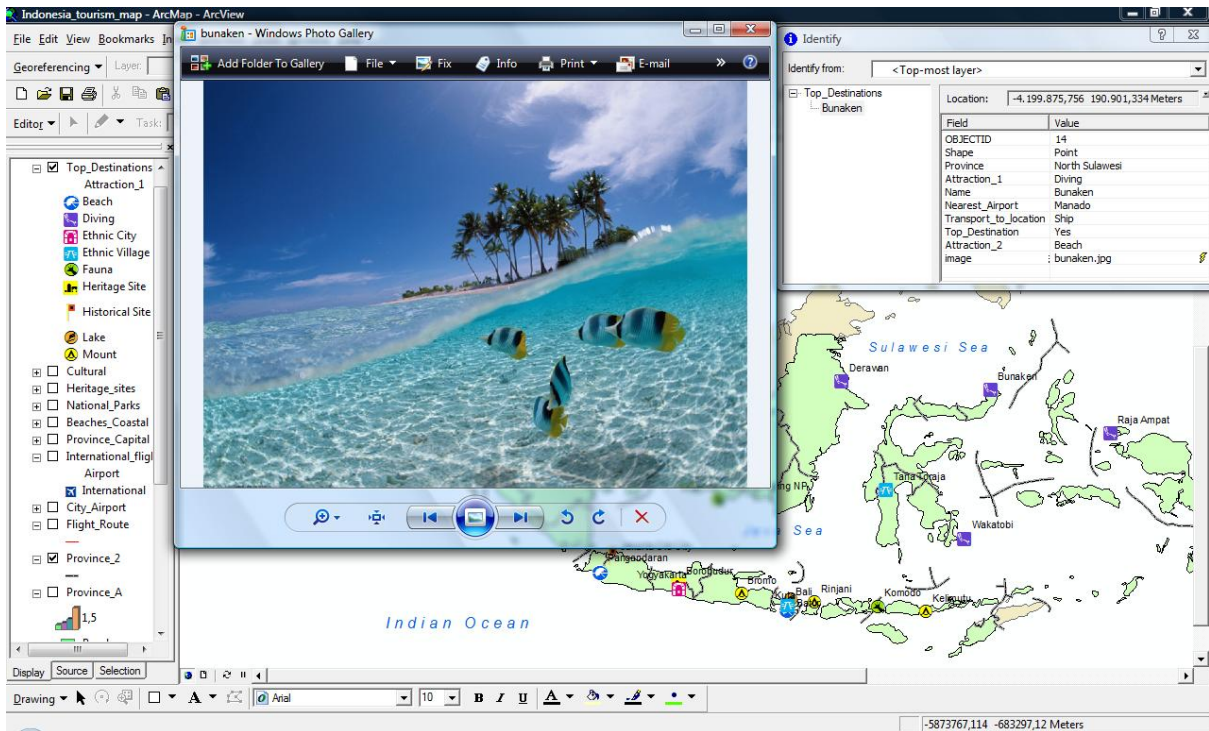


Image 7: Hyperlink feature & identify dialog box

Each destination regarded as top destination has hyperlink function to give image of attraction at the destination. Statistical analysis such as analysis of the distribution of destinations would support decision maker whether to develop better infrastructure in the region where many attractions located.

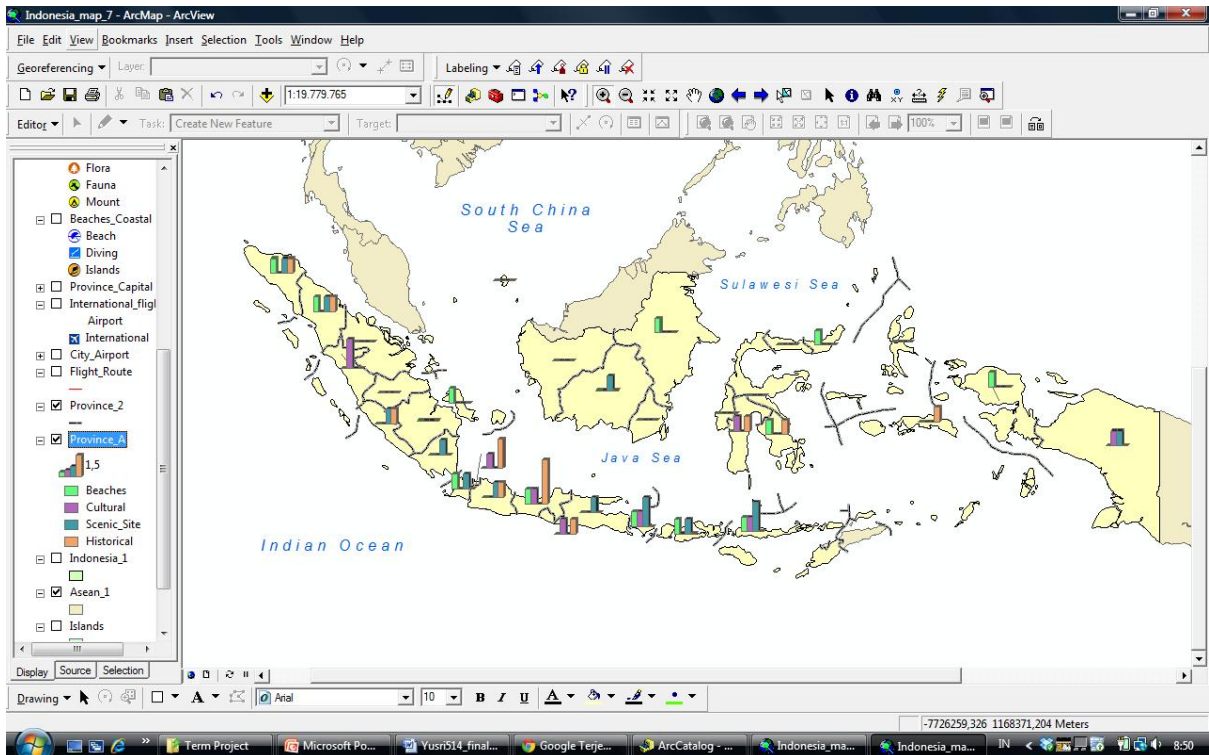


Image 8: Analysis of the distribution of tourism destinations

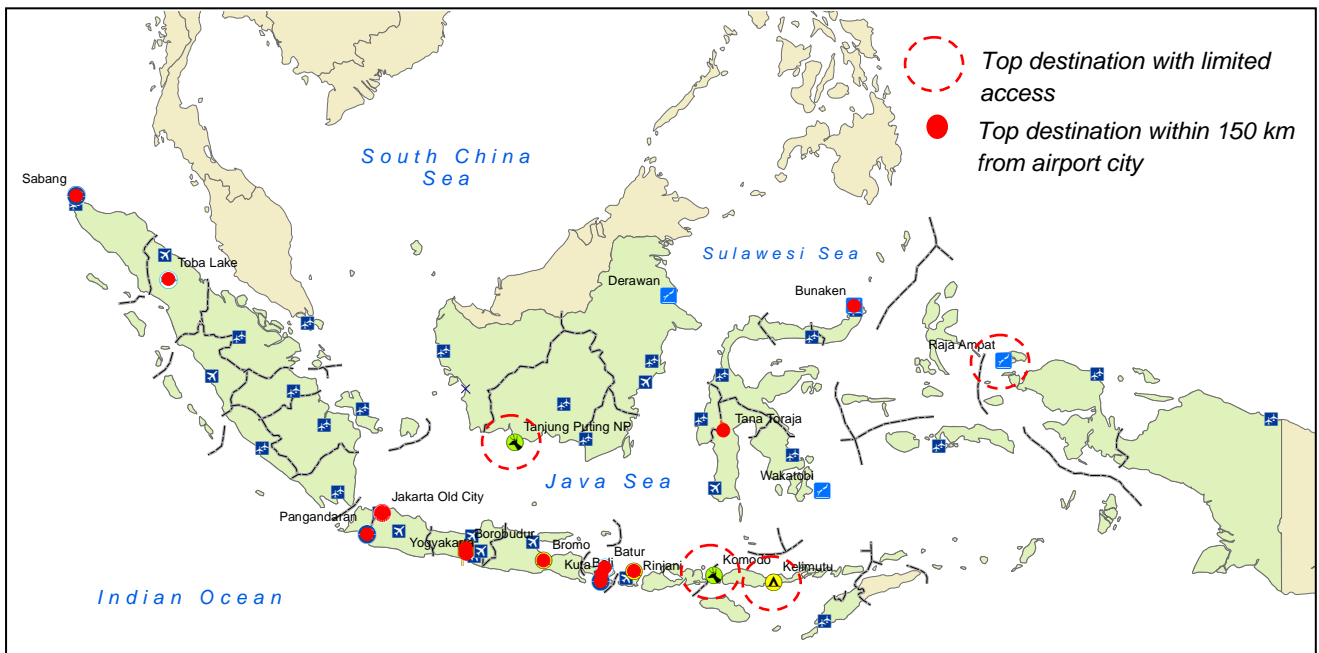


Image 9: Top Destinations with Limited Connection

Image 9 shows how GIS spatial analysis can be used to recognize which destination located within 150 km from airport city, from this analysis also, tourist authority can discover which destination have limited access, in this example there is four top destinations have limited access, then if tourist authority want to develop these destination, at least they have to consider the availability of transportaion to the destination.

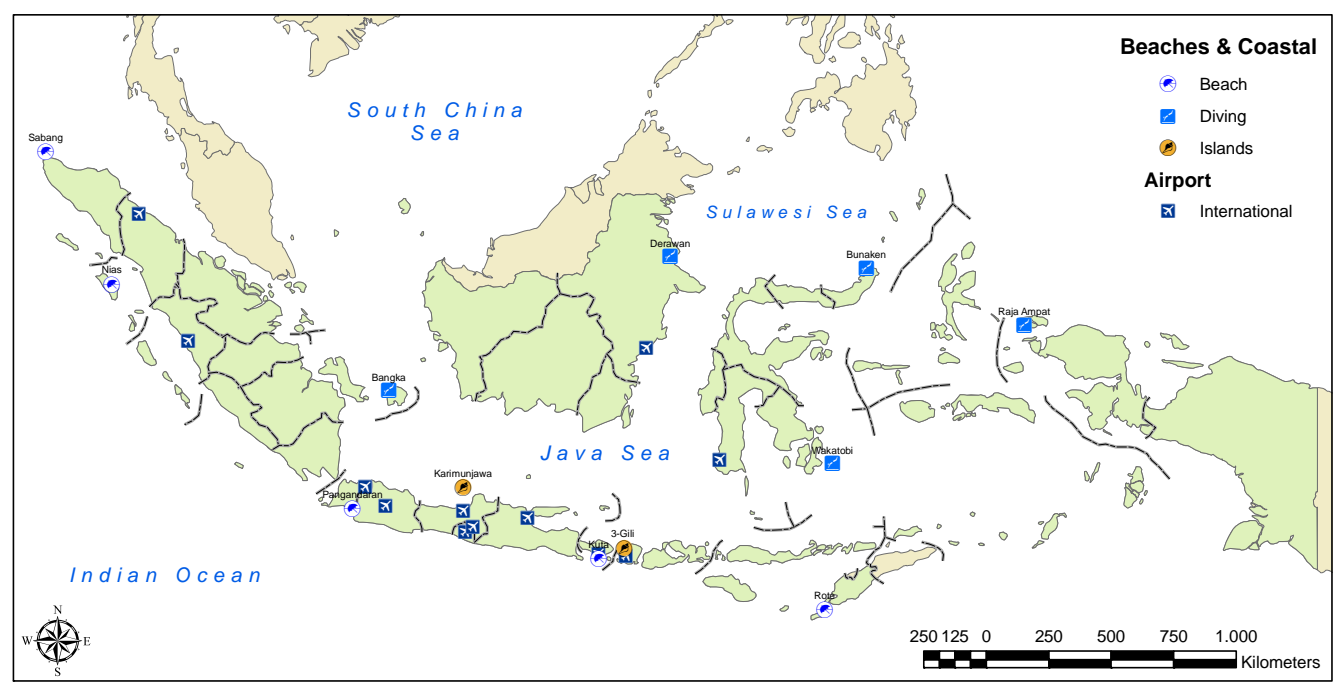


Image 10: Thematic map of Beaches & Coastal Destinations

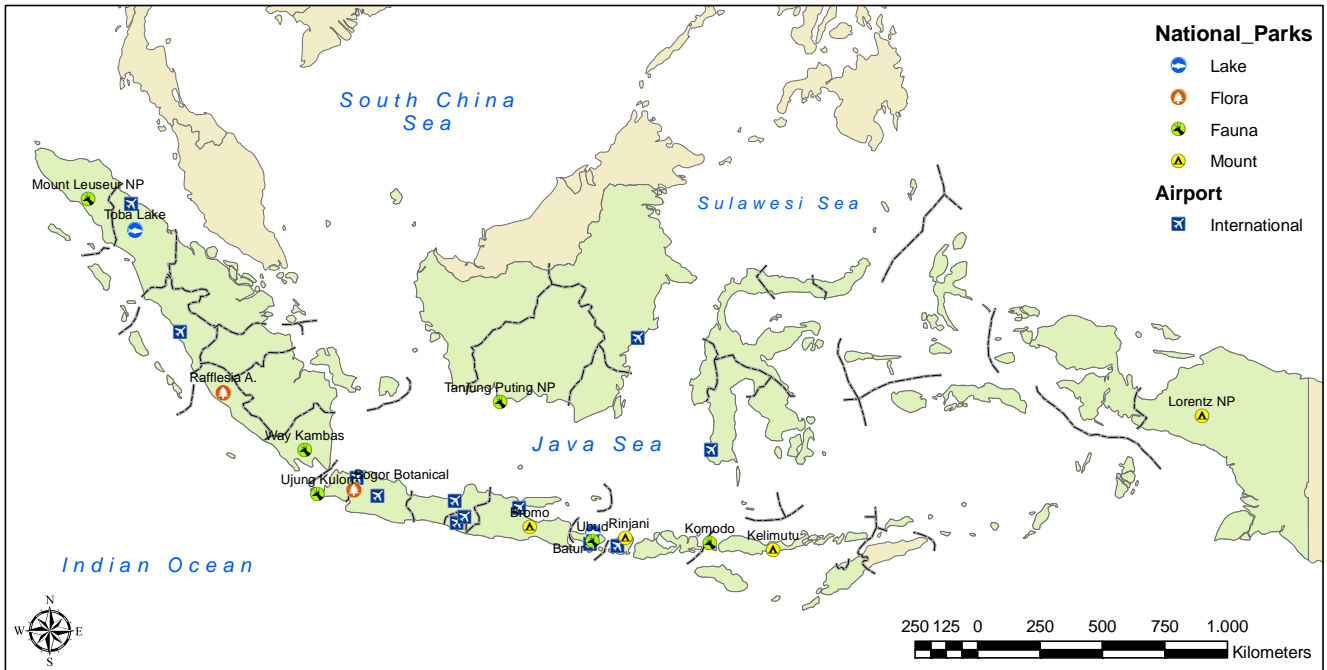


Image 11: Thematic map of National Parks Destinations

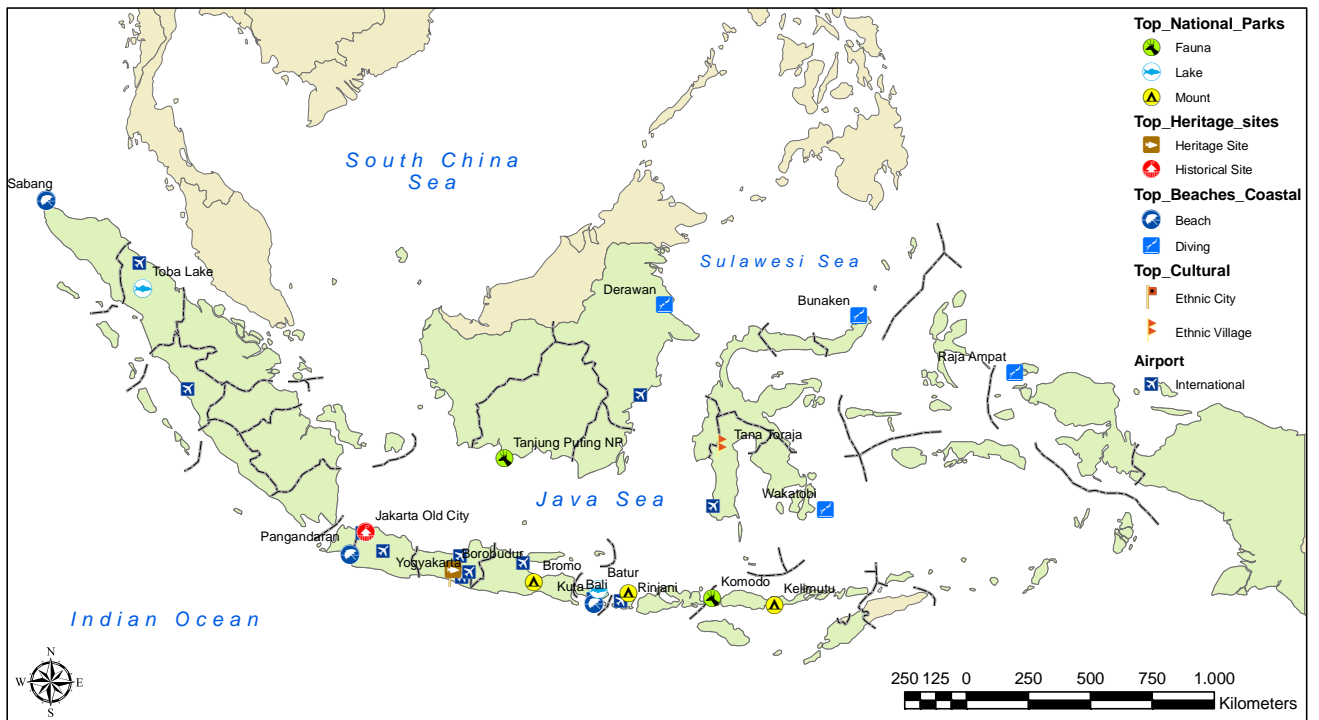


Image 12: Tourism Map of Top Destinations in Indonesia

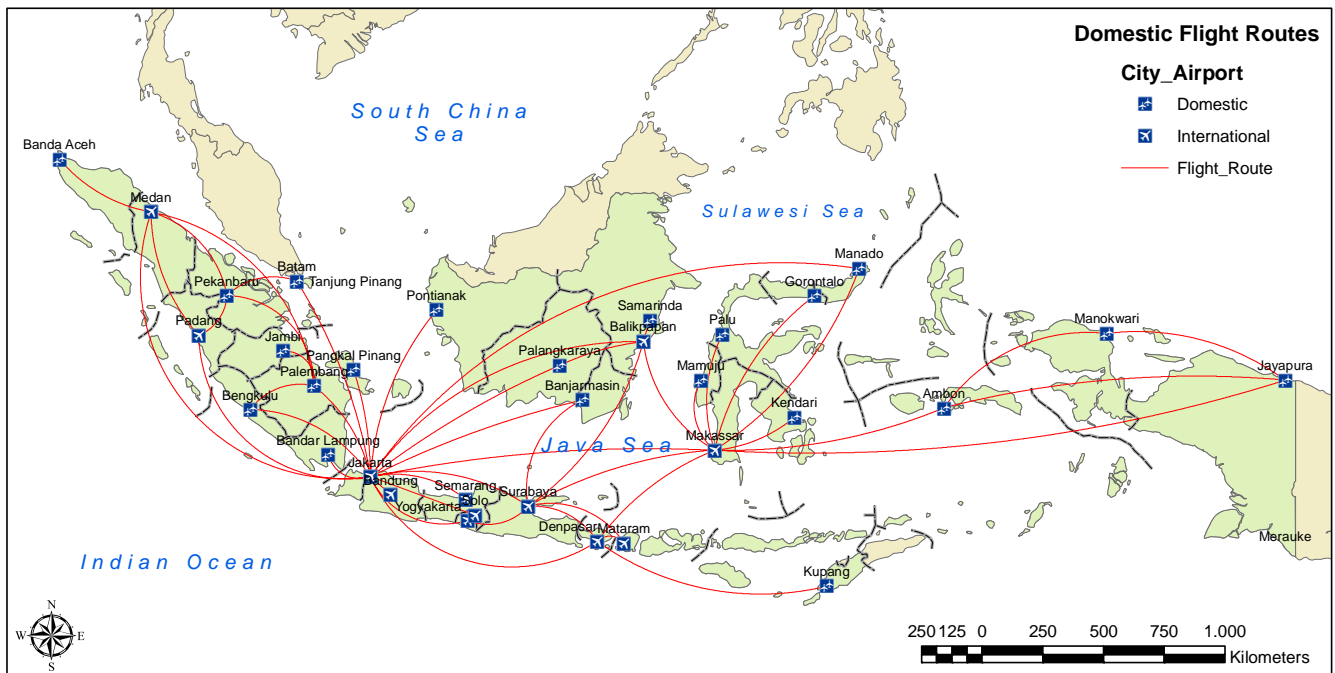


Image 13: Domestic Flight Routes Map

5. Conclusion and Recommendation

5.1. Conclusion

Unique geographical condition and long and dynamic historical background provide Indonesia of abundant and diverse tourist destinations. GIS is a powerful tool to inventory them. By using GIS, the diversity of the tourism destinations can be easily mapped and classified in digital format. The digital information of tourism activity then can be used for the development of printed maps for brochures, attraction maps and other advertising. This same information can be used to create visual references for tourism-related websites. UK and China had shows how collaboration of GIS and web-technology will make GIS more powerful for promoting tourism.

The analysis function of GIS will be very helpful for tourism development. The tourism authority can utilize GIS to identify spatial problems around destinations. For example, GIS can recognize which destination have limited accessibility. Tourists also can get information which cities have international flight and how many destination have connection with the city so they can plan their trip before it begins.

5.1. Recommendation

1. Extention of this project is needed since Indonesia has abundant resources in tourism which are still not cover here
2. Collaboration between the tourism authority, accomodation providers, and transportation departement would provide strong database for tourism development
3. Establishing national tourism information management for resource sharing
4. Developing tourism self-service GIS by collaborating GIS and web-technology

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