



APPLICATION OF GIS IN IDENTIFYING POTENTIAL SITE FOR RIVER TOURISM ACTIVITIES ALONG THE PETAGAS RIVER

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Abstract- The usage of river for tourism purpose becomes increasingly demanding. River has the potential for tourist attraction as it can showcase the scenery of the places and promote local culture. Petagas river which located in the Putatan district of Sabah, has the potential to become a tourist attraction because of its long river and situated near to some villages. With natural scenery, cultural activities and some fishing site, this place is suitable to operate river cruise tour to bring the tourists view the attraction along the river. However, the uneven surface of the river side makes it hard to build the jetty and place for the local to promote their culture and products. This problem however can be rectify using geographic information system (GIS). GIS has the capability to do slope analysis which can calculate the slope percentage of the area. Based on a digital elevation map (DEM), a slope map can be produced for the whole area of Putatan and specifically near the Petagas river. The color-coded slope map makes it easier for the user to identify the location for tourist site. Therefore, this will help the people to find places to build jetty, kiosk for the locals to sell local delicacies and traditional products. This study shows that the GIS capable to assist the local tourism by producing the slope index map which can be conducted easily with less cost, time saving and with few manpower.

Keywords: GIS, river tourism, slope index, Petagas River, tourist attraction

I. INTRODUCTION

The river is an important source of clean water for daily use. 95% of Malaysia's water supply comes from rivers and lakes. Equatorial climatic conditions that receive rainfall above 2000 mm per year in Malaysia keep Malaysia's river water resources stable. Besides, the river is also an important asset to all aspects including social, economic and natural aspects. In terms of economics, river water can supply the largest source of drinking water which is 97% of the water supply and almost all of the power stations available in Malaysia depend on the river, (Koh, 1999). In addition to that, economic activities such as agriculture, fisheries, industrial, tourism and transportation also depend on the river.

According to Widodo (2004), the maintenance of the river environment is focused on the management of river flows in coastal areas and in the water environment. Maintenance analysis can be done with changes in land use and its impact on local water quality and air quality. From time to time, residents along the Code river have increased so that the Code river is unable to provide clean water to the population as the river water has been affected (Bapedalda and Widodo, 2008). Moreover, according to the Serayu River Opak Center (2008), under the Water Resources Act No.7 of 2004, the Code river management and development strategies have been emphasized in five aspects: water resource conservation, water resource use, water damage control, empowerment and community role enhancement, the private and government sectors and the openness and availability of water resources and data. Therefore, the balance of the river as a tourist destination depends on the management by the responsible parties. According to King (1993), there are many economic benefits of ecotourism such as development in the rural areas and increasing the income of the locals.

The river provides water sources, water transport, and water tourism destinations. The river is also an important element of space in the landscape and is an important source of tourism (Fachrudin and Lubis, 2016). Physical aspects, natural resources, and social environment are key attractions for tourists (Soemarwoto, 2001). The development and promotion of water tourism will give a positive impact on the social and cultural aspects. Therefore, the maintenance of river cleanliness is important, and preservation of natural resources is essential. There are well known river tourism products and services in Asia region, for example, riverboat cruises in China, Thailand, Vietnam, Singapore, Penang, Melaka and Sarawak.

Figure 1, 2 and 3 below show the example of river cruise in Malaysia and Singapore as one of the activities in river tourism.



Figure 1: River Cruise in Kuching, Sarawak



Figure 2: Melaka River Cruise



Figure 3: Singapore River Cruise

River tourism literature documents are increasingly popular in various parts of tourism (Fachrudin and Lubis, 2016). At the same time, the public needs to understand the importance of potential river views to handle tourism such as river cruises. The communities that live along the river play an important role in developing and promoting river tourism. In fact, locals need to be given an understanding of the importance of tourism activities based on the river environment and what needs to be done to support these activities. In addition, the local community should acquire the knowledge and skills needed to operate and manage river tourism products and services in a sustainable way through relevant training programs and workshops.

Many of the rivers in Sabah have the potential to be developed and promoted as river tourism sites and offer a variety of ecotourism packages and services. In particular, the pristine environment along the river provides authentic scenery and range of wildlifes as well as local culture and heritage. In general, river tourism in Sabah is not developed and promoted. There seems to be little recognition of the role of rivers

in tourism as well as the involvement of local communities in river tourism is still questionable. Hence, the research aims to address these gaps and focus on the Petagas-Putatan River as a research area. Petagas-Putatan River is located close to Kota Kinabalu city and is easily access. Also, the state government has shown great interest to improve the condition of the river and develop relevant tourism activities along the river.

The objectives of this study are to explore the key potential tourism sites and products along Petagas-Putatan River and recommend the suitable tourism sites and products as river tourism products by using GIS application.

Putatan District Background

The Putatan name is derived from the Putat tree. This tree grows around swamp water. Putatan is the 25th district in Sabah. Putatan has a total area of 169 sq. Km and an area of 30 km. In total, the total area of Putatan is 199 sq km. The district was gazetted as a small district in the Penampang area on March 18, 1997 and was gazetted as a full district on March 1, 2007. According to the 2010 census, the population of Putatan is 55, 864 where the Bajau ethnic group dominated the area. The figure 4 as follow shows the location of the Petagas river in Putatan.

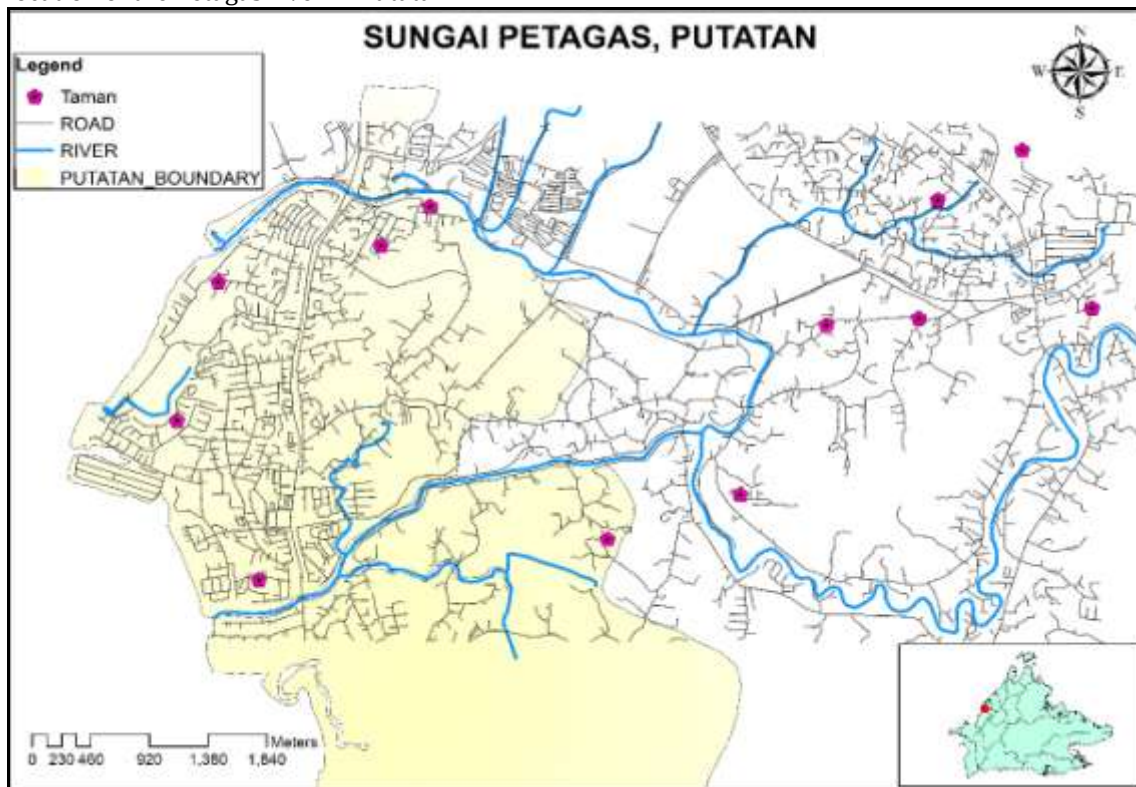


Figure 4: Petagas River, Putatan

Villages near The River Background

There are four villages near the river's background namely Kampung Petagas, Kampung Contoh Petagas, Kampung Tengah Padang, and Kampung Muhibah. Each village has its own attractive place and infrastructure as listed in table 1 below.

Table 1: Attractive place & infrastructure in each village.

Name of Village	Attractive place & Infrastructure
Kampung Petagas	- Bumbu Ihsan & MM Katering
Kampung Contoh Petagas	- Q Kitchen - Eagle Tea House - Gerai Mak Siti Putatan - Vsecret Garden - Sri Pandan Homestay

	<ul style="list-style-type: none"> - Lamdin Resort - Kota Kinabalu Homestay - Azah & Afif Urban Stay - Al-Firdaus Mosque - BCCM Petagas
Kampung Muhibah	<ul style="list-style-type: none"> - Palm tree - Jetty - Fishing site - Nur Al Jannah Mosque - Multi Bake - Kuih Tradisional Kak Yah - 1 Malaysia Internet Center - Warung Gila - Amirkhan Malakand Restoran - Sri Muslim Restaurant - Dapur Shikeen - Islamic II Restoran - Penyet - Jumbo Petagas Guesthouse - Azneal @ Gee Homestay - Christie Guesthouse
Kampung Tengah Padang	<ul style="list-style-type: none"> - Coconut Tree - Paddy Field - Jetty - Palm Tree - Market Site - Red Cakes & Cup Cakes

River Issue

The Petagas river is a river in the village of Petagas, Putatan. The Petagas river connects to the Moyog river and the Putatan river in Penampang Sabah. The Petagas river today is polluted. This situation is driven by an irresponsible party dump the trash and waste from industrial materials to the Petagas River and this causing the river to become polluted (Daily Newspaper, 2012). Regarding this, the sustainability of the Petagas river has not been developed due to pollution. The Petagas river is polluted because of the activities of the residents who built a house along the Petagas river which was not suitable for a settlement. In addition, residents living in the Petagas river area have low levels of awareness in environmental protection.

As a result, polluted rivers cannot be used by the community for daily activities. The Petagas River has deteriorated due to erosion, sedimentation, and pollution. Problems arise from the human attitude of the river as an easy way to dispose of waste. This has severed the relationship between the community and the river as the river can no longer be used by the community for various activities such as bathing, washing, fishing, and recreation. The use of rivers is currently limited to its function as a transportation route only (Sulong et al., 2005).

However, the river has a lot of potential that can be developed as river tourism. This can help increase the socio-economies of the local communities. By identifying the type of tourism attraction and its suitable location, this would greatly help the locals to plan and setup their business easily. Therefore, the usage of GIS to for this is necessary as it can help identify the type and suitable location for the tourism attraction along the Petagas River accurately. This study will show how the type of river tourism potential attraction was identified and the way the application of GIS using slope analysis was conducted.

River Tourism Potential

During site observations of the area. there are several locations that can be found potentially to be an attraction along the Petagas river. Some of them are restaurants, fishing huts, coconut trees, resting

cottage, mangroves trees and jetties. All these can become the potential location for river tourism. The details description of the place are as follows.



Figure 5: Coconut tree

Coconut trees can be found a lot along the Petagas river as shown in figure 5. This can help boost the economy of the villagers as they can sell the coconut fruits to provide refreshments for the tourists.



Figure 6: Restaurant

The restaurant in the area can be a good place for the visitor to stop by and have lunch or dinner. The place (as shown in figure 6) for now are not in good condition but it can be a potential attraction for tourist if the river can be developed as river tourism. This place also can be a good location for the locals to showcase its culture especially the Bajau dance.



Figure 7: Cottage beside palm tree.

The cottages in the area serves as a place for those who wants to do fishing (figure 7). The river produces a lot of fish and each day the locals will gather in this place for fishing activities.



Figure 8: Jetty

In figure 8, this place can become a jetty or a stopping point for the river cruise. This site can also become a place to set-up kiosks to sell the traditional delicacies and local handicrafts to the visitors or tourists that ride the river cruise.



Figure 9: Mangroves

Petagas river provide a lot of mangroves trees that serve as habitats for the animals at the river (figure 9). It produces food for the fishes and birds around the place.



Figure 10: Boat services

There are many boats own by the local in the area for fishing and as a mean for transportation in the area. Some of them provide sight-seeing ride for the visitors or tourists to view the places of attraction along the river. Figure 10 shows the type of boat that can be used by the local or tourism department.

Geographic Information System (GIS)

GIS is a computer-based system for the purpose of capturing, storing, analyzing and presenting spatial or spatial data (Rosmadi Fauzi, 2015). In addition, GIS can provide a framework for integrating data from a variety of sources and time as a space analysis tool. World phenomena are represented in the form of symbols using computers. In GIS there are only two types of data models that can form databases namely vector and raster data models (Ang Kean Hua, 2015). Each item in the GIS database is represented by various forms such as points, lines, and polygons that represent an area or zone (Debats and Gregory, 2011).

Application of GIS in Tourism

Geographic Information System (GIS) offers opportunities for the development of tourism using maps and its used to provide attractions map, a digital map, digital files for internet mapping, and digital files for mobile mapping (Verka Jovanovic and Angelina Njegus, 2008). Usually, tourism planning refers to the integrated planning of attraction, service, and transportation facilities. Hereby, GIS can describe and identify tourism infrastructure elements geometrically, thematically and topologically (Bas Boers & Stuart Cottrell, 2007).

In addition, GIS can make it possible for resources managers to perform queries and analysis on large volume of spatial and non-spatial data. GIS can make it more accurate and faster than manual analysis. In this case, GIS can help to create awareness to tourist centres and improve the management of the tourism industry (J.T. Fadahunsi, 2011).

In Pannee Cheewinsiriwat (2009) study, it said that GIS application used to produce the maps of tourist attractions and ethnic groups of Nan Province in Thailand. GIS database had been set up by combining map layers from several sources such as administrative boundaries, roads, rivers, contour lines, and associated locations of the villages. Then, it could be used to help the tourists.

Before this, tourism industry used the traditional map and distributed the information through the different sites in the web. However, there were several problem using the traditional map because it was static and expensive to keep it up to date. Besides, it is more difficult to use the sites in the web because of the widespread tourist information. Therefore, GIS is one of the best way to solve this problem as it can produced the map that able to show a large amount of tourism information which is always up to date and the tourist also can use the different sets of information from a map (Bederiana Shyti and Evis Kushi, 2012).

Last but not least, in Malaysia, GIS technology used in developing a database and analyzing data associated with the tourist accommodations in the east coast states of Malaysia, namely; Pahang, Terengganu and Kelantan. The results from this study helps tourist to know where the lodging, road networks, and tourism products. Besides, this study will help the managers to improve the strategies for the future of the tourism industry in the study area (Abdul Ghapar Othman, 2010).

Digital elevation modelling (DEM) for slope mapping

Digital elevation model (DEM) is the most common digital data of the shape of the earth's surface (ESRI, 2020). This data is used as input to quantify the characteristics of the land surface. In other words, a DEM is a raster representation of a continuous surface, usually referencing the surface of the earth. DEM is capable in producing the slope mapping of the study area using GIS application.

The slope analysis in GIS capable to calculates the maximum rate of change between each cell ad its neighbors. The lower the slope value indicates the flatter the terrain. Otherwise, the higher the slope value, the steeper the terrain. The slope can be calculated as either a percentage slope or degree of slope. In this study, the slope area will be categorized into different class of degree (as shown in figure 11). This will be useful for the people or the authority to manage the location of the tourism site near the Petagas river.

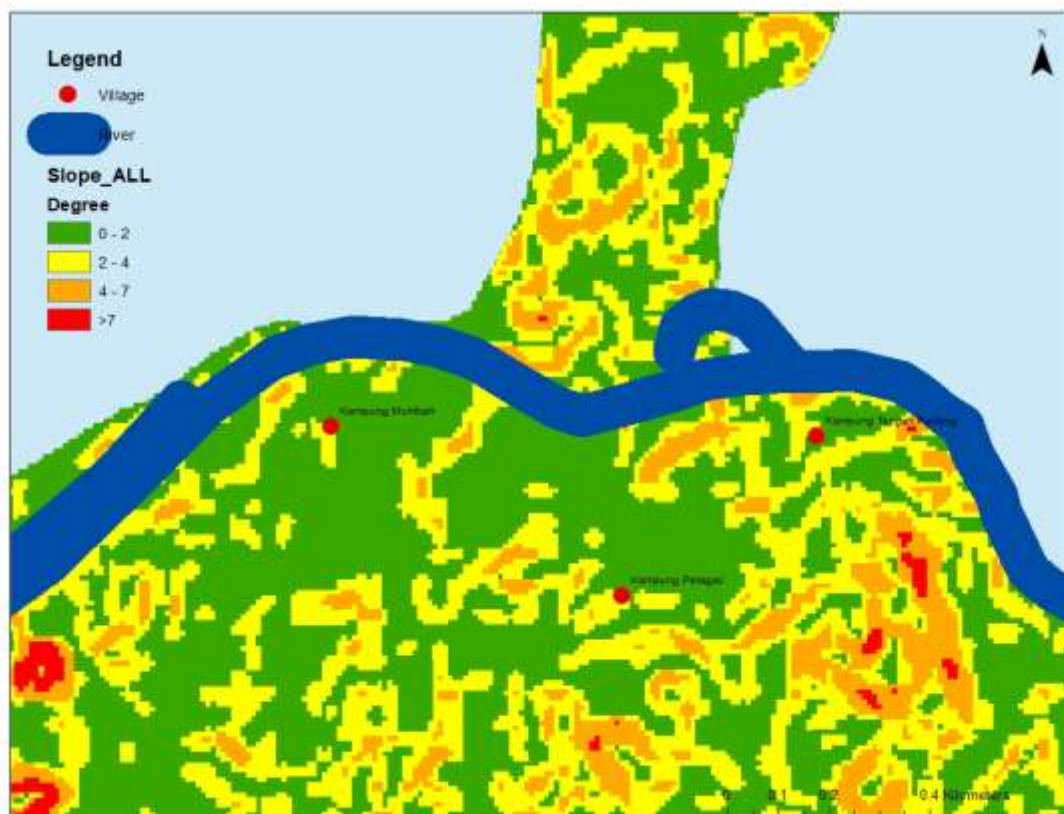


Figure 11: Slope degree near the petagas river

Mapping of potential tourism site location based on slope analysis

The potential tourism site near the Petagas river area can be identified by selecting the site near the river in which has flat land or less steep. Based on the slope output produced from the DEM analysis, the area in which the slope value estimated around 0-2 or 2-4 degrees slope can be considered as suitable for most tourism site location. The green and the yellow colored area indicate that the place is flat or less steep with 0-2 and 2-4 degrees respectively. While the orange and red colored areas are very steep with 4-7 and more than 7 degrees slope respectively but it still suitable for certain tourism site location.



Figure 12: Potential river tourism site location based on slope degree in Petagas

Based on the analysis output in figure 12, the tourism site of food kiosk, fishing site, agriculture and jetty can be identified. Since the Food kiosk, fishing site and Jetty require flat land (green area), therefore the designated tourism site can be placed accordingly in the green area as shown in figure 12 above. For the agricultural activities, this tourism element can be placed on the orange area which have slope. Other than that, river cruise stopping point also needed for the river cruise to make a stop for the tourist to buy the handicrafts and local food and taking pictures of the area near the river.

Therefore, with this map as a guide, the local and the authority will be able to promote the culture, food and nature of Petagas to the tourist with the river as the attraction. River tourism will surely boost the economy of the area.

II. CONCLUSION

This paper shares the researcher's experience on the field to obtain the information which has the potential for tourism attraction along the Petagas river. The study shows that Petagas river has a lot to offer as it has plenty of coconut trees, full of mangrove trees that has potential to become fireflies habitat, boat services that can provide sight-seeing tour for the tourist, fishing spot and places for kiosk that selling local delicacies and souvenirs. Therefore, the use of GIS is important to identify the tourism potential sites and its products that can be developed as river tourism products. This is considered as a novel approach instead of just focus on resource audit. The mapping of tourism sites offers a better way to plan and develop river tourism products. Simply this approach examines the degree of slope along the river which is crucial in this context. Finally, the usage of GIS can also help the locals to identify the tourism attraction easily with less cost, less manpower and less time.

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