

ASSESSMENT OF INDIGENOUS COMMUNITY SOCIAL-ECONOMY
SUSTAINABILITY USING GEOGRAPHICAL INFORMATION SYSTEM

NORDHALIA BINTI MUSTAFA

A thesis submitted in fulfilment of the
requirements for the award of the degree of
Master of Philosophy

Faculty of Built Environment and Surveying
Universiti Teknologi Malaysia

APRIL 2019

DEDICATION

This research is dedicated to my beloved mother and my late father

Norazizian Binti Muhammad and Mustafa Bin Mohamad

My Beloved and Caring Husband

Azlan Bin Mohd Khalid

and my siblings

Mohd Mokhzani Bin Mustafa and Nurul Fathira Binti Mustafa

*Thank you for your love and supporting me in my study
Thanks to all my colleagues that always help me in everything I do.*

ACKNOWLEDGEMENT

In preparing this research, I was in contact with my supervisor and also academicians. They have contributed towards my preparation of this research thesis. With sincere, I really want to show appreciations to my beloved supervisor, Dr.Othman Bin Zainon who support me and always convince me to finish my research. Thanks for his guidance, advice and motivation that lead me to finish this thesis. Thanks also for his time that had already spend for me.

My sincere appreciations extend to my beloved mother, Pn. Norazizian and my family as well as my beloved husband, Azlan Bin Mohd Khalid who always support me, give motivation and also spent their money. Their advices always accompany me while finishing this research. I would also like to recognize my teammates, Shazwani Binti Mohd Shah and others for their support and also motivation. Their help and kindness are valuable indeed.

I am also indebted with UTM for providing public utilities. I want to express much appreciation to all staff of Ukur Kadaster dan Kejuruteraan Laboratory for guidance and assistance while collecting the data in the field. Unfortunately, it is not possible to list all people that had helped me a lot in this limited space. However, I am really grateful to who had helped me a lot.

ABSTRACT

The rapid growth of Information and Communication Technology (ICT) as well as a country's modernization and application of Geographical Information System (GIS) is considered as a way forward to hasten the social-economic development of indigenous communities. An indigenous community in Royal Belum State Park lives in the rural area and refuses to be part of the development intervention. Besides, due to the limited of information about the indigenous community and absence of a large-scale map of their settlements within Royal Belum State Park, infrastructure developments of among them are difficult to identify. It is expected that the latest technology can help the authorities to monitor the development for this community. Thus, this research developed a spatial database system which composed of spatial information and attributes such as demographic information with functioning tool, descriptive analysis and query functions. In the research, User Requirement Analysis (URA) was conducted by distributing the questionnaire to 50 relevant agencies. Spatial data were collected using surveying techniques whereas attribute data were collected using survey form. A database system was developed using GIS software and the web-based system was developed using PHP, JavaScript, HTML, CSS and PostgreSQL. Next, the system was validated using questionnaire distributed to 20 agencies and 30 public users who will use the system. The result showed that 72% (n=36) of respondents strongly agreed and 28% (n=14) of respondents agreed that the web-based system is functioning well and enables data management purpose. As conclusion, the findings have shown that the spatial database can facilitate the assessment of social-economy indicators and provide larger scale mapping for agencies involved in future development planning.

ABSTRAK

Perkembangan pesat Teknologi Maklumat dan Komunikasi (ICT) serta pemodenan dan aplikasi Sistem Maklumat Geografi (GIS) negara dianggap sebagai satu langkah ke depan untuk mempercepatkan pembangunan ekonomi sosial masyarakat orang asli. Masyarakat orang asli di Taman Negeri Royal Belum tinggal di kawasan pedalaman dan enggan menjadi sebahagian daripada campur tangan pembangunan. Selain itu, disebabkan oleh maklumat yang terhad tentang masyarakat orang asli dan ketiadaan peta berskala besar di penempatan mereka di Taman Negeri Royal Belum, perkembangan infrastruktur di antara mereka sukar dikenal pasti. Adalah diharapkan teknologi terkini dapat membantu pihak berkuasa untuk memantau perkembangan masyarakat ini. Oleh itu, kajian ini membangunkan sistem pangkalan data spatial yang terdiri daripada maklumat spatial dan atribut seperti maklumat demografi dengan alat fungsi, analisis deskriptif dan fungsi pertanyaan. Dalam kajian ini, Analisis Keperluan Pengguna (URA) telah dijalankan dengan mengedarkan soal selidik kepada 50 agensi yang berkaitan. Data spatial dikumpulkan menggunakan teknik pengukuran manakala data atribut dikumpulkan menggunakan borang tinjauan. Sistem pangkalan data telah dibangunkan menggunakan perisian GIS dan sistem berasaskan web telah dibangunkan menggunakan PHP, JavaScript, HTML, CSS dan PostgreSQL. Seterusnya, sistem ini telah disahkan menggunakan borang soal selidik yang diedarkan kepada 20 agensi 30 pengguna awam yang akan menggunakan sistem tersebut. Hasil menunjukkan bahawa 72% (n=36) responden sangat bersetuju dan 28% (n=14) responden bersetuju sistem berasaskan web berfungsi dengan baik dan membolehkan tujuan pengurusan data. Kesimpulannya, penemuan telah menunjukkan bahawa sistem pangkalan data spatial dapat memudahkan penilaian penunjuk sosial-ekonomi dan menyediakan pemetaan berskala lebih besar untuk agensi yang terlibat bagi perancangan pembangunan masa depan.

TABLE OF CONTENTS

	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xi
	LIST OF FIGURES	xii
	LIST OF ABBREVIATIONS	xv
	LIST OF APPENDICES	xvi
CHAPTER 1	INTRODUCTION	1
1.1	Background of Study	1
1.2	Problem Statement	3
1.3	Aim and Objectives	5
1.4	Research Questions	5
1.5	Scope of Study	6
	1.5.1 Study Area	6
	1.5.2 Indigenous Community Sustainability	7
	1.5.1 Software	9
	1.5.1 Hardware	9
1.6	Significance of Study	9
1.7	Research Methodology	10
1.8	Thesis Outline	12
CHAPTER 2	LITERATURE REVIEW	15
2.1	Introduction	15
2.2	Royal Belum State Park	16

2.3	Indigenous Community	20
2.3.1	Ethnic of Indigenous Community	22
2.4	Social-economy Sustainability	25
2.4.1	Indicator of Social-economy	27
2.4.2	Factors Influencing Rural Community towards Sustainability	29
2.4.2.1	Demography	30
2.4.2.2	Economic Structure and Performance	30
2.4.2.3	Accessibility: Distance from Urban Areas	31
2.5	Geographic Information System (GIS)	32
2.5.1	Application of GIS for Indigenous Community	34
2.6	Summary	37
CHAPTER 3	RESEARCH METHODOLOGY	39
3.1	Introduction	39
3.2	Preliminary Study	41
3.2.1	Literature Review	41
3.2.2	Study Area	41
3.2.3	Software and Hardware	42
3.3	User Requirement Analysis (URA)	42
3.4	Database System Design	43
3.4.1	Conceptual Design	43
3.4.2	Logical Design	45
3.4.3	Physical Design	46
3.5	Data Collection	47
3.5.1	Spatial Data	47
3.5.2	Non-Spatial Data	48
3.6	Development of Database and Web System	53
3.6.1	Data Processing	53
3.6.2	Data Inserted	57
3.6.3	Development of Web System Interface	59

3.6.3.1	Interface Design	60
3.7	Validation System	65
3.7	Summary	65
CHAPTER 4	RESULTS AND ANALYSIS	67
4.1	Introduction	67
4.2	User Requirement Analysis	67
4.2.1	The Existing Data Storage	68
4.2.2	Database System	70
4.3	Social-economy Indicators	74
4.4	Database System	75
4.5	Web-base System of Indigenous Community	76
4.5.1	Royal Belum	77
4.5.2	Indigenous People	79
4.5.3	Tradition Culture	79
4.5.4	Indigenous People in Royal Belum	80
4.5.5	Database System Indigenous Community	81
4.6	Social-economy Assessment for Indigenous Community Sustainability	84
4.6.1	Economy Performance	84
4.6.2	Demography	86
4.6.3	Education	88
4.6.4	Health	89
4.6.5	Social Capital	90
4.7	User Feedback Analysis	91
4.7.1	Web-based System	92
4.7.2	Database System	96
4.8	Summary	100
CHAPTER 5	CONCLUSION AND RECOMMENDATIONS	101
5.1	Introduction	101
5.2	Conclusion	101
5.2.1	Advantages of Web-based System	103

5.2.2	Disadvantages of Web-based System	104
5.3	Recommendation	105
REFERENCES		107
APPENDICES		113
LIST OF PUBLICATIONS		121

LIST OF TABLES

TABLE NO.	TITLE	PAGE
Table 1.1	Research methodology frameworks	11
Table 2.1	The Belum-Temenggor surrounding events for protection (Schawabe <i>et.al.</i> , 2014)	17
Table 2.2	Ethnics of indigenous peoples in malaysia, 2008 (jako, 2012)	23
Table 2.3	Subgroups of Indigenous Minorities of Peninsular Malaysia (JAKOA, 2013)	24
Table 2.4	Indigenous Subgroups in Belum-Temenggor, Perak (JAKOA, 2013)	25
Table 2.5	Rural vitality measures based on dependent variables (Laura, 2012)	29
Table 2.6	Summary of previous research studies	36
Table 3.1	Logical design for entity	45
Table 3.2	Physical design of database system	47
Table 3.3	Survey form	47
Table 3.4	Survey equipments used in this study	50
Table 3.5	Supported equipment used	51
Table 3.6	Coordinates used for control points	56
Table 3.7	Software specification used for the web system	62
Table 4.1	Final indicators of social-economy influencing the sustainability	74
Table 4.2	Menu description for the web system	77

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
Figure 1.1	Research study area (WWF Malaysia, 2007)	7
Figure 1.2	Hierarchy of rural community vitality (Cook <i>et al.</i> , 2009)	8
Figure 2.1	Map of Royal Belum (WWF Malaysia, 2007)	18
Figure 2.2	Indigenous Peoples and Locations (Alberto, 2004)	22
Figure 2.3	Male and Female Ethnic's faces (JAKOA, 2014)	23
Figure 2.4	Conceptual Models for Community Vitality (Katherine, 2010)	26
Figure 2.5	Development of community's profile using GIS (Hanina <i>et al.</i> , 2012)	34
Figure 3.1	Indigenous community assessment process	40
Figure 3.2	Components of the database design (Klien, 2012)	43
Figure 3.3	Entity relationship diagram	44
Figure 3.4	Maps covered the area of RBSP	48
Figure 3.5	Location of GPS points	52
Figure 3.6	Fieldwork survey within indigenous settlements	52
Figure 3.7	Detail data of indigenous settlement exported into AutoCAD software	54
Figure 3.8	Georeferencing process.	55
Figure 3.9	Control points inserted	55
Figure 3.10	Georeferencing maps of RBSP	57
Figure 3.11	Layers content in the database system	58
Figure 3.12	Attribute data for spatial feature	59
Figure 3.13	Interface design of database system	61
Figure 3.14	Table created for database development	63
Figure 3.15	Interface development for the indigenous community web system	64
Figure 4.1	The existing format of data storage	69

Figure 4.2	Time taken to seek information	69
Figure 4.3	The response item towards the understanding about the database system	70
Figure 4.4	The response item towards the development of database system for indigenous community	71
Figure 4.5	The response item towards the information needed to display in the database system	72
Figure 4.6	The response item toward the function needed in the development of an interactive map	73
Figure 4.7	The response item towards the frequency of the staff update the database	73
Figure 4.8	Final output of Spatial Database	75
Figure 4.9	<i>Pengenalan</i> interface	78
Figure 4.10	<i>Peta Royal Belum</i> interface	78
Figure 4.11	<i>Suku Kaum Bangsa</i> page	79
Figure 4.12	<i>Pengenalan</i> interface page	80
Figure 4.13	<i>Kemudahan Masyarakat</i> page	81
Figure 4.14	Login window	82
Figure 4.15	Main interface for <i>Kampung Sungai Tiang</i> to be selected	82
Figure 4.16	The functionality of database system	83
Figure 4.17	<i>Tanmbah Maklumat</i> interface	83
Figure 4.18	Economy performances for indigenous community within two indigenous settlements	85
Figure 4.19	The statistical analysis of demography indicator for both settlements	87
Figure 4.20	Total Student in Primary School over 10 years	89
Figure 4.21	Health status of Indigenous community in RBSP	90
Figure 4.22	Percentage of indigenous community's religious	91
Figure 4.23	Information provided in the web-based system	92
Figure 4.24	Interface of the web-based system	93
Figure 4.25	Web-based system navigate	94
Figure 4.26	Images quality used	94

Figure 4.27	Interactive map	95
Figure 4.28	Functionality of the developed system	96
Figure 4.29	Data provided in the database system	96
Figure 4.30	The response item towards the graphic used in Database	97
Figure 4.31	The response item for the database functionality	98
Figure 4.32	The response item towards the database update	98
Figure 4.33	The response item on the social-economy assessment	99
Figure 4.34	The response item for the management purpose	100

LIST OF ABBREVIATIONS

CSS	-	Cascading Style Sheets
GIS	-	Geographical Information System
GPS	-	Global Positioning System
HTML	-	Hypertext Transfer Protocol
JAKOA	-	Jabatan Kemajuan Orang Asli
PTNP	-	Perbadanan Taman Negeri Perak
RBSP	-	Royal Belum State Park

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix A	User Requirement Analysis	113
Appendix B	Validation for Web-Based System	117

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Indigenous community is a minor community living in the Peninsular Malaysia. The majority of them live in the rural area especially within forest area and generally, they still practice a way of life which is heavily influenced by traditional natural and cultures from generation passed. The indigenous peoples are very unique compare to other community in Malaysia in terms of personality, anthropometric character, and also community capital. Entirely, there are almost eighteen (18) tribes of indigenous community within Peninsular Malaysia that are categorized into three main groups which are Senoi, Negrito and Proto-Malay and each main language is differed from other tribes (Choi *et al.*, 2010). In particular, indigenous peoples are placed under the supervision the Ministry of Rural and Regional Development managed by the Jabatan Kemajuan Orang Asli (JAKOA). Every department has the same function and would help promote the stability needed to foster sustainable human capital development (JAKOA, 2014). Thus, maintaining and enhancing the community sustainability is one of the main problems for this study in order to ensure the wellbeing and prevent depopulation of indigenous community in Malaysia.

Royal Belum State Park (RBSP) is declared by the Sultan of Perak, Sultan Azlan Shah in Kuala Sungai Kejar, Royal Belum in July 2003 and was previously known as tropical rain forests of the oldest and largest in Peninsular Malaysia. RBSP was gazetted as a protected area under the Perak State Parks Corporation Enactment 2001 on 3rd of May 2007 and the total area of RBSP is almost 117,500 hectares (Suksuwan and Kumaran, 2003). There are several settlements of indigenous community within RBSP which are Kampung Sungai Tiang and Kampung Sungai Kejar. Generally, indigenous community in Royal Belum State Park mostly are Jahai

tribes (Perak GIS, 2014).Royal Belum State Park (RBSP) is declared by the Sultan of Perak, Sultan Azlan Shah in Kuala Sungai Kejar, Royal Belum in July 2003 and was previously known as tropical rain forests of the oldest and largest in Peninsular Malaysia. RBSP was gazetted as a protected area under the Perak State Parks Corporation Enactment 2001 on 3rd of May 2007 and the total area of RBSP is almost 117,500 hectares (Sukswan and Kumaran, 2003). There are several settlements of indigenous community within RBSP which are Kampung Sungai Tiang and Kampung Sungai Kejar. Generally, indigenous community in Royal Belum State Park mostly are Jahai tribes (Perak GIS, 2014).

The sustainability of indigenous community has become a concern by the government agencies in the context of social-economy such as depopulation trends, where the rural residents leave their settlements and move to other places for searching jobs; lack of facilities; and other factors. The term of community sustainability is very broad and unclear defined how liveable an area is. It is also related to equally unclear and popular terms like ‘vitality’ and ‘liveability’ (Koomen, 2011).The sustainability also can refer to the economic performance of communities, such as the employment and unemployment rate, average income, jobs availability and others (Laura, 2012). However, in the context of indigenous community sustainability, the infrastructure and social-economic developments and modernization are giving less impact on their lives. Sustainability for a community is important especially a community from rural areas because it is normally linked to a town’s continuity. People living in a specific area for a reason and would like to see that area of their settlements remain vital in the future.

Thus, the system of information and management for indigenous community can be developed using the application of Geographic Information System (GIS). GIS is a combination of database and map that can be seen on the table of database when the map is clicked. Basically, GIS comprises of five (5) components which are software, hardware, data collection, analysis, and people’s source. In addition, GIS software provides the tools and functions required to store, query, display, analyse, create and modify the referenced geographical information. Besides, the current assessment depends on the use of GIS that enable the social-economy level to be

measured aligned with national development policies. This supposedly increases the potential of indigenous community development towards sustainability.

1.2 Problem Statement

Some rural communities are still lagging behind even though the country continues to prosper towards modernity. There are many rural areas in Malaysia that are experiencing changes in economies, populations, and sustainability. In addition, the depopulation trends of indigenous communities in rural areas is concerned the most by the government policy maker, as the majority of indigenous peoples do not want to be insulated from the interventions of development but seek to benefit from them while preserving their cultures, values and institutions. Therefore, maintaining and boosting rural community especially for minor community such as indigenous community is one of the main concerns of policy makers in order to ensure the wellbeing of rural residents and prevent depopulation of communities. According to Koomen (2011), an important issue that has been considered by a related agenda for a living countryside and execution program that has been drafted, is maintaining and improving countryside vitality.

Moreover, there is lack of description in terms of proper instruments to improve rural community sustainability in the context of social-economy, providing the importance of indigenous community with ample opportunities for residential and economic development as they constitute an important group of rural poor. This study is to investigate the indigenous community in RBSP and also explore the factors that influence the indicators of social-economy towards the sustainability of rural areas. Selecting the variables to describe the indigenous community sustainability is important in order to evaluate its performance over time. Moreover, this study explores efforts carried out by them to secure the ability to prosper, or in other words, to promote sustainability.

The rapid growth of Information and Communication Technology (ICT) and growing modernization of the country has made the application of GIS as essential

method used in community's sustainable development. Generally, the GIS can be applied in order to display the demographic characteristics such as economic performance level, population changes, age distribution, education level and skills of a community (Hanina *et al.*, 2012). As a result, the assessment of indigenous community sustainability in terms of social-economy can be done using the GIS application as well as to describe the world of rural areas as a geographical reality characterized by low population trend; where a specific combination of built areas and open spaces is led by the land and natural resources. Besides, the assessment of social-economy for indigenous peoples will give the opportunities to the organizations that responsible to this community for sustainable human capital developments.

Furthermore, the limited sharing of information and insufficient data management has hindered the social-economy development of indigenous communities that is supposed to be in line with the development and modernization policies of the country. The information about the indigenous community is important because the indigenous cultures and social-economy can be introduced to other people in a country. Subsequently, due to the limited information about indigenous community, the ability to identify the infrastructure developments in RBSP and explore their ability to remain sustain, has become challenging. Thus, the establishment of a geospatial database system is to provide a convenience to overcome the problems. The presence of GIS able to store and manage the attribute information and digital cartographic data. Subsequently, through this system, the data can be manipulated simultaneously (Zamri and Said, 2007). The information in the database developed can be accessed effectively and efficiently. The information also can be continuously updated at any time compare to the manual system such as filing system.

In addition, large scale map is not developed for the settlements of indigenous peoples within RBSP (JAKOA, 2014). The topography map of RBSP that has been obtained from Jabatan Ukur dan Pemetaan Malaysia (JUPEM), is not updated since 1989. Therefore, with the capabilities of geomatic equipment and technology, a highly mapping of indigenous settlements can be produced using detailing survey equipment, total station and other supported equipments in order to obtain detail data

within study site and consequently update the previous map of RBSP. This process of survey also has been supported with Global Positioning System (GPS) technology in order to acquire the identified location of site survey. These problems are mentioned based on the statement from JAKOA, that none of the survey work has been conducted before, either to develop a map or to generate the area of indigenous settlements.

1.3 Aim and Objectives

The aim of this research is to explore the potential of GIS for the social-economy sustainability of indigenous peoples within RBSP. Therefore, there are three objectives to be achieved in this research which are:

1. To determine the availability of social-economy indicators within indigenous settlements in RBSP.
2. To develop a web-based system of indigenous community in RBSP
3. To evaluate the functionality of indigenous community system for the social-economy assessment Hardware

1.4 Research Questions

The following are the research questions in order to achieve the above mentioned objectives successfully:

- i. What are the economic activities carried out by Indigenous peoples in RBSP?
- ii. What are the economic strengths of the indigenous peoples in settlements area?

- iii. What are the infrastructures facilities provided for the indigenous community in their settlements area?
- iv. What indicators of social-economy can be measured among Indigenous people in RBSP?
- v. How to manage the indigenous community information or data provided systematically and efficiently?
- vi. How the rural community sustainability of indigenous community can be assessed using GIS?
- vii. What is the current living status among indigenous peoples in RBSP aligned with the national development?

1.5 Scope of Study

There are many aspects to be considered in GIS based assessment perspective of indigenous community sustainability based on the social-economy. In order to fulfil the aim and objectives of this study, the aspects to be considered are as follows:

- i. Study Area
- ii. Indigenous community vitality
- iii. Software
- iv. Hardware

1.5.1 Study Area

This study focuses on indigenous communities in RBSP which is located in Hulu Perak. The RBSP is a huge park in the northern parts of Peninsular Malaysia and it is part of Belum-Temengor Forest Complex (BTFC) which is shared with

Thailand. It is also one of the oldest rainforest in world, dating back about 130 million years. Furthermore, within the RBSP lies Lake of Temenggor which is the second largest lake in Peninsular Malaysia after Kenyir Lake, Terengganu. Generally, there are several settlements of indigenous community in RBSP which are Kampung Sungai Tiang and Kampung Sungai Kejar. Both indigenous settlements have been selected in this study, as these communities are lived in poor status and lagging behind in socio-economic factors compared to other settlements. Besides, Kampung Sungai Tiang and Kampung Sungai Kejar have been registered or listed as the settlement for indigenous community within RBSP by JAKOA. Figure 1.1 shows the location of the study area.

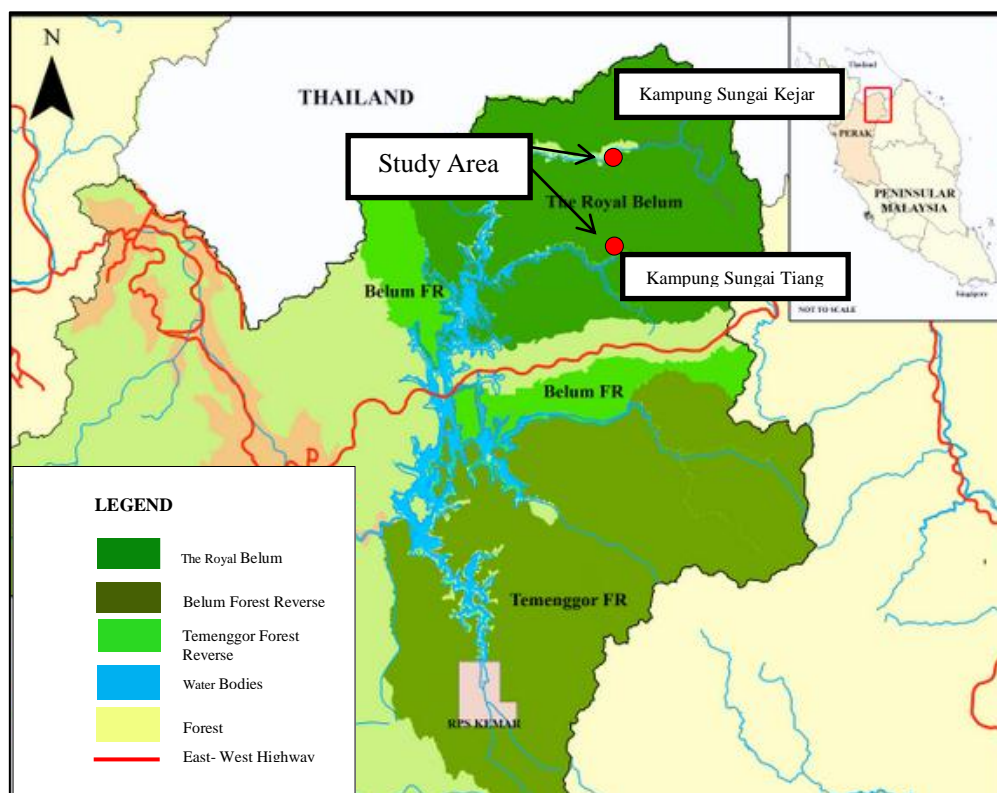


Figure 1.1 Research study area (Source: WWF Malaysia, 2007)

1.5.2 Indigenous Community Sustainability

The purpose of this study is to explore the potential of GIS for the social-economy sustainability of indigenous peoples within RBSP. Therefore, the scope of

this study is to gain understanding of two villages' sustainability within the RBSP based on the economic activity, population, amenities and social capital. Figure 1.2 depicts a useful framework of several indicators of community vitality for exploring the rural community vitality prepared by Cook *et al.*, (2009) as laid out in the background section. The diagram can be used as a reference for the assessment of social-economy indicators among indigenous community in RBSP towards sustainability.

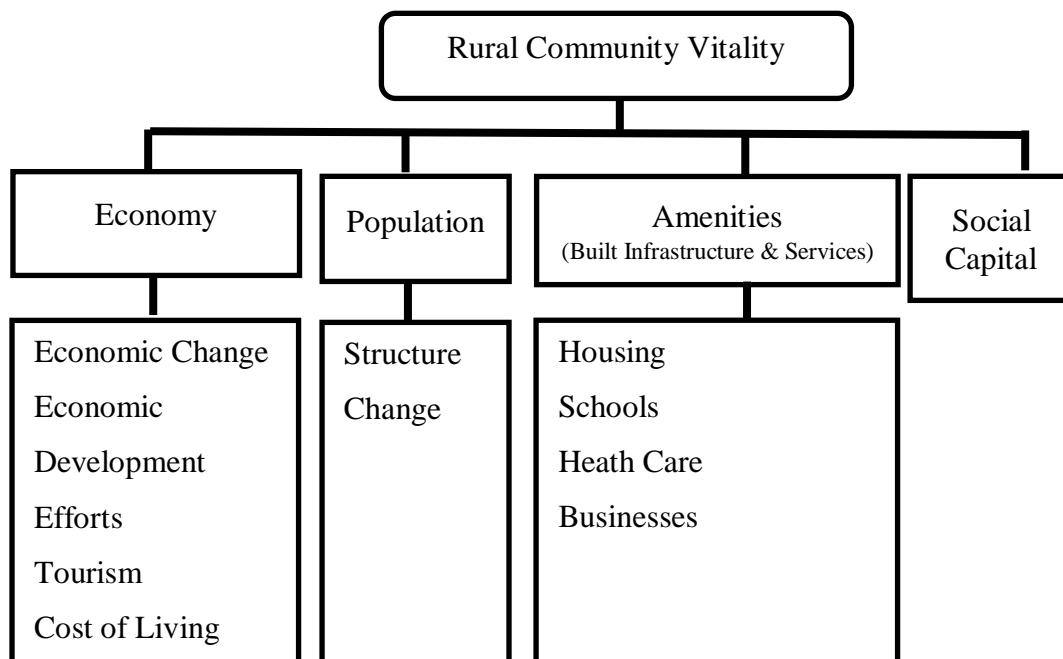


Figure 1.2 Hierarchy of rural community vitality (Source: Cook *et al.*, 2009)

Based on the referenced, the indicators of social-economy among indigenous community in RBSP have been selected in this study which are demography, economic performance, social-capital, educational status, and health status. Several variables of social-economy indicators which influence the indigenous community sustainability in RBSP can be identified through observation method. Moreover, the selected variables of social-economy indicators can be analysed through descriptive analysis in the system that will be developed.

1.5.3 Software

ArcGIS software is used in order to develop a geodatabase management system for indigenous community in RBSP as well as to produce map. ArcGIS software is licenced source software that is user friendly and it also allows users to create maps with different layers. Besides, the web-based system was developed by using PHP and JavaScript as well as the programmer languages. Meanwhile, the database development of web-based system for social-economy assessment was developed using PostgreSQL through PgAdmin III software.

In addition, supported software such as Civil Design and Survey (CDS) and AutoCAD software were used in this study to produce a map of indigenous villages within RBSP. The data acquisitions of detail survey were processed using supported software through certain procedure as well as data acquisition from GPS that was required to process using TTC software.

1.5.4 Hardware

The data acquisition have been carried out using survey equipment such as total station ES Series (reflector less) to perform detail survey within indigenous settlements through certain procedure. In addition, several control points were established using GPS within the area of the indigenous settlements and the GPS data were acquired using Topcon GPS receiver. In this study, GPS technique was used in field surveying work for obtaining the real site location of indigenous settlements.

1.6 Significance of Study

Recently, GIS technology has been proven to be a useful contribution to many organizations for their job scope and institutions for their research. Therefore, the contributions that can be expected from the assessment of social-economy sustainability for Indigenous community in RBSP using GIS are as follows:

- i. To expand the field of geomatic through GIS technology towards social science
- ii. To improve the condition in rural area as related to the execution program that have been drafted by the government agencies especially for the indigenous community
- iii. To expand knowledge to rural communities and explore how this area has the ability to remain sustain.
- iv. To develop an understanding of what rural communities can look like in the future, and how economic development efforts may be beneficial.
- v. To give opportunity to the organizations involved in indigenous affairs such as JAKOA to enhance the social-economic development for the sustainable human capital; aligned with the development and modernization of a country.
- vi. To provide understanding on GIS technique and its benefits for company or agency in order to integrate the filing data. This is because there are company or agency that is still using manual method to manage the data.
- vii. To expand the use of geospatial system in social science research dealing with the socio-economic condition of the local and indigenous people in the area

1.7 Scope of Study

The research methodology contains several phases that is elaborated with details in the research methodology chapter. Table 1.1 shows the research framework on assessment and mapping of indigenous community sustainability in terms of social-economy within RBSP using GIS. As mentioned, there are three objectives to

be fulfill in this study. Therefore, there are several methods to be carried out in order to achieve the objective of the study successfully.

Table 1.1 Research Methodology Frameworks

Research Objective	Methodology
i. To determine the availability of social-economy indicators within indigenous settlements in RBSP	<ul style="list-style-type: none"> • Establish Survey Form
ii. To develop a web-based system of indigenous community in RBSP	<ul style="list-style-type: none"> • User Requirement Analysis • System design • Detail survey to collect attribute data • Development of database system
iii. To evaluate the functionality of indigenous community system for the social-economy assessment	<ul style="list-style-type: none"> • Validation by semi-structured questionnaire

The availability of social-economy indicators within indigenous settlements in RBSP can be identified by established a survey form. Next, in order to develop a web-based system which is the second objective in this study, the method involved in this part is User Requirement Analysis (URA). A set of questionnaire was established and contributed to the several agencies in order to obtain the response about the information needed, to be included in the database system of indigenous community. Besides, this study was focused on the database system design. The database design involved three elements which are conceptual design, logical design and physical design, in order to make the data collections run smoothly.

Data collection was carried out at indigenous settlements within RBSP. The data is constituent into two, which are spatial data and non- spatial data known as attribute data that is used as data input in the database system. All the data was collected through detail survey within the area of settlements.

Upon completion of the data collection, the database system of indigenous community was developed. The database development involved several elements

which are data processing, data inserted to the database framework, and lastly design the user interface of system. All of the elements were carried out in order to fulfill the second objective of this study.

Next part focuses on the system validation. The validation was carried out based on the development of indigenous community system and tested by establishing a set of questionnaire to the several respondents in order to obtain review of the system whether it is a success or vice-versa. This phase was carried out to fulfill the third objective in this study.

1.8 Thesis Outline

The thesis consists of five (5) chapters that provide an understanding of the objectives to be achieved. The first chapter is introduction where it gives basic information about the history of RBSP. The chapter also thoroughly explains the indigenous community lived within RBSP and some indicators or factors that lead to sustainable development in terms of social-economy. Moreover, this chapter also describes the research problem, aim and objectives of study, scopes of study, and the significant of the study. Generally, this chapter presents the entire structure of the thesis.

Chapter two is known as literature review comprises of general briefing, current knowledge and past study that shared the same concern with this study. Overall, this chapter focuses on RBSP history, highlights the general knowledge of indigenous peoples, ethnics of indigenous community, and social- economy of indigenous community within RBSP towards sustainability. It also states the suitable measures designed for their protection and advancement in policy statement in year 1961. This chapter also gives the general understanding about the potential of GIS as a tool to achieve the assessment of social-economy sustainability towards indigenous community.

Next, chapter three presents the methodology of the research where it describes the process that had been taken to fulfill the research aim and objectives. It states the whole process of all phases, covers literature review from the previous

study, study area selection, and fieldwork survey with the additional of User Requirement Analysis. This chapter also focuses on the process of database system development and digital mapping that displayed the visual of the social-economy assessment summary and the settlements of indigenous community.

Chapter four deals with the results and data analysis in this study. It presents the results based on the data collection and respondents feedback. Besides, this chapter shows more analysis on data assessment using database system developed for the social- economy assessment towards the sustainability of indigenous community in RBSP. Subsequently, the functionality of the system developed is presented through the validation system that has been tested by using questionnaire.

Finally, chapter five which is the last chapter of the thesis presents the detailed conclusion and recommendations of the study. Conclusions are made based on the achievement of objectives and experienced faced in this study. Meanwhile, the recommendations are provided in order to assist other researchers for further research, and make improvement of the study.

REFERENCES

- Agarwal, Sheela, Sanzidur Rahman and Andrew Errington (2009). 'Measuring the Determinants of Relative Economic Performance of Rural Areas'. *Journal of Rural Studies* 23, no. 3: 309-321.
- Alberto, G.G. (2004). 'The Orang Asli of Malaysia'. *IIAS Newsletter*.
- Bandyopadhyay, A.S., Blossom, J., Wenger, J., and Castro, M.C. (2013). 'Population Migration through Railroads And Spatial Diffusion Of Polio In India: A Cross-Sectional Proximity Analysis Using Geographic Information System'. *The Internet Journal of Epidemiology*. Volume 11, No. 2.
- Carol Yong Ooi Lin (2008). 'Autonomy Reconstituted: Social and Gender Implications of Resettlement on the Orang Asli of Peninsular Malaysia. In B. P. Resurreccion & R. Elmhirst (Eds.), *Gender and natural resource management: Livelihoods, Mobility and Interventions*'. London: Earthscan.
- Copus, Andrew and Crabtree, J.R. (1996). 'Indicators of Socio-economic Sustainability: An Application to Remote Rural Scotland'. *Journal of Rural Studies* 12, no. 1: 41-54.
- Cook, Christine, Sue Crull, Marilyn Bruin, Becky Yust, Mack Shelley, Sharon Laux, Jean Memken, Shirley Niemeyer and B.J. White (2009). 'Evidence of a Housing Decision Chain in Rural Community Vitality'. *Rural Sociology* 74, no. 1: 113-137.
- Clark, David and William Hunter (1992). 'The Impact of Economic Opportunity, Amenities and Fiscal Factors on Age-Specific Migration Rates'. *Journal of Regional Science* 32, no. 3: 349-365.
- Colleen, J. Howell, Kurt, A. Schwabe, and Azizan, A. Samah. (2010). 'Non-timber forest product dependence among the Jah Hut subgroup of Peninsular Malaysia's Orang Asli'. *Environment, Development and Sustainability*. Vol. 12, pp 1-18.
- Demers, M.N. (2009). 'Fundamentals of Geographic Information Systems'. *Wiley Publication: Minnesota*.
- Dollah, R., (1996), 'Orang Asli: Tiada Tanah, Tiada Jatidiri, Diterkam Pembangunan dan Terjun ke Dalam Kemiskinan', Paper presented at the National Conference

on Pan- Malaysia Indigenous Peoples and Rights and Cultural Identity at University Malaya from 2nd to 3rd September 1996.

- Dale, A., Ling, C., and Newman, L. (2010). 'Community Vitality: The Role of Community Level Resilience Adaptation and Innovation in Sustainable Development'. *Sustainability*, 2(1), 215–231.
- Deller, Steven C., Tsung-Hsiu Tsai, David W. Marcouiller and Donald B.K. English (2001). 'The role of Amenities and Quality of Life In Rural Economic Growth'. *American Journal of Agricultural Economics* 83, no. 2: 352-365.
- Er Ah Choy, Zalina and Joy Jacqueline Pereira. (2010). 'Sosioekonomi Masyarakat Orang Asli :Kajian Kes Di Hutan Simpan Bukit Lagong, Selangor Malaysia'. *Jurnal Melayu* (5)2012: 295-314.
- Elwood, S. (2009). 'Integrating Participatory Action Research and GIS Education: Negotiating Methodologies', *Politics and Technologies*. Pp 51-65.
- Food and Agriculture Organization. (2010). 'Global forest resources assessment 2010': Main report. Rome, Italy: FAO of the United Nations.
- Geok, L.K. and Zalilah, M.S. (2008). 'The Ecology of Health and Nutrition of "Orang Asli" (Indigenous People) Women and Children in Peninsular Malaysia'. *Ecology of Health and Nutrition Of Orang Asli In Malaysia*. No. 2: 67-77
- Gibson, L., Lee, T. M., Koh, L. P., Brook, B. W., Gardner, T. A., Barlow, J., Sodhi, N. S. (2011). 'Primary Forests are Irreplaceable for Sustaining Tropical Biodiversity'. *Nature*, 478, 378–381.
- Golledge, R. G. (2002). 'The Open Door of GIS'. *Handbook of Environmental Psychology*. New York: John Wiley & Sons. pp. 244-255.
- Holland, David, Paul Lewin, Bruce Sorte, and Bruce Weber (2009). 'How Economically Interdependent is the Portland Metro Core with its Rural Periphery? A Comparison Across Two Decades'. *Working Paper No RSP 0901*. Oregon State University.
- Hanina H. H., Asnarulkhadi A. S., and Ja'afar A. (2012). 'Application of GIS in Orang Asli Community Profiling'. *2012 International Conference in Green and Ubiquitous Technology*. Bandung, West Java, Indonesia.
- Jabatan Kemajuan Orang Asli (JAKOA).(2012). 'Maklumat Statistik Penduduk'. Department of Orang Asli Development. Malaysia.

- Jabatan Kemajuan Orang Asli (JAKOA).(2013). ‘Pembangunan Sosioekonomi’.Department of Orang Asli Development. Malaysia.
- Jabatan Kemajuan Orang Asli (JAKOA).(2014). ‘Masyarakat Orang Asli’.Department of Orang Asli Development. Malaysia
- Jabatan Kemajuan Orang Asli (JAKOA).(2014). ‘Kenali Orang Asli’. Online:
http://www.jakoa.gov.my/wp-content/uploads/2014/12/kenali_orang_asli.pdf.
 Accessed on 14th December 2018.
- Jabatan Pendidikan Daerah (2015). ‘Basic Education for Indigenous Peoples’.
 Jabatan Pendidikan Daerah, Gerik.
- Koomen, E. (2011). ‘Indicators of Rural Vitality: A GIS-Based Analysis of Socio-economic Development of the Rural Netherlands’. Vrije Universiteit Amsterdam, Faculty of Economics and Business Administration, *Research Memorandum 2011-50*.
- Kidman G. and Palmer G (2006). ‘GIS: The technology is there but the Teaching is yet to catch up’. *International Research in Geographical and Environmental Education*. 15 (3), 289-296.
- Klien E. (2012). ‘Why conceptual data modeling?’ . Online:
<https://www.ariscommunity.com/users/eva-klein/2012-12-28-conceptual-data-modeling-aris-using-er-models-motivation>. Accessed on 15th November 2016.
- Kyem, P.A. K., Rambaldi, G., and Mike, W. (2006).‘Participatory Spatial Information Management and Communication in Developing Countries’.
- Katherine. S (2010).‘Community Vitality’.*Canadian Council on Social Development (CCSD)*. University of Waterloo, Canada.
- Kilkenny, Maureen (2010). ‘Urban/Regional Economics and Rural Development’.*Journal of Regional Science* 50, no. 1: 449-470.
- Lim, K. C. (2010). ‘Belum-Temengor Forest Complex, North Peninsular Malaysia’.
Birding Asia, 14, 15–22.
- Latiff, A., and Yap, S. K. (2000).‘An expedition to Belum Forest Reserve, Perak, Peninsular Malaysia: An introduction’. *Malayan Nature Journal*, 54, 147–149.
- Laura, T. (2012).‘Rural Vitality in the Netherlands’.Master thesis Spatial Economics, VU University, Amsterdam.

- Liou, W. H. (2011). 'ESDA-GIS Analysis of Spatial-temporal Disparity in Rural Economic Development of Guangxi'. *Asian Agricultural Research*. Volume 03: 20-23.
- Peter A. K. K. and James C. S. (2009). 'Web-Based Gis and The Future of Participatory GIS Applications Within Local and Indigenous Communities'. *The Electronic Journal on Information Systems in Developing Countries*.38, 7, 1-16.
- Partridge, Mark D and Dan S. Rickman. (2008). 'Distance from Urban Agglomeration Economies and Rural Poverty'. *Journal of Regional Science* 48, no. 2: 285-310.
- Perak GIS (2014). 'Kaum Jahai'. Online:
<http://www.perakgis.my/jakoa/index.php/kenali-orang-asli/suku-kaum-orang-asli/kaum-jahai>. Accessed on 5th October 2014.
- Malaysian Nature Society (2015). 'The Belum Temengor Forest Complex-The pride'. Online: <https://www.mns.my/the-belum-temengor-forest-complex-the-pride/>. Accessed on 7th October 2016.
- McGranahan, David A (2008). 'Landscape Influence on Recent Rural Migration in the US'. *Landscape and Urban Planning* 85, no. 3-4: 228-240.
- Nicholas, C. (2002): 'Organizing Orang Asli Identity: Tribal Communities in the Malay World: Historical, Social and Cultural Perspectives'. *Leiden, IIAS and Singapore, ISEAS*, pp. 119–137.
- National Geographic Education.(2014). 'GIS (geographic information system)'. Online: <https://blog.education.nationalgeographic.org/2014/05/27/geographic-information-systems-the-missing-educational-technology/>. Accessed on 15th January 2016.
- Suksuwan, S. and Kumaran, S. (2003). 'A Proposal for a Management Plan for the Royal Belum, Perak Darul Ridzuan with Some Recommendations'. WWF Malaysia. Petaling Jaya, Selangor.
- Sandra, B. (2003). 'Spatial Analysis of Socioeconomic Issues: Gender and GIS in Nepa'l. pp 338-344.
- Tawhid, M. (2014). 'ESDA Techniques in identifying the Spatial Structure of the Tokyo Metropolitan'. Master Thesis. Ritsumeikan Asia Pacific University.

- WGIP Report, (1996), 'Report of the Working Group on Indigenous Populations', 14thSession (Geneva, 29 July – 2 August 1996), E/CN4/Sub2/1996/21, 16 August 1996.
- WWF Malaysia.(2007). 'General Map of Royal Belum State Park'. Online:
http://www.wwf.org.my/about_wwf/what_we_do/forests_main/forest_protect/protect_projects/project_royal_belum/. Accessed on 10th November 2014.
- Zamri, I. and Said, M.N. (2007). 'GIS Application for School Information and Management System'. *VOT Penyelidikan 71967*, Universiti Teknologi Malaysia.
- Zhen, Z.,Jin, J.M., and Liu, F. (2010). 'The Application of Geographic Information System (GIS) In The Field of Public Health'. *2nd Iita International Conference On Geoscience and Remote Sensing, Iita-Grs 2010*.Pp 442-445.