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

## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECLARATION</td>
<td>ii</td>
</tr>
<tr>
<td>DEDICATION</td>
<td>iii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td>iv</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>v</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>vi</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xi</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xii</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td>xv</td>
</tr>
<tr>
<td>LIST OF APPENDICES</td>
<td>xvi</td>
</tr>
</tbody>
</table>

### CHAPTER 1  INTRODUCTION

1.1 Background of Study

1.2 Problem Statement

1.3 Aim and Objectives

1.4 Research Questions

1.5 Scope of Study

1.5.1 Study Area

1.5.2 Indigenous Community Sustainability

1.5.1 Software

1.5.1 Hardware

1.6 Significance of Study

1.7 Research Methodology

1.8 Thesis Outline

### CHAPTER 2  LITERATURE REVIEW

2.1 Introduction

2.2 Royal Belum State Park
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
### CHAPTER 4 RESULTS AND ANALYSIS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.6.3.1</td>
<td>Interface Design</td>
<td>60</td>
</tr>
<tr>
<td>3.7</td>
<td>Validation System</td>
<td>65</td>
</tr>
<tr>
<td>3.7</td>
<td>Summary</td>
<td>65</td>
</tr>
</tbody>
</table>

#### 4.1 Introduction

#### 4.2 User Requirement Analysis

- 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 of 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
### LIST OF TABLES

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

<table>
<thead>
<tr>
<th>FIGURE NO.</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1.1</td>
<td>Research study area (WWF Malaysia, 2007)</td>
<td>7</td>
</tr>
<tr>
<td>Figure 1.2</td>
<td>Hierarchy of rural community vitality (Cook et al., 2009)</td>
<td>8</td>
</tr>
<tr>
<td>Figure 2.1</td>
<td>Map of Royal Belum (WWF Malaysia, 2007)</td>
<td>18</td>
</tr>
<tr>
<td>Figure 2.2</td>
<td>Indigenous Peoples and Locations (Alberto, 2004)</td>
<td>22</td>
</tr>
<tr>
<td>Figure 2.3</td>
<td>Male and Female Ethnic’s faces (JAKOA, 2014)</td>
<td>23</td>
</tr>
<tr>
<td>Figure 2.4</td>
<td>Conceptual Models for Community Vitality (Katherine, 2010)</td>
<td>26</td>
</tr>
<tr>
<td>Figure 2.5</td>
<td>Development of community’s profile using GIS (Hanina et al., 2012)</td>
<td>34</td>
</tr>
<tr>
<td>Figure 3.1</td>
<td>Indigenous community assessment process</td>
<td>40</td>
</tr>
<tr>
<td>Figure 3.2</td>
<td>Components of the database design (Klien, 2012)</td>
<td>43</td>
</tr>
<tr>
<td>Figure 3.3</td>
<td>Entity relationship diagram</td>
<td>44</td>
</tr>
<tr>
<td>Figure 3.4</td>
<td>Maps covered the area of RBSP</td>
<td>48</td>
</tr>
<tr>
<td>Figure 3.5</td>
<td>Location of GPS points</td>
<td>52</td>
</tr>
<tr>
<td>Figure 3.6</td>
<td>Fieldwork survey within indigenous settlements</td>
<td>52</td>
</tr>
<tr>
<td>Figure 3.7</td>
<td>Detail data of indigenous settlement exported into AutoCAD software</td>
<td>54</td>
</tr>
<tr>
<td>Figure 3.8</td>
<td>Georeferencing process</td>
<td>55</td>
</tr>
<tr>
<td>Figure 3.9</td>
<td>Control points inserted</td>
<td>55</td>
</tr>
<tr>
<td>Figure 3.10</td>
<td>Georeferencing maps of RBSP</td>
<td>57</td>
</tr>
<tr>
<td>Figure 3.11</td>
<td>Layers content in the database system</td>
<td>58</td>
</tr>
<tr>
<td>Figure 3.12</td>
<td>Attribute data for spatial feature</td>
<td>59</td>
</tr>
<tr>
<td>Figure 3.13</td>
<td>Interface design of database system</td>
<td>61</td>
</tr>
<tr>
<td>Figure 3.14</td>
<td>Table created for database development</td>
<td>63</td>
</tr>
<tr>
<td>Figure 3.15</td>
<td>Interface development for the indigenous community web system</td>
<td>64</td>
</tr>
<tr>
<td>Figure 4.1</td>
<td>The existing format of data storage</td>
<td>69</td>
</tr>
</tbody>
</table>
Figure 4.2  Time taken to seek information  
Figure 4.3  The response item towards the understanding about the database system  
Figure 4.4  The response item towards the development of database system for indigenous community  
Figure 4.5  The response item towards the information needed to display in the database system  
Figure 4.6  The response item toward the function needed in the development of an interactive map  
Figure 4.7  The response item towards the frequency of the staff update the database  
Figure 4.8  Final output of Spatial Database  
Figure 4.9  *Pengenalan* interface  
Figure 4.10  *Peta Royal Belum* interface  
Figure 4.11  *Suku Kaum Bangsa* page  
Figure 4.12  *Pengenalan* interface page  
Figure 4.13  *Kemudahan Masyarakat* page  
Figure 4.14  Login window  
Figure 4.15  Main interface for *Kampung Sungai Tiang* to be selected  
Figure 4.16  The functionality of database system  
Figure 4.17  *Tanmbah Maklumat* interface  
Figure 4.18  Economy performances for indigenous community within two indigenous settlements  
Figure 4.19  The statistical analysis of demography indicator for both settlements  
Figure 4.20  Total Student in Primary School over 10 years  
Figure 4.21  Health status of Indigenous community in RBSP  
Figure 4.22  Percentage of indigenous community’s religious  
Figure 4.23  Information provided in the web-based system  
Figure 4.24  Interface of the web-based system  
Figure 4.25  Web-based system navigate  
Figure 4.26  Images quality used
<table>
<thead>
<tr>
<th>Figure 4.27</th>
<th>Interactive map</th>
<th>95</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 4.28</td>
<td>Functionality of the developed system</td>
<td>96</td>
</tr>
<tr>
<td>Figure 4.29</td>
<td>Data provided in the database system</td>
<td>96</td>
</tr>
<tr>
<td>Figure 4.30</td>
<td>The response item towards the graphic used in Database</td>
<td>97</td>
</tr>
<tr>
<td>Figure 4.31</td>
<td>The response item for the database functionality</td>
<td>98</td>
</tr>
<tr>
<td>Figure 4.32</td>
<td>The response item towards the database update</td>
<td>98</td>
</tr>
<tr>
<td>Figure 4.33</td>
<td>The response item on the social-economy assessment</td>
<td>99</td>
</tr>
<tr>
<td>Figure 4.34</td>
<td>The response item for the management purpose</td>
<td>100</td>
</tr>
</tbody>
</table>
## LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSS</td>
<td>Cascading Style Sheets</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographical Information System</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>HTML</td>
<td>Hypertext Transfer Protocol</td>
</tr>
<tr>
<td>JAKOA</td>
<td>Jabatan Kemajuan Orang Asli</td>
</tr>
<tr>
<td>PTNP</td>
<td>Perbadanan Taman Negeri Perak</td>
</tr>
<tr>
<td>RBSP</td>
<td>Royal Belum State Park</td>
</tr>
</tbody>
</table>
# LIST OF APPENDICES

<table>
<thead>
<tr>
<th>APPENDIX</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendix A</td>
<td>User Requirement Analysis</td>
<td>113</td>
</tr>
<tr>
<td>Appendix B</td>
<td>Validation for Web-Based System</td>
<td>117</td>
</tr>
</tbody>
</table>
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
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).

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

2
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

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](image-url)  
*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.

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

<table>
<thead>
<tr>
<th>Research Objective</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. To determine the availability of social-economy indicators within indigenous settlements in RBSP</td>
<td>• Establish Survey Form</td>
</tr>
</tbody>
</table>
| ii. To develop a web-based system of indigenous community in RBSP | • 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 | • 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


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

Community Level Resilience Adaptation and Innovation in Sustainable

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

Er Ah Choy, Zalina and Joy Jacqueline Pereira. (2010). ‘Sosioekonomi Masyarakat
Orang Asli : Kajian Kes Di Hutan Simpan Bukit Lagong, Selangor Malaysia’.

Elwood, S. (2009). ‘Integrating Participatory Action Research and GIS Education:

Food and Agriculture Organization. (2010). ‘Global forest resources assessment


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


Holland, David, Paul Lewin, Bruce Sorte, and Bruce Weber (2009). ‘How
Economically Interdependent is the Portland Metro Core with its Rural

Orang Asli Community Profiling’. 2012 International Conference in Green and

Department of Orang Asli Development. Malaysia.


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.


Birding Asia, 14, 15–22.


