A STUDY ON PARTICIPATORY MANAGEMENT AND CONSERVATION OF MANGROVE ECOSYSTEM IN MATANG AND CAREY ISLAND, MALAYSIA

MEHDI ALMASI

FACULTY OF SCIENCE
UNIVERSITY OF MALAYA
KUALA LUMPUR

2018

A STUDY ON PARTICIPATORY MANAGEMENT AND CONSERVATION OF MANGROVE ECOSYSTEM IN MATANG AND CAREY ISLAND, MALAYSIA

MEHDI ALMASI

THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

INSTITUTE OF BIOLOGICAL SCIENCES
FACULTY OF SCIENCE
UNIVERSITY OF MALAYA
KUALA LUMPUR

2018

UNIVERSITY OF MALAYA
ORIGINAL LITERARY WORK DECLARATION

Name of Candidate: MEHDI ALMASI

Registration/Matric No: SHB100016

Name of Degree: DOCTOR OF PHILOSOPHY

Title of Project Paper/Research Report/Dissertation/Thesis ("this Work"):

A Study on Participatory Management and Conservation of Mangrove Ecosystem in Matang and Carey Island, Malaysia.

Field of Study: Environmental Management

 I do solemnly and sincerely declare that:

(1)   I am the sole author/writer of this Work;

(2)   This Work is original;

(3)   Any use of any work in which copyright exists was done by way of fair dealing and for permitted purposes and any excerpt or extract from, or reference to or reproduction of any copyright work has been disclosed expressly and sufficiently and the title of the Work and its authorship have been acknowledged in this Work;

(4)   I do not have any actual knowledge nor do I ought reasonably to know that the making of this work constitutes an infringement of any copyright work;

(5)   I hereby assign all and every rights in the copyright to this Work to the University of Malaya ("UM"), who henceforth shall be owner of the copyright in this Work and that any reproduction or use in any form or by any means whatsoever is prohibited without the written consent of UM having been first had and obtained;

(6)   I am fully aware that if in the course of making this Work I have infringed any copyright whether intentionally or otherwise, I may be subject to legal action or any other action as may be determined by UM.

Date:

Subscribed and solemnly declared before,

Witness's Signature   Date:

Name:

Designation:

A STUDY ON PARTICIPATORY MANAGEMENT AND CONSERVATION OF MANGROVE ECOSYSTEM IN MATANG AND CAREY ISLAND, MALAYSIA

ABSTRACT

Management of mangrove forests is vital, especially for the conservation and revival of mangrove resources. Community-based mangrove forest management with involvement of various stakeholders could be an effective way for the conservation of the rich ecosystem of mangrove forests. The present research aims to formulate a participatory management strategy to conserve mangrove forests in the Matang Mangrove Forest and Carey Island in Malaysia as the participatory approach in management has not been well addressed in the literature on mangrove forest management in this country. The major management tool is a SWOT matrix analysis. For this purpose, the analysis of the data collected from in-depth interviews (31 for the Carey Island and 35 for Matang) with local people living in both areas of research as well as the information from the researchers' observation resulted in identification of a series of internal and external factors in the targeted areas in terms of conservation of the mangrove forest. The factors were then scored using a SWOT questionnaire filled by respondents (312 for the Carey Island and 377 for Matang). Resulting in sixteen strategies (for both research areas) were considered using SWOT matrix and pairwise matching for the conservation of the mangrove forests. Later, the Quantitative Strategic Planning Matrix (QSPM) was used and prioritized strategies were determined. As a conclusion, the prioritized strategies in the Carey Island were all related to capacity building, involvement and participation of stakeholders in the process of the mangrove forest conservation. Therefore, mangrove forest management requires a participatory approach in a way that not only the mangrove harvesting would be sustainably controlled, but stakeholders, especially villagers, will be simultaneously empowered and take responsibility of the sustainable conservation of their habitat and its biodiversity. In the Matang Mangrove Forest, it was concluded that participation of local

communities in the management of the Mangrove forest is the key element of the priority strategies.

KAJIAN PENGURUSAN PENGLIBATAN DAN PEMULIHARAAN

EKOSISTEM HUTAN PAYA BAKAU DI MATANG DAN PULAU CAREY,

MALAYSIA

ABSTRAK

Pengurusan hutan paya bakau adalah penting, terutama bagi pemuliharaan dan pemulihan sumber hutan bakau. Pengurusan hutan paya bakau berasaskan penglibatan pelbagai pihak komuniti yang berkepentingan dalam pemuliharaan ekosistem yang kaya dengan hasil paya bakau. Penyelidikan ini bertujuan merangka strategi pengurusan bagi pemuliharan hutan paya bakau di Hutan Paya Larut Matang & Pulau Carey di Malaysia memandangkan pendekatan berasaskan penglibatan komuniti dalam pengurusan pemuliharan hutan paya bakau di negara ini masih belum meluas. SWOT merupakan alat utama di dalam pengurusan. Data untuk SWOT dalam kajian ini diperolehi melalui temu-bual dengan penduduk tempatan (31 untuk Pulau Carey dan 35 Hutan Paya Larut Matang) dan dengan beberapa penyelidik sumber hutan bakau. Berdasarkan data yang diperolehi beberapa faktor dalaman dan luaran yang mempengaruhi sumber di kawasan kajian telah dikenalpasti. Skor diagihkan kepada faktor-fakor ini yang seterusnya menjadi panduan merangka dan membentuk soalan soal-selidik untuk diisi oleh responden (312 dari Pulau Carey dan 377 Hutan Paya Larut Matang). Hasilnya ialah 16 strategi (untuk kedua-dua kawasan) yang dipertimbangkan untuk matriks SWOT dan penyepadan pasangan. Seterusnya Perancangan Matriks Strategik Kualitatif (QSPM) digunakan dan strategi utama ditentukan. Kesimpulannya ialah strategi utama bagi Pulau Carey lebih berkaitan dengan keupayaan pembinaan. Penglibatan dan penyertaan pihak-pihak yang berkepentingan dalam proses pemuliharan hutan paya bakau sangat penting. Oleh demikian pengurusan hutan paya bakau memerlukan pendekatan yang lebih terperinci bukan sahaja dari sudut pengambilan hasil bakau akan tetapi penglibatan pihak berkepentingan seperti penduduk tempatan dengan memberi tanggungjawab dalam

proses pemuliharan habitat hutan paya bakau dan biodiversiti. Manakala kesimpulan bagi

Hutan Paya Larut Matang, penglibatan komuniti tempatan dalam pengurusan

pemuliharan Hutan Paya bakau merupakan faktor utama dalam strategi ini.

Katakunci: Perumusan strategi, perancangan strategik, pemuliharaan yang mampan, kaedah SWOT, QSPM

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF SYMBOLS AND ABBREVIATION

EF	External Factors
EFE	External Factor Evaluation
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
FDP	Forestry Department of Perak
GEC	Global Environmental Centre
GOV	Government
IA	International Agencies
IF	Internal Factors
IFE	Internal Factor Evaluation
JKOA	Jabatan Kemajuan Orang Asli (Department of Orang Asli)
Kg	Kampung (Village)
MRC	Mangrove Research Centre
MU	Malaysian Universities
NGO	Non-Governmental Organization
O	Opportunity
QSPM	Quantitative Strategic Planning Matrix
S	Strength
SD	Sime Darby Sdn.Bhd
Sg	Sungai (River)
SWOT	Strengths, Weaknesses, Opportunities, Threats
SGP	Small Grants Programme
SO	Strengths-Opportunities
ST	Strengths-Threats
St	Strategy

T	Threat
UM	University of Malaya
UNDP	United Nation Development Programme
W	Weakness
WAG	Women Active Group in kampong sg Bumbon
WO	Weaknesses-Opportunities
WT	Weaknesses-Threats

LIST OF APPENDICES

CHAPTER 1 : INTRODUCTION

1.1   Statement of the topic

Mangroves have been defined by Hamilton et al. (1984) as salt tolerant ecosystems of the intertidal regions along coastlines and are an intertidal forest which includes shrubs and with their plants (Prance, 1987).

Mangroves generally grow in loose, wet soils, saltwater and are periodically submerged by tidal flows along sheltered coastal, estuarine and riverine areas in tropical and subtropical latitudes (Kamaruzaman & Kasawani, 2007), or as Ashton et al. (1999) have indicated mangroves form a characteristic saline woodland or shrub land habitat, called mangrove swamp, mangrove forest, mangrove or mangal.

Nowadays mangrove forests are important, because they play a major role in protecting the coastlines, especially against erosive wave action and coastal winds; also, mangroves contribute to improved water quality by filtering and assimilating pollutants, stabilizing bottom sediments; they also serve as natural barriers against tsunamis and torrential storm; such forests retain, concentrate and recycle nutrients and provide resources for communities who depend on the plants for timber, fuel, food, medicinal herbs, and other forest products; they can be harvested sustainably for wood and other products, and are an important breeding ground for many species (Sheng & Zou, 2017; Tsuchiya et al., 2015; Lee et al., 2014).

In Malaysia mangroves are more diverse than other places such as Australia's tropical, the Red Sea, Africa and the Americas tropical (WWF, 2012). About 50% of fish landings on the west coast of Peninsular Malaysia are associated with mangroves.

Meanwhile protection of mangrove forests around the world as the most important centers of biodiversity has been emphasized. While these forests are now threatened by various human activities such as forest destruction, oil pollution and indiscriminate

harvesting of fish stocks those factors are causing the destruction of these valuable habitats in the world (Dilmaghani et al., 2011).

The main purpose of mangrove forest management is creating necessary background for protecting and reconstruction of mangrove resources (Dilmaghani, 2010). For example, management of the Matang mangrove forest in Perak, Malaysia, which is one of the best managed mangrove forest in the world is based on the protection of natural mangrove forest and restoration of destroyed mangrove forest (Goessens et al., 2014).

Mangrove forest ecosystems support important wetland communities of plants and animals. They are characterized by unique species of trees and shrubs that fringe the intertidal zone along sheltered coastal, estuarine and riverine areas in tropical and subtropical latitudes (Macintosh & Ashton, 2002).

In the Peninsular Malaysia Mangrove forests are found mainly on the sheltered coasts, estuaries, rivers and some near-shore islands. Mangrove forests support a diverse range of animals and plants and are important breeding ground for a vast array of organisms. The importance of mangrove forests in providing invaluable goods and services both in economics and environmental terms are well understood and documented (Jusoff & Taha, 2008).

With this long list of benefits of mangrove forests, a proper management and conservation is certainly vital to ensure the sustained existence of mangrove forests in Malaysia. Traditionally, the coastal communities living within or at the borders of the mangrove forests have been dependent on the mangrove forests for their livelihood. Mangrove forests are a major source of fishery resources. The mudflats are habitats for various types of shellfish, where many species of fish, prawns and other marine fauna spawn and feed. Local societies have been relying on the mangrove forests for consumable plants and medicinal herbs. Leaves, buds, fruits, and seeds of some mangrove species are used for human consumption. Some provide a wide range of medicinal uses,

such as the bark of Rhizophora, which is used to heal fractures, cure diarrhoea and stop haemorrhages (Jusoff & Taha, 2008). Therefore, if there is anything to be done to conserve the mangrove, has to be done by these people. As FAO (1994) mentions in its management guidelines for mangrove ecosystem, "the basic fault" in the conventional approach is that the rural poor are rarely consulted in planning or given an active role in development activities. This is because the poor have no organizational structure to represent their interests. The first task therefore is to assess the needs of the direct and indirect beneficiaries and direct planning towards meeting as much as possible the needs of the target groups. The lesson is clear: unless the rural poor are given the means to participate fully in development, they will be excluded from its benefits (FAO, 1997). In fact, participatory management of mangrove ecosystems can be one of the major solutions for conservation of these important ecosystems.

The mangrove forests are under control of the Forestry Department in all states of Malaysia. The mangrove management practices in Malaysia differ from state to state (Khoon & Eong, 1995).

The main objective of the research by Khoon and Eong (1995) was to maximize the sustained yield of wood for charcoal production. However, this is not the case in many other places. That is why many projects have been introduced and implemented in different places to conserve mangrove forests, for instance, UNDP (2008) and local company Petra Perdana Bhd., in partnership with the State Government of Terengganu, have joined 150 families to implement a community-based mangrove regeneration project. Terengganu is one of the poorer states in Malaysia, with a household poverty rate in 2004 of 15.5 percent, compared to the national average of 5.9 percent. As of December 2007, four mangrove-replanting schemes have been completed and a nursery has been established.

The community has managed to increase the nursery's capacity from an initial 10,000 to 36,000 saplings (UNDP, 2008). Also, SGP Malaysia (2012) has funded certain projects since 2000 to support local activities to conserve mangrove ecosystem in Penang, Sataman (Sarawak) and Sabah. Within the framework of these community-based projects, activities to strengthen and improve the knowledge, capacity and management skills required for promoting ecological sustainability including organic farming, value added food processing and ecotourism to maintain the community's biosphere and natural resources while at the same time provide a source of sustainable livelihood for the families and the local community have been supported. In fact, awareness raising and people's empowerment, their active and comprehensive participation, and as a results, formation of bodies based on people's potentials are among the preconditions of sustainable development. As it is clear in the following diagram by Piran (2003) the pillars and preconditions of sustainable development are highly interwoven and interrelated.
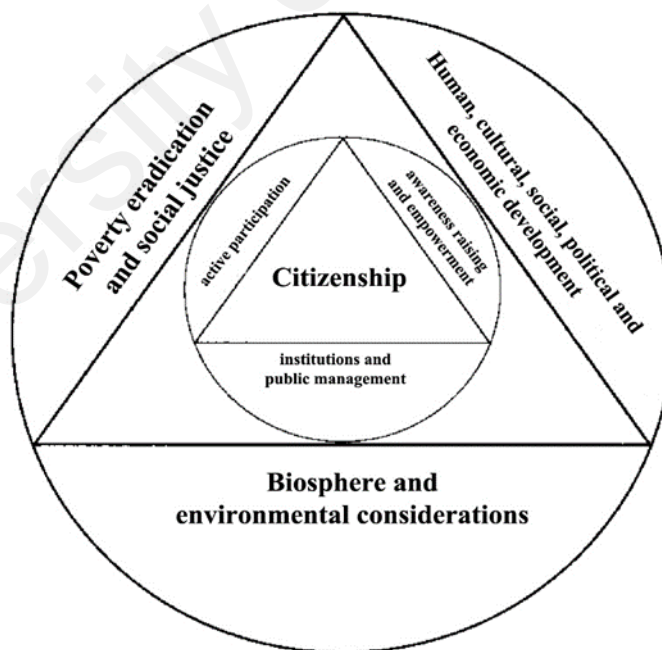
Figure 1.1: Citizenship and sustainable development (Piran, 2003)

Without satisfying any of these requirements, one cannot claim that a sustainable conservation is happening. In fact, the sustainable development is a collection of policies

that considers development as a concerted progress in three fields of human development (including social development and increased participation of social groups in development), economic development and conservation of environment (resource management and a sustainable use of existing resources). Sustainability means that people use the resources in a sustainable way which means not only their today needs are met, the future generations are guaranteed to be able to benefit from the resources too. Sustainability also means if there should be an intervention, these are the people who start the process, and it continues to happen without any outsider, and local people cannot change their situation without being enough empowered. Sustainability also means an access to the resources that can be helpful in creating the change (Nouri Neshat, 2009).

1.2 Research hypotheses

The following hypotheses help the researcher to design the framework of the study in a way that research questions and objectives can be framed.

- With current strengths framework, we cannot use the identified opportunities for managing mangrove forest.

- Using the identified strengths controlling the threats is not possible.

- Using the identified strengths advantages recovering the threats is not possible.

- Minimize losses from threats and identified weaknesses is not possible.

1.3 Problem statement

Malaysia has the strongest governmental structure with federal support but the weakest in community management (Nasuchon, 2009). Those who have carried out research on mangrove management in Malaysia have not paid enough attention to participatory methods of conservation. Three examples are as follow:

Choudhury (1997) listed a series of factors for degradation of mangrove forests; he mentions that increase of population, among others, is an important factor but did not analyse the role that can be played by people.

After a decade, Jusoff and Taha (2008) recognize that public awareness has been recently increased while still there are people who do not know much about the role of mangroves. No reference to community participation in mangrove management can be found.

Ahmad (2009) has recognized the recreational values of mangrove but does not refer to the role that people can have in conservation of mangroves.

Since 2003, some projects have been defined by GEF/SGP/UNDP in Malaysia (Penang Island, Seberang Prai, Kedah and Sematan- Sarawak) to support Sustainable livelihood for protecting mangrove ecosystem biodiversity.

Implementation of the projects indicate that people's participation is an important factor for sustainability. However, there is no effort to create a participatory management plan for mangrove habitats. No academic research or evaluation report is available about these projects.

It seems that participatory approaches in mangrove management have not been applied in Malaysia.

1.4 Key questions

1. Have the people who are living in coastline communities been involved in participatory environmental management of mangrove ecosystem in the Carey Island and the Matang Mangrove Forest?

2. What are the opportunities, threats, strengths and weaknesses in communities around Mangrove forest regarding conservation of this habitat?

3. Is there any bottom-up approach for formulation of projects carried out on these habitats?

4. What would be possible management strategies for that selected areas?

1.5. Objectives

1. To explain the way and levels of involvement of people who are living in coastline communities in participatory environmental management of mangrove ecosystem in the Carey Island and the Matang Mangrove Forest

2. To explore the approach used for formulation of projects carried on in Matang and the Carey Island

3. To identify strengths, weaknesses, opportunities and threats affecting the mangrove forest conservation in the areas of study

4. To achieve a method of Mangrove forests management in Matang and the Carey Island

The researcher would like to establish a link between mangrove conservation, people's participation and to find out major obstacles and facilitating factors on participation.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

The literature review has been prepared in three parts. The first deals with participatory forest management; the second focuses on Participatory mangrove management and the third discuss Mangrove management in Malaysia.

2.2. Participatory forest management.

In a long working paper, Amanor (2004) looks deeply at how forest policies are constructed and implemented in West Africa while trying to find out where concepts of "community" and "environmental crisis" are dealt within the policies. The author emphasizes on the notion of "building natural assets" as one important factor, which should be regarded in any forestry strategy. He writes that the mere protection of the forest cannot be much useful, and it is necessary that "objectives of reducing poverty" merge with "protecting the environment". The paper remains at policy level and analyses obstacles, concerns and reasons of resistance to participatory management schemes.

Walters (2004) in his paper on local management of mangrove forests presented two case studies of two coastal sites of Bais Bay and Banacon Island in the Philippines that are very famous as success stories of mangrove participatory management and reforestation. The researcher, using ethnographic and ecological methods, shows that these two cases need to be qualified, since plantations are progressively invading into and replacing natural forests and the conservation values are not duly considered. The paper emphasizes on the role played by the government, especially as facilitator of local management and as an active agent in conservation especially where critical conservation values exist (such as rare wildlife). The author does not refer to "sustainability" as an important factor in qualifying a community-based project, a factor that might have been

ignored by the project implementers in the Philippines. A community-based project can be sustainable, when not only from economic and social point of view is successful (which is the case here) but should be environmentally sustainable too.

The Regional Community Forestry Training Center for Asia and the Pacific based in Bangkok has defined its mission to enhance and develop community forestry in the region and has published various manuals and papers on participatory management of forests. Among them, there is a paper connects community forestry and poverty (Gilmour et al., 2004). The paper shows the role that forests play in people's livelihood at local level, and indicates that community forestry can be understood as one significant strategy that can address forest lost and its negative impact on rural life. The paper presents various cases where various forms of community forestry (such as joint forest management and community-based forest management) have been implemented in different places. The paper concludes that the major future challenge would be still to see how benefits obtained from the community forestry decrease rural poverty.

Ali et al. (2007) showed that joint forest management could be successful in increasing social assets of the local communities in Northwest Pakistan, but it could act like a barrier in motivating the local people in forest since in such projects, mostly the immediate financial benefits of forest for people living there are omitted.

Also in a recent paper by Ghasemi et al. (2010), values, functions and attributes of mangrove ecosystem have been depicted and the importance of the local people in biodiversity conservation in the mangrove of Gas and Hara Rivers Delta (GHRD) in the Iranian coastline of Oman Sea has been shown. This study indicated that mangroves of GHRD are greatly influenced by the coastal environment and fulfil important socio-economic and environmental functions. This study also provides the state of key guidelines for protecting biodiversity of mangroves by the local people.

2.3. Participatory mangrove management

Earlier studies recommended management plans for long-term conservation of resources in mangrove forests around the world (Kairo et al., 2001; Kay & Alder, 1998; Mangora et al., 2016; Rasolofo, 1997; Walters et al., 2008).

There are papers that refer to the traditional uses of mangrove without any indication that these uses can be a foundation for participatory management by the people who are using the wood. Among them, we can refer to the paper written by Bandaranayake (1998) which shows Mangrove forest has been usually harvested for charcoal and firewood and how people have been traditionally consuming mangrove. Mangroves have been used largely in folkloric medicine, as insecticides, pesticides and these practices continue to these days. In many place, villagers (and generally those living near Mangrove forests) need mangroves for timber and firewood, to build houses, furniture, fences, bridges and boats (Bandaranayake, 1998).

There is a long list of related literature on conservation of mangrove forests; it somehow shows the importance of mangrove ecosystem. Mangrove Forest Management Guidelines of FAO (1994) is one of the major resources, in which many other related resources can be found. The guideline focuses specifically on the management of the forest resources contained in the mangrove ecosystem, including wood and non-wood forest products, with a chapter on mangrove ecology. It includes chapters on inventory and assessment of mangrove resources, and on traditional and potential uses of products provided by them. Environmental impact assessment is finally reviewed, and conclusions and recommendations are given to summarize the findings in the document. It is an important resource while it is a general text (with certain references to Malaysia too); it is clear that for a sustainable management of a mangrove ecosystem within a country, there is always a growing need for empirical knowledge. Of course, there are many

ecological research activities on mangrove, but what we are looking for in this research, is the sustainable management of mangrove forests.

A project entitled "Coastal Habitats at Risk" was initiated by the joint cooperation of the United Nations University and the World Resources Institute, and in partnership with UNESCO and the International Society for Mangrove Ecosystems with an aim to enhance mangrove conditions in East and Southeast Asia. In this study, the human element of mangrove ecosystems is more important. It emphasizes on this point that mangrove ecosystems have been traditionally managed by the local people in a sustainable way for producing various items such as food, fuel wood and medicines. That is why this analysis recommends policies involving participatory approaches and management strategies in conservation of mangrove forests (Adeel & Pomeroy, 2002).

Datta et al. (2012) have studied community based mangrove management (CBMM) in a comprehensive paper. They have concluded that community management is needed for conserving the mangrove forests and consider CBMM an effective alternative for a sustainable management of forests. They have reviewed many projects implemented in different areas of the world and mention that communities around the mangrove forests have potentials to be involved as actors for ecologically managing the forests. However, they have found that the globalization process has affected the communities in a negative way. The authors think that the implemented projects of CBMM in South Asia has been more socially equitable with involvement of community members in decision-making processes and resources sharing, in comparison with the projects implemented in Africa and South America. In fact, in such community projects, it is required to establish links between ecology (in terms of conservation activities), society (community mobilization) and economics (Datta et al., 2012).

2.3.1. Thailand

Tavorn et al. (2013) study the establishment of community organizations in mangrove forest management and their achievements in Thailand. The paper that is a quality research, is based on the field activities in the area of Paklok Bay (Phuket). The study concluded that the community mobilization goes on through two phases. The first is to understand the causes of the threats to the mangrove forest, and to establish a conservation group. The second phase is to involve the group into conservation and help them to become a stable organization. The groups can be categorized into two forms: direct groups involved in managing activities, and indirect ones, such as rice group or credit funds that help the management of the forest in an indirect way. In another paper, Webb & Sudtongkong (2008) present a case study of two coastal villages in Trang province where there is enough evidence of successful mangrove management and conservation. In their paper, they also provided information on biological outcomes of the management. In the paper, there is a comparison between the forests managed by the State and those of communities that concluded the governance system is more sustainable in communities due to factors such as connection between local livelihood and the resources, involvement decision-making, high social capital, defined user groups, monitoring, effective leadership (for conflict resolution), and assistance from external NGOs (Webb & Sudtongkong, 2008). Also, Erftemeijer & Bualuang (2002), examine a project of community participation for rehabilitation of mangrove forest in Pattani Bay (which is an important international wetland in Southern part), in which facilitators worked together with local communities in three villages to restore a degraded area that was once mangrove forest. The paper which is mostly an extensive report of what was done in this three-year project, shows how local ownership led to sustainable impacts in mangrove rehabilitation and conservation. The authors claim that the sustainability of the work can be shown by the fact that the local communities have been involved in promoting capacity

building in other villages for a logical use of coastal resources (Erftemeijer & Bualuang, 2002).

2.3.2. Vietnam

Ha et al. (2014) study how the forest tenure policy has affected the livelihood of farmers in mangrove-shrimp farming in Vietnam. The research has been done in Ca Mau (in Mekong Delta) which is a vast area of mangrove forest. The research shows the income from aquaculture is enough for the life of farmers however if they can harvest the forest, they can maximize the income and as a result, they have to conserve the mangrove forest. The present land tenure in Vietnam promotes such decentralized management of forest. The results of the research prove there is an imbalance between the two important actors of the mangrove forest: state forest companies and farmers in terms of their powers, income and access to markets. In a previous research by Ha et al. (2012) in the same region, it is concluded that if mangrove forests are managed by farmers with full rights, responsibility and benefits over forest products, then the forests are well conserved. That is why a policy that considers both the farmers' livelihood (from shrimps) from mangrove (both direct income and indirect ecological benefits), then the farmers may understand the value of mangroves and plan for a sustainable mangrove protection. Nguyen (2014) in a study of coastal mangroves in another part of Vietnam (Kien Giang) emphasizes on policies for successful participatory mangrove conservation. For people to be involved in conservation, a clear policy with defined rights, responsibilities and benefits is needed. The study first looks at human and natural drivers for the loss in mangrove forest ecosystem and later, studies how policies (past and present) have affected the forest, especially the policies on local participation in sustainable mangrove management. In another research by Dat & Yoshino (2013) in Hai Phong (Northern coast of Vietnam), the authors studied the mangrove change and compared different mechanisms of

mangrove forest conservation and management. Among their conclusions, they have referred to this point that community forest management is required to be expanded to all coastal districts since there have been successful practices in communities for mangrove conservation. However, the researchers have emphasized on the role of the government in providing technical support as well as education and finance for community entities involved in mangrove forest management (Dat & Yoshino, 2013).

2.3.3. Bangladesh

Jashimuddin & Inoue (2012) study the community forestry in Bangladesh and its effectiveness in sustainable forest management. It is not directly about the mangrove forest management in this country, but it is an informative research since it shows how the forest management has changed into community-based models of management. NGOs are also involved in promoting community forestry. The authors explain about the 2004 Social Forestry Rules which facilitate a policy of broader participation for local communities, especially for involvement of poorer people in forestry. As a result, community forestry in its various forms (social forestry; participatory forestry and agroforestry) are in practice (Jashimuddin & Inoue, 2012).

In a review paper on the status and management of mangrove resources in Bangladesh, the authors have shown that there is a rapid shift from ecological approach towards community-based approach in forest management in that country. In fact, community participation is highly required in populated areas. There have been efforts to include local people's views and experiences in forest planning (Islam & Wahab, 2005).

In a paper by Iftekhar & Islam (2004), the authors look at the strategies used in managing mangroves in Bangladesh. They analysed various management plans but refer to participatory forestry program as one way to protect mangrove habitats. They mention

that such participatory programs were supported under the Coastal Greenbelt Project (CGP) in Bangladesh that not only improves the economic conditions of poor people, but helps them to conserve the environment too. The paper also analyses the programs under the supervision of non-governmental organizations that are involved in plantations. However, the paper does not explain whether such schemes have been sustainable or not (Iftekhar & Islam, 2004).

Getzner & Islam (2013) in a research on the Sundarbans Reserved Forest in Bangladesh study the dependency of communities on forest resources, evaluate the ecosystem services to the local livelihood while explaining the social and economic situation of the related local communities. In their conclusion they provide a list of recommendations for improvement of local communities' livelihood, among them, they have referred to the involvement of local communities in designing and implementing an effective management system, empowerment of women and their involvement in income generation activities, encouraging the NGOs in supporting local communities; and the existing potential for sustainable tourism with the involvement of communities.

2.3.4. Pakistan

Memon (2012) in his paper, while giving an overview of the existing mangroves in Pakistan, refers to the changes in forest management techniques and methods in Pakistan. There has been a paradigm shift from top-down management approaches to the community and participatory management. This paradigm has been encouraged by NGOs and a series of community-based projects have been implemented, and as Memon indicates, there have been significant results in Keti Bunder and Sandspit (on the Sindh coast).

A participatory research was done in Sonmiani Bay (in Pakistan) where WWF (2012) acted as a facilitator to help the involved community to prepare a plan containing the existing challenges and solutions for conservation of mangrove forests at coastal areas of Sindh and Balochistan in Pakistan (Amjad et al., 2007). The paper shows that the plan has been successful. The authors emphasize that local communities have to be regarded as important stakeholders in conservation of mangroves. The involved communities whose profession was once fishing, have been involved in plantation of a considerable degraded area with mangroves.

2.3.5. East Africa

In a research on potentials for community-based management of mangrove ecosystem in East Africa, the focus was on relationships between the mangrove forest and the human life in communities with an aim to find solutions for mangrove ecosystem management. The researchers have shown that participatory approach could be very useful but mangrove exploitation could easily destroy the forest if it goes out of control. In fact, they have also shown that local communities would not use the forest in an unsustainable way unless they are forced to do so (for any reason such as lack of resources). Meanwhile, the real pressure on mangroves is not by those who are living in communities but traders who do not live over there. Locals do cut mangroves often at the request of traders, and therefore, it has been shown that a policy to regulate such behaviour is necessary (Zorini et al., 2004).

2.4. Mangrove management in Malaysia

Choudhury (1997) and Teh (2014) in their paper which is mostly a review of technical aspects of mangrove management systems (that was presented in the XI World Congress of Forestry), reviews management systems in different countries including Malaysia, but

it does not discuss whether a participatory management can be applied for Mangrove or not. As the author believes that mangrove forests are relied on their ecosystem therefore the dynamic nature of the ecosystem has to be considered within a management approach. The paper is silent about the communities who are close to mangrove forests and does not mention whether people can have a part in conservation of mangrove or not. The important point is that the author has mentioned a series of effective factors in degradation of mangrove forests as such: increase of population; higher short-term benefits of mangrove lands; lack of government attention and overall awareness; obscure regulations and inefficient reforestation techniques, and inadequate manpower and logistics (Choudhury, 1997). Surprisingly, all factors are in one way or another related to human beings, but there is not any reference in the paper to participatory conservation where people can have more participation in mangrove management.

In a paper by Jusoff &Taha (2008), there is a more systematic approach to mangrove management in Malaysia. The paper reviews thematically forestry policies regarding mangrove and other related laws and regulations such as National Forestry Policy 1978 (revised 1992) (NFP); National Forestry Act 1984 (revised 1993); Land Conservation Act 1960; Protection of Wildlife Act 1972; National Park Act 1980; the Environmental Quality Act 1974; Water Enactment 1935; National Economic Recovery Plan 1998; National Biodiversity Policy1998; and the National Physical Plan 2005. According to the NFP, the four classes of Mangrove forests are: (1) protection for ensuring of favorable climate and conservation of biodiversity; (2) protection for supply of all form of forest productions; (3) protection for reasons of recreation and eco-tourism; and (4) protection for conducting research and education. Based on this classification, the paper studies different mangrove forests in Malaysia. The paper looks into various issues that affect mangrove forests in Malaysia too, and mentions various factors such as rapid economic growth and increasing demand for land as the major issues that affect the fragile

mangrove ecosystem. The researcher refers to the existing lack of scientific data on mangrove destruction in Malaysia. It has been mentioned that public awareness has been recently increased while still there are people who do not know much about the role of mangroves. In the end, the author emphasizes that the national policies in Malaysia regarding mangrove forests have to be revised "from time to time" to guarantee a sustainable and perpetual management (Jusoff & Taha, 2008). The paper has no reference to participatory management of mangrove in Malaysia.

Chong (2006) in his paper about mangrove ecosystem management in Malaysia, refers to another managerial issue. He writes that conflicting jurisdictions of State and Federal governments in Malaysia over land issues and policies of mangrove conservation is a major barrier for a sustainable management. He adds that inconsistent policies are largely sectoral. For instance, fisheries management is under the Department of Fisheries but the quality of coastal water is under the Department of Environment. Two other examples are the mangrove clearing for aquaculture and the selective silviculture more beneficial mangrove species. He concludes that an "integrated coastal zone management" is vital since that is the way to resolve the existing conflicts regarding multiples land uses. It is important to add that there is an integrated coastal zone management in Indonesia (Sukardjo, 2002) which has included community participation as one of its major strategies. This component has to promote community organizations in villages that can be involved in mangrove ecosystem conservation.

Ahmad (2009) recognizes the recreational values of mangrove, especially in mangrove forest of Larut Matang. In his paper he intends to examine the recreational values and benefits of the related forest and emphasizes on people participation in such recreational activity but does not refer to the role that people can have in conservation of mangroves.

Since 2003, some projects have been defined by GEF/SGP/UNDP in Malaysia (Penang Island, Seberang Prai, Kedah and Sematan- Sarawak) to support Sustainable livelihood for protecting Mangrove Ecosystem Biodiversity. However, there is no effort to create a participatory management plan for mangrove habitats. No academic research or evaluation report is available about these projects.

Nasuchon (2009) in her yearly report for the United Nations (Division for Ocean Affairs and the Law of the Sea) has reviewed the approaches of coastal management among the countries around the Gulf of Thailand which is important because of many reasons including Mangrove habitat. Vietnam, Cambodia, Thailand and Malaysia are the countries that have been studied regarding their coastal and community management system. In comparison, Vietnam has a better community management based on the traditional methods of resource management, while Malaysia has the strongest governmental structure with federal support but the weakest in community management. In Vietnam, traditionally, the small-scale fisheries have participated in fisheries management. For instance, a fisher has certain rights (right to fish in a certain area, inheritance rights, right to loan or share their access rights). Also, the fishermen have established Fishery Protection Group – that was recognized by the local government. As a result, the number of fishermen using electric gears decreased. On the other hand, Thailand has benefited from a centralized approach beside a poor fisheries community based resource management but this country encounters to overexploitation of resources, while Cambodia is very young in its coastal and community management and mostly is focused on the freshwater management. Such analysis shows that participatory approaches in mangrove management have not been applied in Malaysia. This is a major gap that can be addressed.

CHAPTER 3: RESEARCH METHODOLOGY

3.1. Studied areas

3.1.1. The Matang mangrove forest

The Matang mangrove forest with an area of 40,466 ha is located in the west part of peninsular Malaysia in the state of Perak between the latitude 4° 15'N − 5° 1'N and longitude 100° 2' − 100° 45'E (see Figure 3.1). The Matang is among the best sustainable and intensively managed for production of fuel wood and charcoal (Amir, 2012; Ashton et al., 1999; Chong, 2006; Chowdhury, 2008). Matang is managed by the Forestry Department of Perak and is the single largest mangrove forest in Peninsular Malaysia (with 40% of the total mangrove forest in the peninsular). Maximizing production of green wood for pole and charcoal wood is the main objective for mangrove economic utilization in the Matang Working Plan (Ahmad, 2009; Chong, 2006).

The Matang mangrove forest is rich in the various species of mangroves and it has been claimed that there are about 28 true mangrove species and 13 associate species, while 85 per cent of the total forest area are *Rhizophora apiculata* and *Rhizophora mucronata* (Alongi, 2002; Ashton et al., 1999).

A total of 74% of the Larut Matang mangrove forest is gazetted as productive forests for the purpose of logging and regeneration while 24% has been designated as protective area for ecotourism activities and another 1% is kept as virgin jungle reserve for research purposes (Ahmad, 2009). The Larut Matang mangrove ecosystem includes the surrounding village communities, which in one way or another, are dependent on the forest. The Malay and Chinese communities are mostly involved in agricultural, forestry and fishing sectors (fish, prawn and crab catching and cockle farming). The mangrove

forest in Larut Matang provides employment to almost 12500 villagers in the forestry and fisheries sectors.

Charcoal is the Matang Mangroves' primary economic timber product. Besides its usage as fuel, charcoal is also further processed into other products such as soap, cigarette filters, shoe soles and water filters.

The mangrove forest of Larut Matang is a well-known location for bird watching activity. It is a rich habitat for migratory and local forest birds (Jasmi et al., 1992). More than 58 species of migratory birds have made stopovers in mudflats of the mangrove forest. Storks and terns are the main attraction for bird watchers in the location (Malaysia, 2009).

Figure 3.1: Map of the Matang mangrove forest reserve (insert: map of Peninsular Malaysia indicating Matang mangrove)

3.1.2. The Carey Island

The Carey Island is one of the Mangrove Protected areas in the Malaysia which is situated in the state of Selangor, on the West coast of Peninsular Malaysia in south west of Kuala Lumpur.

Carey Island with total area of 16,187 hectares where 65% of it is under plantation with Oil Palm is a large island and is an initial settlement area for Mah Meri who is one of the major tribes of aboriginal tribes of Malaysia (Yong, 2009; Affandi et al., 2010).

In the early 1900s, the Carey Island was known as Pulau Si Alang (some peoples refer Pulau Bangsar), located approximately 14km off Port Klang, the island was only inhabited by the Mah Meri tribe (Figure 3.2). It became the Carey Island after planter, an Englishman in the name of Edward Valentine John Carey has acquired an island from His Highness Sultan Sulaiman of Selangor to start rubber plantations and since then until now, the island is known as the Carey Island or Pulau Carey.
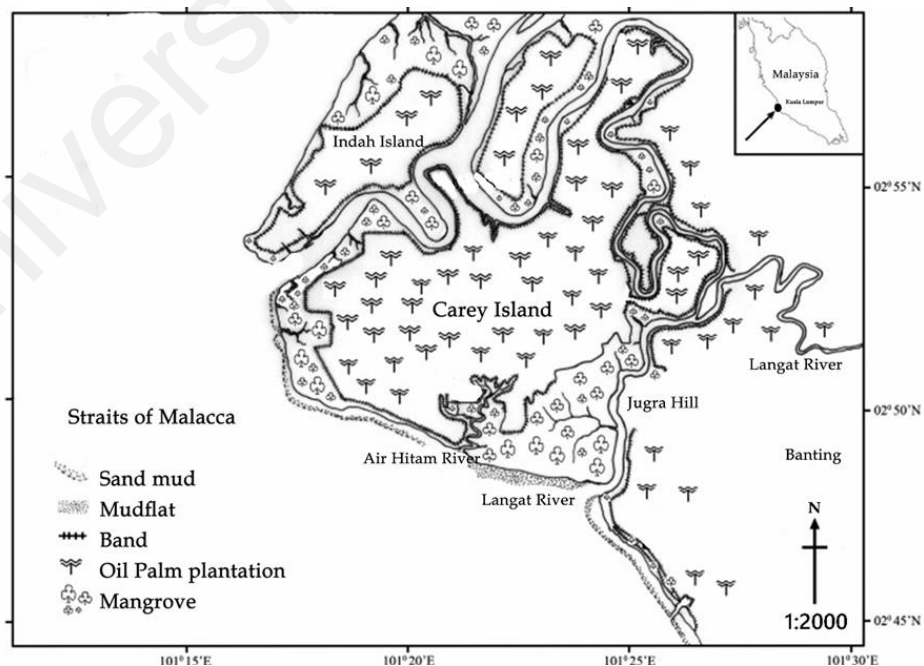
Figure 3.2: Map of the Carey Island Mangrove Forest

3.2. Methodology background

The research uses a managerial analytic tool (Chang & Huang, 2006) based on a participatory approach that goes through three stages of data gathering. An analytical model of assessing strengths, weaknesses, opportunities and threats (SWOT) has been selected for the purpose of studying the internal and external factors affecting an environment for deciding on the management strategies. It applies a qualitative research methodology for data collection. It uses interviews, Focus Group Discussions (FGD), field observations and using questionnaires in various phases of the study.

SWOT is a participatory model if is based on the contribution from stakeholders while during its implementation it can raise their awareness, and contributes to their empowerment (Camden et al., 2009). Data is collected in participatory manner (Mendoza & Prabhu, 2005) since it is based on brainstorming (Popper et al., 2008), engages communities (Margles et al., 2010) and uses a facilitated process (Mendoza & Prabhu, 2005). It involves actors (Vonk et al., 2007) that assist to a participatory evaluation (Pesonen et al., 2001; Camden et al., 2009).

SWOT is an analytical model of planning used for an entity or an environment as a management tool which proposes a series of categorized strategies by listing, evaluating and matching strengths and weaknesses (as internal factors) and opportunities and threats (as external factors) through participation of stakeholders.

SWOT analysis has been used in coastal management (Horigue et al., 2014; Nouri et al., 2008; Panigrahi & Mohanty, 2012; Siaosi et al., 2012), in evaluation of regulations (Panigrahi & Mohanty, 2012), in environmental evaluation (Lee & Lin, 2008); forest research and management in general (Đào et al., 2002; Dwivedi & Alavalapati, 2009; Guiang et al., 2001; Masozera et al., 2006; Mendoza & Prabhu, 2005; Pykäläinen et al.,

2007; Rauch, 2007) and in particular in mangrove forest management (Dilmaghani et al., 2011) as well as in tourism and ecotourism management (Hong & Chan, 2010; Jie, 2008; Sariisik et al., 2011) and last but not least in participatory community-based management and stakeholders' analysis (Margles et al., 2010; Mendoza & Prabhu, 2005; Robins & Dovers, 2007; Srivastava et al., 2005; Suh & Emtage, 2005).

To justify why SWOT has been used, a comparison is required to be done with other similar tools. SOAR, SCOPE and PEST are three similar methods that are used in management and strategy formulation. SOAR stands for "strengths", "opportunities", "aspirations" and "results" is a similar method to SWOT which is based on the positive thinking approach, and that's why it ignores two factors of "weaknesses" and "threats". Those who use the SOAR tool claim that it is a methodology that includes factors such as motivation and engagement into planning (Jairam & Kiewra, 2009). The researcher did not choose SOAR since the two factors of "weaknesses" and "threats" were important in the forest management and strategy formulation and the researcher could not ignore them.

SCOPE is another management tool. It is the same as SWOT since it analyses both internal and external factors but in its own language and method. SCOPE stands for "situation", "core competencies", "obstacles", "prospects" and "expectations". For instance, when obstacles are studied in this model, they refer to all internal and external factors. However, SCOPE has been used few times by academic researchers. There is doubt whether it can be effective in forest management, while SWOT has been extensively used by academicians.

Another management tool is "PEST" which is the use of political, economic, social and technological analysis. PEST is also referred to as "STEP" (a simple change in the place of letters). PEST is a framework for analysing macro-environmental factors (Shtal

et al., 2018). Certain researchers have included "environment" as a factor and have changed it in form of STEEP. Other have added other factors such as "legal" and "ethical" factors and called it STEEPLE. PEST can be used along with SWOT and the four factors are analysed through the four political, economic, social and technological aspects. However, for the purposes of the present research which is limited to two forests in Malaysia, then PEST cannot be regarded a suitable tool. PEST is a macro-environmental management tool, and could not be applied in smaller target groups. The four factors in SWOT are studied within the limited area of the two forests and the target villages on their periphery.

Finding priority strategies for managing a mangrove forest can be a major part of managerial decisions that might be considered in planning phase of the forest management. It is part of the management process (including an analysis of the external and internal environment, strategy formulation, implementation, monitoring and evaluation). In fact, SWOT can be used as the analysis tool and the Quantitative Strategic Planning Matrix (QSPM) is used as strategy formulation tool. Both SWOT and QSPM are used together to help managers of a conserved area to find priority strategies for its management.

Quantitative Strategic Planning Matrix (QSPM) or strategies attractiveness matrix is a managerial technique used along with SWOT in decision-making stage for prioritizing strategies through comparing their relative attractiveness (Hosseini Nasab & Milani, 2012). The QSPM tool has been used in coastal flood management (Vafaei & Harati, 2010), mangrove forest management (Dilmaghani et al., 2011), coastal ecotourism (Monavari et al., 2013; Nourbakhsh et al., 2013; Tabibi & Rohani, 2011) and protecting coastal landscape resources (Baby, 2013).

David et al. (2009), while demonstrating QSPM's usefulness, refers to it as a "clear framework" for strategy formulation, since it provides a method for prioritizing strategies in an "objective/quantitative" process. In the present research, the fourth key question is to find out the possible management strategies for the selected areas. Therefore, QSPM could be a good framework for responding the fourth key question. Another method that can be used instead of QSPM is AHP or the analytic hierarchy process. This tool can be used along with SWOT to prioritize strategies. Ananda et al., (2009) in a study of multi-criteria decision making methods, writes about AHP that in most studies, AHP have been used where there is a single decision-maker. In fact, AHP is more effective where there are various decision-makers. As this research does not aim to study the levels of decision-making, therefore, it seems QSPM is more appropriate.

3.3. Definitions

It is important to define the five words that will be used during the applying the methodology. These are as follow:

3.3.1. Strategy

According to the Oxford Advanced Learners' Dictionary, 'strategy' means "a plan that is intended to achieve a particular purpose". It was derived from the Greek stratēgia that means 'generalship' or in other words, it is about the art of leadership by a general (how to lead an army). In the second half of the twentieth century that the term 'strategy' came into the business literature. In fact, it is a chosen mechanism to guarantee the realization of the goal through the proper consideration of capacities and opportunities within a selected area. In the present research, the researcher used SWOT analysis to find out the priority strategies for two targeted natural forests in Malaysia.

3.3.2. Strength

It is a positive factor that refers to an internal ability, capacity, resource or advantage within a defined limit of a forest that can help a sustainable activity to be planned for the forest conservation. Also, strengths are the characteristics of the location or people involved or the local group that give it an advantage over others. The purpose is to profit from the strengths.

3.3.3. Weakness

It is a negative factor that refers to a condition or a disadvantage that hampers an activity to succeed for conservation of a forest. Also, weaknesses refer to the characteristics of the people involved or the local group at a disadvantage relative to others. The purpose is to overcome the weaknesses.

3.3.4. Opportunity

It is a positive external factor that refers to the resources or capacities within the environment (out of the forest) that can help an activity to success for conservation of a forest or to improve the performance of the people involved in the area in conservation. The purpose is to use the opportunities as much as possible.

3.3.5. Threat

It is a negative external factors within the environment (out of the forest) that might reduce the chance of successful activities or hampers them or cause problems for the forest. The purpose is to overcome the threats.

3.4. Methodology design

This work was conducted through three stages using various methods and tools for data collection. Figures 3.3 and 3.4, illustrates the process of the research methodology in terms of methods, outputs, kind of respondents and number of respondents/participants, and shows how they have been used to produce data for finding management strategies of the two selected forests: The Matang Mangrove Forest Reserve and the Carey Island Mangrove Forest. The process of the research methodology for both selected targets have been illustrated below.
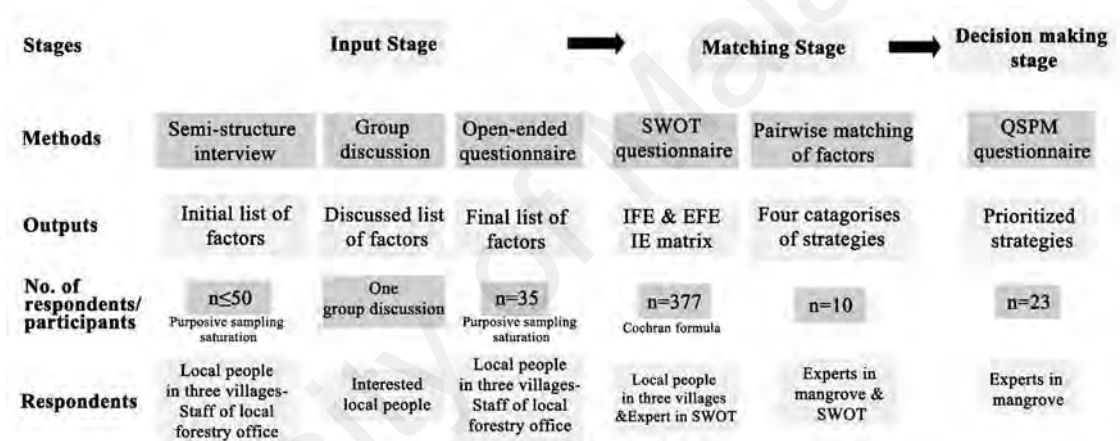
Figure 3.3: The process of the research methodology for the Matang Mangrove.
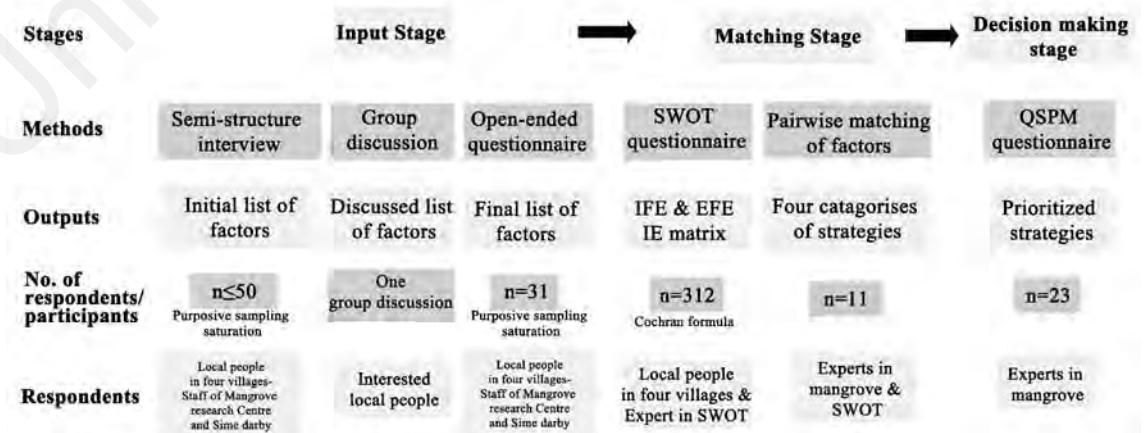
Figure 3.4: The process of the research methodology for the Carey Island.

3.4.1. The research process

The research methodology process had three stages in both cases. It started with the Input Stage that was composed of three phases: i. Semi-structure interview, ii. Group discussion and iii. Open-ended questionnaire. The first phase was the "semi-structured interview" that aimed at preparing an initial list of opportunities and threats (as the external factors affecting the mangrove forest in Matang) and strengths and weakness (as the internal factors). Each interview started with a summary of what the research was about through which the interviewee was encouraged to think about the forest and respond the four main questions (arising from the SWOT method) regarding the factors, while the interviewer was open to the ideas to be raised during the interview.

For the Matang Mangrove Forest Reserve, the main sources of data came from the three selected local communities and the Forestry Department local office staff (13 people). The selected villages were on the periphery of the Matang forest reserve: 1. Kuala Sepetang (previously called Port Weld), a Chinese fishing village with a population of 5500, 2. Kampung Menteri with a population of 1300, located next to Kuala Sepetang, 3. Kuala Gula located northwest of Matang with a population of 7100. The villages affect the Reserve and use it as a resource in different forms. It is important to add that the Global Environment Centre (GEC) – a non-governmental organization - has facilitated the process of formation of a local group (Sahabat Hutan Bakau or the Friends of Mangrove Forest) in Kuala Gula since 2008. The group is responsible for promoting and encouraging mangrove rehabilitation.

When an initial list of factors was prepared out of the interview contents, the second phase of the first stage started. The list was checked in a discussion group with a number of respondents during the next field trip; based on these discussions, the initial list was revised. In the next phase, an open-ended questionnaire was prepared to examine the

factors indirectly. In Matang, the respondents (n=35) were Chinese (47%), Malay (46%) and Indian (7%); also 67 per cent of them were men and 33 per cent women. The majority of the respondents (76%) have been living there for more than ten years and more than 70% of them were from young generation (between 20 and 40 years old). Based on the results from this questionnaire, the list of factors was finalized. The whole process of the first stage took about seven months (from March 2011 to October 2011). The researchers travelled to the villages several times.

In Carey Island with the population of 2700, there were 312 respondents from four villages and the staff of the Mangrove Research Centre (MRC). The Four villages were Kampung Sungai Bumbun, Kampung Orang Asli Sungai Judah, Kampung Sungai Rambai and Kampung Malayu.

The second stage lasted more than one year (October 2011 to November 2012). It built upon the inputs from the first one and consisted of two phases: the SWOT questionnaire and the pairwise matching. For the questionnaire, the factors were scored on the basis of a Likert scale from 5 to 1 (very great extent, great extent, some extent, little extent, very little extent). For each factor (Strengths, Weaknesses, Opportunities and Threats), there was one question (in total 50 questions). This questionnaire was required to be filled with more respondents.

3.4.2. Questionnaires

As it is clear from the process of the research methodology in two selected forest areas, three sets of questionnaires were designed and filled (in total six questionnaires). The initial questionnaire was designed with aim to finalize the factors; the SWOT questionnaire was designed to weigh the four kinds of factors by the local communities, and the QSOM questionnaire was designed to prioritize the strategies. Each questionnaire

had different respondents. More explanations about the questionnaires have been provided in Table 3.1.

In SWOT questionnaire, factors are scored on the basis of a Likert scale from 5 to 1 (very great extent, great extent, some extent, little extent, very little extent). The Likert scale is a helpful tool used in SWOT questionnaires to quantify the qualitative views of local people regarding factors. In fact, it is a method of measuring factors, and shows the level of people's agreement or disagreement for each strength, weakness, opportunity and threat. In this way, the researcher is able to form the matrices of IFE (for internal factors) and EFE (for external factors) to calculate the sum the weighted scores of every factor, which are much useful in determining strategies. The scoring is done by local people, and later, when QSPM questionnaire is scored by the experts, there is a column of Wi which contains the results of IFE and EFE. This means that weighing implied by local people, are used even in QSPM for prioritizing strategies. The method of weighing for QSPM are explained in the related sub-section.

Table 3.1: Questionnaires used in the various stages of the research

	Kind of Questionnaire	Stage of research	Respondents	Number of Respondents		Explanation
				Matang Forest	Carey Island Forest	
Initial	Open-ended; containing 50 questions for Matang and 36 questions for Carey Island	Input stage	Local people in target villages and staff of local forestry office	35	31	Both questionnaires are attached: appendices A and B

Table 3.1, Continued.

SWOT	Factors were scored on the basis of a Likert scale from 5 to 1. Each question referred to one factor. For Carey Island: 50 questions and for Matang: 51 questions	Matching Stage	Local people in target villages and experts in SWOT	377	312	The text of the both questionnaire (each for one area) is attached: appendi ces C and D
QSPM	allocation an attractiveness score of 0 to 4 to each factor: 816 comparisons for Matang and 592 for the Carey Island	Decision-making Stage	experts in mangrove ecosystem conservation	23	23	The text of the both questionnaire (each for one area) is attached: appendices E and F

3.4.3. Sampling and sampling size

There have been a series of sampling in this research. First of all, two forests have been selected in Malaysia. Secondly, villages on the periphery of the selected forests have been chosen as target villages. And at the third selection, a series of people have been selected randomly as respondents.

The two different forests were selected purposively to create maximum variation. The following table demonstrates this variation. The selected forests are located in two different states, while Matang is systematically managed with the other one (Carey Island) has only a plan of rehabilitation. Even the people living on the periphery of these two forests are diverse. Matang is a large forest in comparison with the Carey Island forest.

While Matang is a productive forest, the Carey Island forest acts like buffer zone for the plantations. The mangrove species in the Matang are more than the Carey Island forest and even the wild life is not the same.

Table 3.2: Comparison of two selected areas

	The Matang Forest Reserve	The Carey Island forest
States	the state of Perak on the West coast of Peninsular Malaysia	the state of Selangor, on the West coast of Peninsular Malaysia in south west of Kuala Lumpur
Management Plans	Matang is managed by the Forestry Department of Perak: 74% as productive forests for the purpose of logging and regeneration while 24% as protective area for ecotourism and 1% is kept as virgin jungle reserve for research purposes	No plan but Mangrove rehabilitation is going on.
People living on the periphery of the forest	Mostly Chinese, with Malay and Indian population	2700 inhabitants including Mah Meri tribe (Orang Asli) and Malay people
Largeness (Area)	40,466 ha	1876 ha Forest Reserve- mainly mangroves – the total size of the Island is 16,187 hectares with 10.521 ha of palm plantation
Functions	Systemic Management with production of green wood for pole and charcoal wood, ecotourism and also research	Acting like a buffer zone for Sime Darby Plantation,
Mangrove species	28 true mangrove species and 13 associate species, while 85 per cent of the total forest area are *Rhizophora apiculata* and *Rhizophora mucronata*	16 species from 5 families of Mangrove such as: *Rhizophora apiculata, R. macronata, Scyphiphora hydrophyllacea, Fageraea crenullatum, Lygodium salicifolium, Nephrolepsis biserrata, Acrostichum aureum, Sonneratia alba* and *Avicennia alba*
Wild life	19 mammals and 155 bird species	75 bird species, 41 species of butterflies, 26 Species of Dragonflies, 52 species of flora

For the selection of villages, there has been no sampling. All related villages on the periphery of the selected forests were chosen as target villages. Three villages for the Matang forest, and four villages for the Carey Island were the target villages. The characteristics of these villages have been explained in the subsections of 4.2.2. for the Matang forest and 5.2.1. for the Carey Island forest.

For respondents, random sampling was applied to avoid bias in the research. In fact, every inhabitant of the villages had an equal chance to be selected. The researcher randomly picked respondents from the villages' population. The simple random sampling was useful to make generalizations about the villages' population. For the research purposes, no subgroups or layers (such as age or gender subgroups or even people from different families or subjects with different education level) were required since the residents of the villages had similar values. Also, the researcher did not want to study the behaviour of different sub-groups in the villages. That's why stratified sampling was not used in the present research.

The sampling size (n) was calculated using the Cochran formula for the target villages (Altomare et al., 1991; Casagrande et al., 1978; Hafezniya, 2009). In the Cochran formula:

$$n = \frac{\dfrac{t^2 pq}{d^2}}{1 + \dfrac{1}{N}(\dfrac{t^2 pq}{d^2} - 1)} = 377$$

t: Is the level of confidence (in this case, 95% equal to 1.96),

p: is the percentage of the population having the attributes (0.36 for the Carey Island & 0.48 for the Matang),

q: is the percentage of the population not having the attributes (0.64 for the Carey Island & 0.52 for the Matang),

d: is deduction of the real proportion of the attributes to estimated size by the researcher which is here five per cent (0.05),

N: is the whole population (13900 for the Matang & 2700 for the Carey Island).

This gave the researchers a total sample size of 377 for respondents from Matang selected villages, which were from the three selected villages with 65% men and 35% women. It is worthwhile to mention that during filling the questionnaires (and even during the time when the open-ended questionnaire was filled at the previous stage), most of the time, people in local communities talked to each other about the questions. This was important, since in this way, they were certain what they were responding.

In the Carey Island, of all the villages located over there, four villages (Kg.Sungai Judah, Kg. Sungai Bumbun, Kg. Sungai Rambai and Kg, Melayu) and the Sime Darby staff were randomly selected as sample ones for interviewing and filling in the questionnaires. Using the above Cochran formula, the sampling size (n) was calculated for the selected villages and the total sample size was 312.

3.4.4. SWOT Matrix and pair-wise matching of factors

Based on the results of analysing from SWOT questionnaire, the main content for SWOT Matrix is produced to codify strategies. To be able to determine strategies, four kinds of pair-wise matching are done. These four matching activities are as follow:

1. Comparing and matching between the internal strengths and the external opportunities and entered into the SO box in the SWOT matrix

2.   Comparing and matching between the internal weaknesses and the external opportunities and entered into the WO box in the SWOT matrix

3.   Comparing and matching between the internal strengths and the external threats and entered into the ST box in the SWOT matrix

4.   Comparing and matching between the internal weaknesses and the external threats and entered into the WT box in the SWOT matrix

Table 3.3: A Schematic view of the Matrix of Strengths, Weaknesses, Opportunities and Threats and pairwise matching

	Strengths (S) 1. 2. 3. 4. 5. 6. 7. 8. 9.	Weaknesses (W) 1. 2. 3. 4. 5. 6. 7. 8. 9.
Always in blank		
Opportunities (O) 1. 2. 3. 4. 5. 6. 7. 8. 9.	**SO Strategies** 1. 2. 3. 4. 5. 6. 7. 8. 9.	**WO Strategies** 1. 2. 3. 4. 5. 6. 7. 8. 9.
Threats (T) 1. 2. 3. 4. 5. 6. 7. 8. 9.	**ST Strategies** 1. 2. 3. 4. 5. 6. 7. 8. 9.	**WT Strategies** 1. 2. 3. 4. 5. 6. 7. 8. 9.

3.4.5. IFEM and EFEM

At this stage, the internal factor evaluation matrix (IFEM) as well as the external factor evaluation matrix (EFEM) were used to give a deeper understanding of all the involved factors. After identifying the strengths and weaknesses as the main content of IFE and EFE matrix, a weight was assigned from 0.00 to 1.00 to each factor. The weight is the sum of the scores by respondents to one factor (in SWOT questionnaire) divided by the total sum of all scores to all factors. Therefore, it is a number between 0 and 1 and the total sum of all weights should be 1. A rating of 1 to 4 was assigned by the researchers to every factor due to their long engagement in data collection and their familiarity with the Matang Mangrove Forest or the Carey Island Forest. For the factor which illustrates a major weakness/threats, rating (1), a minor weakness/threats rating (2), a minor strength/opportunities rating (3), or a major strength/ opportunities, rating (4) is assigned. The result of multiplying of rating by the weight would be a weighted score for each factor and the sum of weighted score is IFE or EFE (Ali Ahmadi, 2007; Almasi et al., 2011; Chang & Huang, 2006; David et al., 2009; Dilmaghani et al., 2011; Moharram Nejad, 2012; Parsayan & Aarabi, 2009; Reihanian et al., 2012).

3.4.6. IFE and EFE

The results from IFE and EFE – which is between 0 and 4 – are helpful in strategy formulation and are used in the Internal-External (IE) matrix. This matrix is another management tool for the simultaneous analysis of both internal and external factors. This tool gives us a better insight of the status quo in the study field based on the results from EFE and IFE. It is a two-dimension matrix in which the IFE total weighted score will be shown on the X axis and the EFE total weighted score on the Y axis. If both scores are between 1.0 and 1.99, they show a weak internal status; if between 2.0 and 2.99, they are considered middle; and if between 3.0 and 4.0 they prove a strong position. When the

two-dimension matrix is illustrated, it can be divided into nine cells with three major regions with different strategy implications (Figure 3.5). The first one is composed of the cells 1, 2 and 4 and it is called the "grow and build" region. There is a need for intensive or integrative strategies which means the present status quo has a good basis. You can move forward and "grow" your work. The second one is named "hold and maintain" and has three cells of 3, 5 and 7. Here, there is a need for strategies that keep the status quo on-going; it means that there is no need for change. You may continue with the previous strategies. The last one is composed of the cells 6, 8 and 9 and it is called the region of "harvest or divest". It means that a change of policy is needed; you might continue with the existing strategies but it is time to change to another policy, as the conditions do not support the present strategies (Butarbutar et al., 2014; Tavallaei et al., 2013).
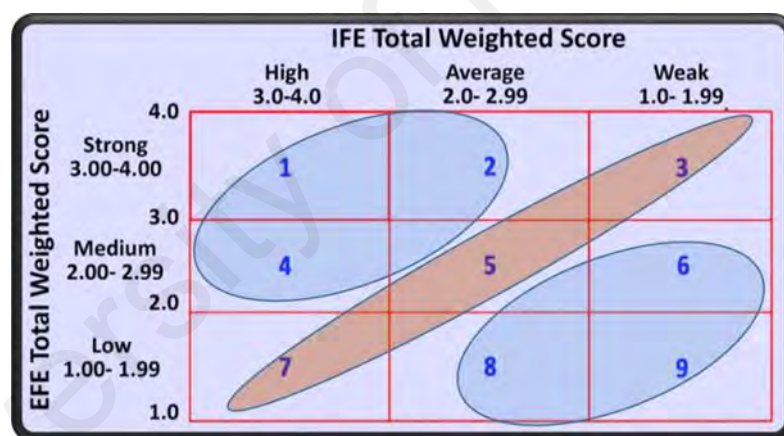
Figure 3.5: Internal-External (IE) matrix template

3.4.7. SWOT Matrix

The second phase of the second stage is to shape SWOT matrix to generate four group of strategies (SO, WO, ST and WT). Usually there will be similarities among the resulted strategies and in certain cases we can merge the strategies.

3.4.8. Quantitative Strategic Planning Matrix (QSPM)

Quantitative Strategic Planning Matrix (QSPM) or as it is often called "strategies attractiveness matrix" is a managerial tool applied with SWOT methodology to prioritize strategies by comparing their relative attractiveness, mostly used in decision-making phases (Ali Ahmadi, 2007; Almasi, 2010; Almasi et al., 2011; Hosseini Nasab & Milani, 2012; Moharram Nejad, 2012; Nouri et al., 2008; Piran, 2003). The QSPM tool has been used in coastal flood management (Vafaei & Harati, 2010), mangrove forest management (Dilmaghani et al., 2011), coastal ecotourism (Monavari et al., 2013; Nourbakhsh et al., 2013; Tabibi & Rohani, 2011) and protecting coastal landscape resources (Baby, 2013). In this research, the QSPM was used in the third stage for prioritizing the strategies.

A QSPM questionnaire was designed (Appendix E and F) for each of the cases. For Matang, fifty-one factors and thirty-seven factors for the Carey Island were listed in the first column. Each of the next columns was used for one strategy (sixteen columns for sixteen strategies). The experts in mangrove ecosystem conservation (n=23) who filled this questionnaire, had to allocate an attractiveness score of 0 to 4 (0= not relevant, 1 = not acceptable, 2 = possibly acceptable, 3 = probably acceptable, 4 = most acceptable) by answering to this question: Has this factor affected to choose this strategy? Through the questionnaire 816 comparisons for Matang and 592 for the Carey Island were made. The data were entered into SPSS for the calculation of the mean scores for each factor.

Based on the results from the QSPM questionnaire, the QSPM matrix is designed with five columns. The first one comprises the factor number. The second column enlists the factors. The third column contains the weighted score of each factor, which have exactly been derived from IFE (for internal factors) and EFE (for external factors) matrices (Wi). The fourth and fifth columns are allocated for one strategy. The fourth is the mean score as calculated for the strategies (AS) and the fifth is the multiplication of the weighted

score of each factor and the mean attractiveness score (WiAS), and then all the results for one strategy were added up. This sum was the relative attractiveness of each strategy. Higher sum signifies a more attractive strategy while to produce these scores we have considered all the relevant external and internal factors that might influence the strategic decision. At this point, the strategies were re-arranged (Rezazadeh et al., 2017).

3.5. Trustworthiness

Trustworthiness, which is validity in qualitative research, has obtained through different techniques in this research. First of all, the researchers spent some time, before starting the data collection, through organized interviews or filling the questionnaire with local communities trying to build trust between them. The site visits and spending long time with the local communities, using their boats to seal over the rivers and communicating with them during the trips as well as contacting to the local Forestry department prepared a friendly atmosphere to collect trustful data from the communities.

The researchers started the interviews only when they were certain that the ice between the participants and the researchers has been broken and a sense of trust was built among them. They were free to leave the interview or stop filling the questionnaire whenever they felt they could not give accurate information. Moreover, they entered the Chinese community in Matang with a Chinese-Speaking citizen who could facilitate the process of ice-breaking and trust-building. To be certain about the internal validity, the researchers checked the collected data through observations and interviews with the members of the targeted local communities. Also where necessary, triangulation was used (local people, local Forestry Department staff and the academic experts in mangrove conservation) the use of experts in two stages of "matching" and "decision-making" was helpful in applying the existing experience on mangrove in generating the strategies and prioritizing them.

To decrease researcher-based bias during the data collection phase, the researchers used other experts (one anthropologist and one community facilitator) to accompany and help them during the interviews and the FGD session.

3.6. Summary

The chapter introduces the methodology of the study. SWOT and QSPM have been selected as two quantitative methods for finding priority strategies for two selected cases: Matang Forest Reserve and Carey Island Forest, both located in Malaysia. The chapter gives certain information about the two forests and the target communities.

The research methodology process has been carried out in three stages. It started with the Input Stage that was composed of three phases of 1) semi-structure interview and 2) group discussion and 3) open-ended questionnaire. The second stage is built upon the inputs from the first one and consisted of two phases: 1) the SWOT questionnaire and 2) the pairwise matching. The third stage of the research methodology deals with decision making where the Quantitative Strategic Planning Matrix (QSPM) was used for prioritizing strategies.

CHAPTER 4: RESULTS FROM THE MATANG MANGROVE FOREST

4.1. Introduction

This chapter aims to provide the prioritized key strategies for the Matang Mangrove Forest Reserve. It starts with certain general information about the Matang Mangrove Forest Reserve giving a profile of its location, forests, species, working plans and the communities living adjacent to the reserve. The chapter continues with the results from the implementation of SWOT and QSPM matrices. A series of lists of internal and external factors, SWOT Matrix and the list of pairwise matching as well as the results from the QSPM are provided. The chapter finishes with a summary.

4.2. The Matang Mangrove Forest Reserve

The Matang is among the best sustainable and intensively managed mangrove forest for production of fuel wood and charcoal (Amir, 2012; E. C. Ashton et al., 1999; Chong, 2006; Chowdhury, 2008). It is the single largest mangrove forest in Peninsular Malaysia (with 40% of the total mangrove forest in the peninsular). Maximizing production of green wood for pole and charcoal wood is the main objective for mangrove economic utilization in the Matang Working Plan (Ahmad, 2009; Chong, 2006).

The following table is an overview of the reserve.

Table 4.1: An overview of the Matang Mangrove Forest Reserve

Items	Explanation
Location	It is located near Taiping on the northwest coast of Peninsular Malaysia between latitude 4° 15'N – 5° 1'N and longitude 100° 2' – 100° 45'E and within the administrative district of Krian, Larut & Matang and Manjung in Perak (in the west part of peninsular Malaysia).
Area	With an area of 40,466 ha. It has been divided into three forest ranges: A) Kuala Sepetang forest range with an area of 21.069 ha, B) Kuala Trong forest range with an area of 10.958 ha and C) Sg Kerang forest range with an area of 8.439 ha.
Management	It is managed by the Forestry Department of Perak.
Wildlife Species	- 19 mammals such as: Long-tailed Macaque (*Macaca fascicularis*), Leopard Cat (*Felis bengalensis*), Malayan Pangolin (*Manis javanica*), Smooth Otter (*Lutra perspicillata*), Short-tailed Mongoose (*Herpestes brachyurus*) and Island Flying Fox (*Pteropus hypomelanus*), White Dolphin (*Sousa chinensis*) - 155 bird species such as: Great Argus Pheasant (*Argusianus argus*), Buffy Fish Owl (*Ketupa ketupu*), Pink-necked Green Pigeon (*Treron vernans*), the rare Bronzed Drongo (*Dicrurus aeneus*) and the Mangrove Whistler (*Pachycephala grisola*)
Mangrove species	11 families, 28 species of Mangrove and 10 families, 13 associate mangrove species

Table 4.1, Continued.

Forest types	1. Accreting *Avicennia* Forest: newly formed, with young stands of *Avicennia* spp.
	2. Transitional New Forest: between the accreting *Avicennia* forest and the *Rhizophora* and *Bruguiera* forest. There are *Rhizophora* and *Bruguiera* in different proportions.
	3. *Berus* Forest: it occurs in sea front, with stands of *Bruguiera cylindrica* with small populations of *Rhizophora* and other *Bruguiera* spp.
	4. *Lenggadai* Forest: An occasional forest which has a mixture of *Bruguiera parviflora* with *Rhizophora* spp towards the mainland and *Bruguiera cylindrica* towards the sea front.
	5. *Rhizophora* Forest: The major forest in Matang (85% of the total forested area). Mostly *R. apiculata* and *R. mucronata*.
	6. Transitional Dryland Forest: between the dense stands of *Rhizophora* forest and the dryland forest, with a mixture of sparse stands of *Rhizophora* spp. and a large population of relic *Bruguiera* spp with a dense crop of *Acrostichum* ferns in the forest floor.
	7. Dryland Forest: Occurs in isolated patches in more elevated interiors of the island and mainland reserves. three canopy layers with a height of about 30 m and a diameter of 50 cm
	8. *Nypa* Forest: Confined to the upper stretches of river banks of tidal rivers where there is a greater freshwater influence (with *Avicennia* and *Sonneratia* near estuaries and *Heritiera* and *Exoecaria* spp. in the hinterland.

4.2.1. Working Plans of the Matang Mangrove Forest Reserve

The Matang Mangrove Forest has a history of more than 100 years of harvesting. It show how Matang has been important, it has had a working plan since 1908. The first working plan was prepared in 1904 by A. E. Wells and it was mostly about the Island reserves. Four years later, a working plan was prepared for the mainland reserves by J. P. Mead. Since then, the Matang Mangrove Forest has enjoyed systematic management. The working plan was revised many times. Also, the first report on mangrove forests was written in 1928 as a result of the research done on mangroves in Matang (Azhar & Nik, 2003).

Later, in 1930, a ten-year working plan was prepared by C. L. Duran that can be considered an important document; this continued with more management plans for the next decades. In 1940, it was E.D. Robertson who prepared the plan for the period of 1940 to 1949. Of course, during the Japanese occupation (1942-1945), the plan was not implemented, and it has been said there was some slight damage to the forest (Azhar & Nik, 2003).

After the war, the boundaries of the reserve were specified and new accurate maps were prepared by the Land and Survey Department of Malaya for the Matang Mangroves. This information helped D.S.P. Noakes to prepare a more comprehensive plan for the period of 1950 to 1959. It has been claimed that this working plan has a sustainable basis, and timber harvesting and fishing have been dealt in the plan in a way that these activities continued during the whole year (Azhar & Nik, 2003). The tradition of preparing ten year working plans for Matang continue with R. G. Dixon for 1960-1969; Mohamad Darus Mahmud for 1970-1979; Haron Abu Hassan for 1980-1989 (Haron, 1981) and Gan Boon Keong for 1990-1999.

The working plan for 1990-1999 was a different one, since it had chapters on fishery and conservation of mangrove forest for ecotourism purposes, and issues such as education and wildlife, traditional methods of timber harvesting were included too. Dato' Azhar Muda and Nik Mohd Shah Nik Mostafa prepared the working plan for the period of 2000 to 2009 (Azhar & Nik, 2003). As it has been mentioned in this plan, they have prepared the plan for the third ten-year period of the second rotation. The present working plan has been prepared by A Roslan and Nik Mohd Shah Nik Mostafa for the period of 2010 to 2019 (Goessens et al., 2014).

Table 4.2: Timeline of workplans for the Matang Mangrove Forest Reserve

Who prepared	The period of the working plan	Explanation
A Roslan, Nik Mohd Shah Nik Mostafa	2010-2019	The first 10- year period (2010–2019) of the third rotation
Dato' Azhar Muda, Nik Mohd Shah Nik Mostafa	2000-2009	The third ten year period of the second rotation
Gan Boon Keong	1990-1999	Balanced approach was used.
Haron Abu Hassan	1980-1989	
Mohamad Darus Mahmud	1970-1979	
R. G. Dixon	1960-1969	
D. S. P. Noakes	1950-1959	More comprehensive plan, sustainable basis
E. D. Robertson	1940-1949	During the occupation, there were some damage to the forest
C. L. Duran	1930-1939	
J. P. Mead	1908-	Working plan on mainland reserves
A. E. Wells	1904-	Working plan on Island reserves

4.2.2. About communities

It has been mentioned in the working plan prepared for the period of 2000-2009, that there are 28 fishing villages (both mainland and islands) that are scattered round about the Matang Mangroves. These villages are: Bagan Kuala Gula, Kuala Sepetang, Kg. Menteri, Telok Kertang, Sungai Punggur, Sungai Tingai, Sungai Kerang, Sungai Che Rahmat and Bagan Panchor (mainland villages) and two island villages of Bagan Kuala Sangga and Bagan Pasir Hitam (Roslan & Nik Mohd Shah, 2014). For the purpose of the present research, three villages (all on the periphery of the Matang forest reserve) were selected: 1. Kuala Sepetang (previously called Port Weld), a Chinese fishing village with a population of 5500, 2. Kampung Menteri with a population of 1300, located next to Kuala Sepetang, 3. Kuala Gula located northwest of the Matang with a population of 7100. The villages affect the Reserve and use it as a resource in different forms. The 377 respondents of the SWOT questionnaire (Appendix C) were from these three selected villages.

4.3. Internal Factors

For determining the factors, semi-structured interview was used to prepare an initial list of strengths and weaknesses as the internal factors and a list of opportunities and threats as the external factors affecting the mangrove forest in Matang. In each interview, the researcher explained about the objectives of the study and encouraged the interviewees to think about the forest and respond the four main questions about strengths, weaknesses, opportunities and threats (arising from the SWOT method), while the interviewer was open to the ideas to be raised during the interview. Other questions were about their livelihood; people's knowledge about Mangrove forest and its wildlife; dependence on Mangrove forest; the interest of the people in conservation; possible stakeholders; and natural and industrial factors.

As it was explained above, the main sources of data came from the three selected local communities (Kuala Sepetang, Kampung Menteri and Kuala Gula), all in places close to the forest as well as the Forestry Department local office staff (13 people). It is important to add that the Global Environment Centre (GEC) – a non-governmental organization - has facilitated the process of formation of a local group (Sahabat Hutan Bakau or the Friends of Mangrove Forest) in Kuala Gula since 2008. The group is responsible for promoting and encouraging mangrove rehabilitation.

When an initial list of factors was prepared out of the interview contents, the second phase of the first stage started. The list was checked in a discussion group with a number of respondents during the next field trip (please see the chapter on research methodology for detailed information on respondents); an open-ended questionnaire (Appendix A) was prepared to examine indirectly the factors. Based on the results from this questionnaire, the list of factors was finalized. The whole process of the first stage took about seven months (from March 2011 to October 2011). The following factors were the result of this stage.

4.3.1. Strengths (S)

Nineteen strengths were identified as the result of the first stage (open-ended questionnaire). All strengths are about the local villagers and their familiarity with the forest, the relationship of their life with the forest; what they know about it; their potentials and capacities in earning money from the forest and their interest in conservation of the Mangrove forest. The list of strengths is as follow:

S1. Most of the local people have been living there above 10 years

S2. The villagers have formal level of education

S3. The villagers are familiar with the Mangrove forest since their childhood

S4. The local people know that the Mangrove Forest can control the effects of erosion

S5. The villagers' life relates to the Mangrove Forest

S6. The local people know about the function of the Mangrove

S7. The villagers have accommodation facilities in their villages

S8. The local people know about what time tourists come to their villages for visiting the Mangrove Forest

S9. The villagers are interested in conservation of the Mangrove forest

S10. The villagers are interested to share their knowledge with others

S11. The local people like to share their knowledge about birds with others

S12. The local people like to protect the environment

S13. The villagers know that the Mangrove Forest can control the effects of tsunami

S14. The local people are interested to know more about the Mangrove Forest

S15. The local people are aware of the Mangrove forest areas in Malaysia

S16. The villagers have not used Mangrove resources for any medical purpose

S17. The local people like to work in a group for conservation of the Mangrove forest

S18. The local people go for harvesting less than 10 times in a month

S19. The villagers select trees (for any possible use) when they are matured

4.3.2. Weaknesses (W)

Sixteen weaknesses have been listed here. All of them are related to the local people and their role in conservation or use of mangrove forest.

W1. - Some of the local people did not know about the Mangrove Forest

W2. The villagers are fishing and harvesting anywhere from the Mangrove

W3. The local people do harvesting near the Mangrove Forest

W4. Selling is the most purpose of harvesting for villagers

W5. The villagers use the Mangrove wood for fire

W6. The local people did not share their knowledge with others

W7. The villagers did not know about Matang, which has the best plan for conservation of the Mangrove in the world

W8. The local people are not familiar with the Forestry House in Matang

W9. The villagers are not familiar with bird watchers

W10. The local people are not interested to share their knowledge about birds with others

W11. The villagers have no idea about the high season for bird watching

W12. The local people did not know about the wildlife in Matang

W13. The mere existence of charcoal factories

W14. Some villagers do not want to be in a group for conservation of the Mangrove Forest.

W15. The local people do irregular harvesting

W16. The villagers' life relates to the Mangrove Forest

4.3.3. Internal Factor Evaluation (IFE)

The Internal Factor Evaluation (IFE) is a strategic management tool for evaluating major strengths and weaknesses in functional areas of a management plan. The IFE matrix also provides a basis for identifying and evaluating relationships among those areas.

After identification of strengths and weaknesses that are the core content of any IFE matrix, the researcher uses the scores given by the respondents and normalizes every factor through giving a weight from 0.00 to 1.00. This is done through dividing the sum of the scores for each factor by the total sum of all factors. The weight given to a specific factor shows the relative importance of that factor. "Zero" means "not important". "One" indicates "very important". If there are more than 10 factors in the IFE matrix, it can be easier to assign weights using the 0 to 100 scale instead of 0.00 to 1.00. Irrespective of whether a key factor is a strength or weakness, those factors with the greatest importance in the management plan should have the highest weight. After assigning weight to individual factors, it was necessary to be sure the sum of all weights equals to 1.00.

The next step is to assign rating to each factor. This will be done by looking at the performance and level of its influence on the conservation plan. Practitioners usually use rating on the scale from one to four. Rating is done on the basis of whether the factor represents a major weakness (rating = 1), a minor weakness (rating = 2), a minor strength (rating = 3), or a major strength (rating = 4). If the rating scale 1 to 4 is applied, then strengths must receive four or three rating and weaknesses must receive one or two rating.

Now it is time for the IFE matrix math. To do that, it is necessary to multiply each factor's weight by its rating. This will produce a weighted score for every factor.

The last step to create the IFE matrix is to calculate the sum the weighted scores of every factor. This provides the total weighted score for the management plan.

Regardless of how many factors are included in an IFE Matrix, the total weighted score can range from a low of 1.0 to a high of 4.0 (assuming that the 1 to 4 rating scale is used). The average score that can be produced is possibly 2.5. Total weighted scores well below 2.5 point to internally weak management. Scores significantly above 2.5 indicate a strong internal position. Table 4.3 shows IFE for the Matang Mangrove Forest.

Table 4.3: Internal Factor Evaluation (IFE) – the Matang Mangrove Forest (n=377)

	Internal Factor	Weight	Rating	Weighed Score
	Strength			
S1	Most of the local people have been living here above 10 years	0.0271	3	0.081
S2	The villagers have formal level of education	0.0235	4	0.094
S3	The villagers are familiar with the Mangrove forest since their childhood	0.0261	4	0.104
S4	The local people know that the Mangrove Forest can control the effects of erosion	0.0263	4	0.105
S5	The villagers' life is related to the Mangrove Forest	0.0247	3	0.074
S6	The local people know about the function of the Mangrove	0.0254	4	0.101
S7	The villagers have accommodation facilities in their villages	0.0247	3	0.074
S8	The local people know about what time tourists come to their villages for visiting the Mangrove Forest	0.0239	3	0.071
S9	The villagers are interested in conservation of the Mangrove forest	0.0247	4	0.098

S10	The villagers are interested to share their knowledge with others	0.0242	3	0.072
S11	The local people like to share their knowledge about birds with others	0.0244	3	0.073
S12	The local people like to protect the environment	0.0250	4	0.100
S13	The villagers know that the Mangrove Forest can control the effects of tsunami	0.0262	4	0.104
S14	The local people are interested to know more about the Mangrove Forest	0.0238	4	0.095
S15	The local people are aware of the Mangrove forest areas in Malaysia	0.0240	4	0.096
S16	The villagers have not used Mangrove resources for any medical purpose	0.0226	4	0.090
S17	The local people like to work in a group for conservation of the Mangrove forest	0.0233	4	0.093
S18	The local people go for harvesting less than 10 times in a month	0.0204	4	0.081
S19	The villagers select trees (for any possible use) when they are matured	0.0221	4	0.088
	Weaknesses			

Table 4.3, Continued.

W1	Some of the local people did not know about the Mangrove Forest	0.0237	2	0.047
W2	The villagers are fishing and harvesting anywhere from the Mangrove	0.0122	2	0.024
W3	The local people do harvesting near the Mangrove Forest	0.0126	2	0.025
W4	Selling is the most purpose of harvesting for villagers	0.0122	2	0.024
W5	The villagers use the Mangrove wood for fuel	0.0122	1	0.012
W6	The local people did not share their knowledge with others	0.0230	2	0.046
W7	The villagers didn't know about Matang which has the best plan for conserve the Mangrove in the world	0.0119	2	0.023
W8	The local people are not familiar with the Forestry House in Matang	0.0126	2	0.025
W9	The villagers are not familiar with bird watchers	0.0121	2	0.024
W10	The local people are not interested to share their knowledge about birds with others	0.0126	2	0.025
W11	The villagers have no idea about the high season for bird watching	0.0128	2	0.025
W12	The local people did not know about the wildlife in Matang	0.0127	2	0.025
W13	The mere existence of charcoal factories	0.0123	2	0.024

Table 4.3, Continued.

W14	Some villagers do not want to be in a group for conservation of the Mangrove Forest.	0.0126	2	0.025
W15	The local people do irregular harvesting	0.0127	2	0.025
W16	The villagers' life is related to the Mangrove Forest	0.0122	2	0.024
	Total Weighted Score			**2.129**

4.4. External Factors

The same process used for the internal factors was used to determine the external factors.

4.4.1. Opportunities (O)

O1. Tourists have some knowledge about the Mangrove Forest

O2. Tourists like to share their knowledge with the local people

O3. The Forestry Department of Perak

O4. People who work for the Government

O5. The existence of the Forestry House

O6. The mere existence of a management plan for the Matang Mangrove Forest

O7. Academic researchers

O8. Malaysian universities

O9. Tourists who come to visit Matang

O10. International agencies have some projects in the Matang Mangrove Forest

4.4.2. Threats (T)

T1. Tourists do not share their knowledge with local people

T2. The threat of Earthquake

T3. Climate Change (in general)

T4. Risk of the tsunami

T5. Oil pollutions from ships

4.4.3. External Factor Evaluation (EFE)

The External Factor Evaluation (EFE) is a strategic management tool often used for assessment of current conditions. The EFE matrix is a good tool to visualize and prioritize the opportunities and threats that a protected area or a natural resource is facing**.**

Is very similar to the IFE matrix. The major difference between the EFE matrix and the IFE matrix is the type of factors that are included in the model. While the IFE matrix deals with *internal* factors, the EFE matrix is concerned solely with *external* factors. Table 4.4. shows the EFF for the opportunities and threats. The total weighted score for EFE for the Matang Mangrove Forest is 1.386 that is below 2.5. This score is later explained in IE Matrix.

Table 4.4: External Factor Evaluation (EFE) – the Matang Mangrove Forest (n=377)

	External Factor	**Weight**	**Rating**	**Weighed Score**
	Opportunities			
O1	Tourists have some knowledge about the Mangrove Forest	0.124	4	0.490
O2	Tourists like to share their knowledge with the local people	0.115	4	0.046
O3	The Forestry Department of Perak	0.104	4	0.042
O4	People who work for the Government	0.113	4	0.045
O5	The existence of the Forestry House	0.140	4	0.056
O6	The mere existence of a management plan for the Matang Mangrove Forest	0.132	4	0.053
O7	Academic researchers	0.245	4	0.098

Table 4.4, Continued.

O8	Malaysian universities	0.249	4	0.100
O9	Tourists who come to visit Matang	0.253	4	0.102
O10	International agencies have some projects in the Matang Mangrove Forest	0.253	4	0.102
	Threats			
T1	Tourists do not share their knowledge with local people	0.252	2	0.050
T2	The threat of Earthquake	0.251	2	0.050
T3	Climate Change (in general)	0.249	2	0.050
T4	Risk of the tsunami	0.258	2	0.051
T5	Oil pollutions from ships	0.257	2	0.051
	Total Weighted Score			**1.386**

4.5. IE Matrix

The Internal-External (IE) matrix is also a management tool for the simultaneous analysis of both internal and external factors. This tool gives us a better insight of the status quo in the study field based on the results from EFE and IFE. It is a two-dimension matrix in which the IFE total weighted score will be shown on the X axis and the EFE total weighted score on the Y axis. If both scores are between 1.0 and 1.99, they show a weak internal status; if between 2.0 and 2.99, they are considered middle; and if between 3.0 and 4.0 they prove a strong position. When the two-dimension matrix is illustrated, it can be divided into nine cells with three major regions with different strategy implications (see Figure 4.1). The first one is composed of the cells 1, 2 and 4 and it is called the "grow and build" region. There is a need for intensive or integrative strategies which means the present status quo has a good basis. You can move forward and "grow" your work. The

second one is named "hold and maintain" and has three cells of 3, 5 and 7. Here, there is a need for strategies that keep the status quo on-going; it means that there is no need for change. You may continue with the previous strategies. The last one is composed of the cells 6, 8 and 9 and it is called the region of "harvest or divest". It means that a change of policy is needed; you might continue with the existing strategies but it is time to change to another policy, as the conditions do not support the present strategies.

When IFE and EFE matrices were formed and calculated (Tables 4.3 and 4.4), it was found that the total weighted score of IFE was 2.192 and EFE was 1.386. Both scores were below 2.5. In this case, weaknesses and threats were superseding strengths and opportunities respectively. It means that the existing system of management is internally weak while there are communities' potentials and at the same time the existing strategies are not appropriately designed to meet the external opportunities and protect the forest against threats.
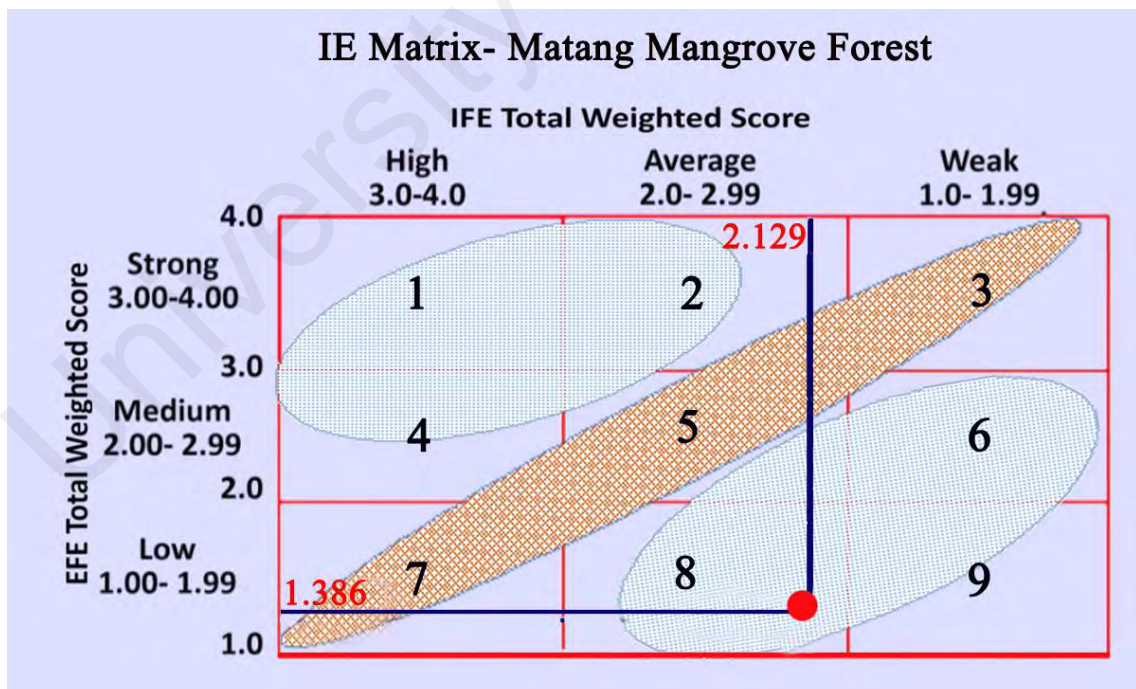
Figure 4.1: IE Matrix- the Matang Mangrove Forest

The point in this matrix referred to the third region which belong to the strategies of "harvest or divest". It indicated that a change in policies has to be decided. The result from this matrix was used by the researchers in pair matching of the strategies, trying to focus on strategies of change – more or less moving from the existing top-down planning to a bottom-up planning. Most of the positive factors (in particular strengths and some of the opportunities) referred to the involvement of local people.

4.6. SWOT Matrix

Based on comparing Internal and External factors (which was done by the researcher), SWOT matrix as shown in the next page (Table 4.5):

Table 4.5: SWOT Matrix with Identify Possible Strategies (the Matang Mangrove Forest)

	Strengths - Most of the local people have been living there above 10 years - The villagers have formal level of education - The villagers are familiar with the Mangrove forest since their childhood - The local people know that the Mangrove Forest can control the effects of erosion - The villagers' life is related to the Mangrove Forest - The local people know about the function of the Mangrove - The villagers have accommodation facilities in their villages - The local people know about what time tourists come to their villages for visiting the Mangrove Forest - The villagers are interested in conservation of the Mangrove forest - The villagers are interested to share their knowledge with others - The local people like to share their knowledge about birds with others - The local people like to protect the environment - The villagers know that the Mangrove Forest can control the effects of tsunami - The local people are interested to know more about the Mangrove Forest - The local people are aware of the Mangrove forest areas in Malaysia - The villagers have not used Mangrove resources for any medical purpose - The local people like to work in a group for conservation of the Mangrove forest - The local people go for harvesting less than 10 times in a month - The villagers select trees (for any possible use) when they are matured	**Weaknesses** -Some of the local people did not know about the Mangrove Forest -The villagers are fishing and harvesting anywhere from the Mangrove -The local people do harvesting near the Mangrove Forest -Selling is the most purpose of harvesting for villagers -The villagers use the Mangrove wood for fire -The local people did not share their knowledge with others -The villagers didn't know about Matang which has the best plan for conserve the Mangrove in the world -The local people are not familiar with the Forestry House in Matang -The villagers are not familiar with bird watchers -The local people are not interested to share their knowledge about birds with others -The villagers have no idea about the high season for bird watching -The local people did not know about the wildlife in Matang -The mere existence of charcoal factories -Some villagers do not want to be in a group for conservation of the Mangrove Forest. -The local people do irregular harvesting -The villagers' life is related to the Mangrove Forest
Opportunities Tourists have some knowledge about the Mangrove Forest - Tourists like to share their knowledge with the local people - The Forestry Department of Perak - People who work for the Government - The existence of the Forestry House - The mere existence of a management plan for the Matang Mangrove Forest - Academic researchers - Malaysian universities - Tourists who come to visit Matang - International agencies have some projects in the Matang Mangrove Forest	**SO strategies** 1. The Local people and tourists can share their knowledge on Mangrove in Malaysia 2. The Forestry Department of Perak, Malaysian universities and international agencies, can use of the local people knowledge in their projects 3. The Local people can be involved as tour guides (general and professional) 4. The Forestry Department of Perak and international agencies can employ the local people as volunteer in their projects for conservation of the Mangrove Forest 5. The local people can use of the knowledge of tourists and the Forestry Department of Perak to conserve the Mangrove Forest 6. The local people can participate and share their knowledge in academic research 7. The Forestry Department of Perak in cooperation with the Malaysian universities can help the local people to know more about the Mangrove Forest 8. The Forestry Department of Perak can handle visits for the local people to other Mangrove sites 9. The local people can collaborate and participate with international agencies and researchers to protect the migratory birds in the Matang Mangrove Forest 10. Malaysian universities in cooperation with the Forestry Department of Perak are able to increase the awareness of villagers to conserve the Mangrove Forest through involving them to monthly workshops 11. Tourists, Malaysian universities and international agencies can help and educate villagers to make a group to protect the Mangrove Forest 12. Malaysian universities, the Forestry Department of Perak and international agencies can increase the villagers knowledge about Mangrove through holding workshops on Mangrove Forest 13. The local people should know more about the role of Mangrove in controlling Tsunami effects 14. As the Matang Forest has a management plan for the Mangrove conservation, the Forestry Department of Perak can reduce the effects of erosion in cooperation with the local people 15. International agencies can make plan to control the erosion in Matang 16. The local people and the Forestry Department of Perak should use the present management plan of Matang for an extensive conservation 17. The villagers can share with and rent their accommodation facilities to others 18. Malaysian universities, international agencies, the Forestry Department of Perak and researchers can educate the group to know more about Mangrove conservation	**WO Strategies** 1. Tourists can share their knowledge with the villagers to know more about Mangrove 2. Tourists knowledge about Mangrove can lead to reduce the amount of use of Mangrove wood among the local people 3. The Forestry Department of Perak should make a document to show the places which the local people can go fishing or harvesting there 4. The Forestry Department of Perak can increase knowledge of local people about the Matang management plan with attending them in to the workshop 5. The Forestry Department of Perak can supervise people to control the amount of selling 6. International agencies, Malaysian universities and the Forestry Department of Perak together can implement projects in the villages for changing the livelihood and the amount of use the natural resources in Matang 7. Introduce the renewable or fossil fuel energy to the local people for reducing the amount of Mangrove wood consumption 8. Support the local people who are interested in continuing their education by the help of Malaysian universities, the Forestry Department of Perak, the Government and international agencies 9. The Forestry House can inform the local people about the suitable season for bird watching 10. The Forestry Department of Perak should inform the local people about the negative effects of irregular fishing on the environment 11. The Forestry Department of Perak in cooperation with Malaysian universities can encourage the local people to protect the environment and make an environmental group 12. The Forestry Department of Perak should supervise on charcoal factories in Matang
Threats - Tourists do not share their knowledge with local people - The threat of Earthquake - Climate Change (in general) - Risk of the tsunami - Oil pollutions from ships	**ST Strategies** 1. The Forestry Department of Perak can use the local people knowledge 2. The local people should protect the Mangrove Forest to control the effects of the tsunami 3. The Mangrove Forest can be used to control the climate change effects by the local people 4. Local groups can do some activities to protect the Mangrove Forest to control any possible tsunami disaster.	**WT Strategies** 1. Decrease the amount of harvesting to control the tsunami disaster 2. Decrease the amount of irregular fishing

4.7. Strategies from Pairwise Matching

The result of the SWOT matrix was a list of 36 strategies was produced. These strategies were compared and merged and, as a result, the following sixteen strategies were proposed .

St1. The Local people, tourists and academic researchers can share their knowledge on Mangrove in Malaysia

St2. The Local people can be involved as tour guides (general and professional)

St3. The Forestry Department of Perak (FDP) and International Agencies (IA) can employ the local people as volunteers in their projects for conservation of the Mangrove Forest

St4. The local people can collaborate and participate with IA and researchers to protect the migratory birds in the Matang mangrove forest

St5. Educate and help villagers to make a group to protect the Mangrove Forest

St6. Increase the villagers' knowledge and awareness about Mangrove Forest and its role to control the Tsunami effects through holding a workshop by the FDP, Malaysian Universities (MU) and IA.

St7. Reduce the effects of erosion by the FDP and IA in cooperation with the local people

St8. Local groups can do some activities to protect the Mangrove Forest to control any possible tsunami disaster.

St9. Reduce the amount of Mangrove wood used by the local people

St10. FDP should make a document to show the places where local people can go fishing or harvesting

St11. Change the livelihood of the villagers to use the natural resources in Matang in a sustainable way by the FDP, Government (GOV), non-governmental organizations (NGOs) and IA.

St12. Support the local people who are interested to continue their education by MU, FDP, GOV and IA

St13. FDP should inform the local people about the negative effects of irregular fishing on the environment

St14. FDP should supervise on charcoal factories in Matang

St15. Decrease the amount of harvesting to control the tsunami disaster

St16. Decrease the amount of irregular fishing.

4.8. Quantitative Strategic Planning Matrix

The third stage of the research methodology focused on decision making where the Quantitative Strategic Planning Matrix (QSPM) was used for prioritizing strategies. A third questionnaire was designed for weighing fifty-one factors (the output of the open-ended questionnaire) against sixteen strategies (from pairwise matching in SWOT matrix) by giving an attractiveness score of 1 to 4 – which meant 816 comparisons had to be made. The questionnaire was filled by 23 experts in mangrove ecosystem conservation. The data were entered into SPSS for the calculation of the mean scores for each factor. After that, for each strategy, a table of factors were drawn in which the attractiveness scores were multiplied by the weight previously calculated based on the data from the SWOT questionnaire, and then all the fifty-one results for one strategy were added up. This sum was the relative attractiveness of each strategy. Higher sums signify a more attractive strategy while to produce these scores we have considered all the relevant

external and internal factors that might influence the strategic decision. At this point, the strategies were re-arranged. Following pages will show the results from QSPM.

St1. The Local people, tourists and academic researchers can share their

knowledge on Mangrove in Malaysia

St2. The Local people can be involved as tour guides (general and professional)

	Determinant Factors	Wi	St1		St2	
			AS1	WiAS1	AS2	WiAS2
S1	Most of the local people have been living here above 10 years	0.0271	4	0.1084	3	0.081
S2	The villagers have formal level of education	0.0235	4	0.094	3	0.071
S3	The villagers are familiar with the Mangrove forest since their childhood	0.0261	4	0.1044	4	0.104
S4	The local people know that the Mangrove Forest can control the effects of erosion	0.0263	4	0.1052	3	0.079
S5	The villagers' life is related to the Mangrove Forest	0.0247	3	0.0741	4	0.099
S6	The local people know about the function of the Mangrove	0.0254	4	0.1016	4	0.102
S7	The villagers have accommodation facilities in their villages	0.0247	2	0.0494	2	0.049
S8	The local people know about what time tourists come to their villages for visiting the Mangrove Forest	0.0239	1	0.0239	2	0.048

QSPM Matrix (the Matang Mangrove Forest), Continued.

S9	The villagers are interested in conservation of the Mangrove forest	0.0247	4	0.0988	4	0.099
S10	The villagers are interested to share their knowledge with others	0.0242	4	0.0968	4	0.097
S11	The local people like to share their knowledge about birds with others	0.0244	3	0.0732	4	0.098
S12	The local people like to protect the environment	0.025	3	0.075	4	0.100
S13	The villagers know that the Mangrove Forest can control the effects of tsunami	0.0262	3	0.0786	3	0.079
S14	The local people are interested to know more about the Mangrove Forest	0.0238	4	0.0952	4	0.095
S15	The local people are aware of the Mangrove forest areas in Malaysia	0.024	2	0.048	3	0.072
S16	The villagers have not used Mangrove resources for any medical purpose	0.0226	1	0.0226	1	0.023
S17	The local people like to work in a group for conservation of the Mangrove forest	0.0233	3	0.0699	3	0.070
S18	The local people go for harvesting less than 10 times in a month	0.0204	3	0.0612	2	0.041

QSPM Matrix (the Matang Mangrove Forest), Continued.

S19	The villagers select trees (for any possible use) when they are matured	0.0221	2	0.0442	2	0.044
W1	Some of the local people did not know about the Mangrove Forest	0.0237	2	0.0474	2	0.047
W2	The villagers are fishing and harvesting anywhere from the Mangrove	0.0122	2	0.0244	2	0.024
W3	The local people do harvesting near the Mangrove Forest	0.0126	2	0.0252	2	0.025
W4	Selling is the most purpose of harvesting for villagers	0.0122	2	0.0244	2	0.024
W5	The villagers use the Mangrove wood for fuel	0.0122	2	0.0244	1	0.012
W6	The local people did not share their knowledge with others	0.023	2	0.046	2	0.046
W7	The villagers didn't know about Matang which has the best plan for conserve the Mangrove in the world	0.0119	2	0.0238	2	0.024
W8	The local people are not familiar with the Forestry House in Matang	0.0126	2	0.0252	2	0.025
W9	The villagers are not familiar with bird watchers	0.0121	2	0.0242	2	0.024
W10	The local people are not interested to share their knowledge about birds with others	0.0126	2	0.0252	2	0.025

QSPM Matrix (the Matang Mangrove Forest), Continued.

W11	The villagers have no idea about the high season for bird watching	0.0128	2	0.0256	2	0.026
W12	The local people did not know about the wildlife in Matang	0.0127	1	0.0127	2	0.025
W13	The mere existence of charcoal factories	0.0123	1	0.0123	1	0.012
W14	Some villagers do not want to be in a group for conservation of the Mangrove Forest.	0.0126	1	0.0126	1	0.013
W15	The local people do irregular harvesting	0.0127	2	0.0254	2	0.025
W16	The villagers' life is related to the Mangrove Forest	0.0122	3	0.0366	4	0.049
O1	Tourists have some knowledge about the Mangrove Forest	0.124	2	0.248	2	0.248
O2	Tourists like to share their knowledge with the local people	0.115	2	0.23	2	0.230
O3	The Forestry Department of Perak	0.104	3	0.312	3	0.312
O4	People who work for the Government	0.113	2	0.226	2	0.226
O5	The existence of the Forestry House	0.014	1	0.014	1	0.014
O6	The mere existence of a management plan for the Matang Mangrove Forest	0.0132	3	0.0396	3	0.040

QSPM Matrix (the Matang Mangrove Forest), Continued.

O7	Academic researchers	0.0245	4	0.098	2	0.049
O8	Malaysian universities	0.0249	4	0.0996	3	0.075
O9	Tourists who come to visit Matang	0.0253	2	0.0506	3	0.076
O10	International agencies have some projects in the Matang Mangrove Forest	0.0253	3	0.0759	3	0.076
T1	Tourists do not share their knowledge with local people	0.0252	1	0.0252	1	0.025
T2	The threat of Earthquake	0.0251	0	0	0	0.000
T3	Climate Change (in general)	0.0249	1	0.0249	1	0.025
T4	Risk of the tsunami	0.0258	1	0.0258	1	0.026
T5	Oil pollutions from ships	0.0257	1	0.0257	1	0.026
				3.335		**3.324**

QSPM Matrix (the Matang Mangrove Forest)

St3. FDP and IA can employ the local people as volunteer in their projects for conservation of the Mangrove Forest

St4. The local people can collaborate and participate with IA and researchers to protect the migratory birds in the Matang Mangrove Forest

	Determinant Factors	**Wi**	**St3**		**St4**	
			AS3	**WiAS3**	**AS4**	**WiAS4**
S1	Most of the local people have been living here above 10 years	0.0271	4	0.1084	4	0.1084
S2	The villagers have formal level of education	0.0235	3	0.0705	3	0.0705
S3	The villagers are familiar with the Mangrove forest since their childhood	0.0261	3	0.0783	4	0.1044
S4	The local people know that the Mangrove Forest can control the effects of erosion	0.0263	4	0.1052	4	0.1052
S5	The villagers' life is related to the Mangrove Forest	0.0247	3	0.0741	4	0.0988
S6	The local people know about the function of the Mangrove	0.0254	3	0.0762	4	0.1016
S7	The villagers have accommodation facilities in their villages	0.0247	2	0.0494	1	0.0247

QSPM Matrix (the Matang Mangrove Forest), Continued.

S8	The local people know about what time tourists come to their villages for visiting the Mangrove Forest	0.0239	2	0.0478	1	0.0239
S9	The villagers are interested in conservation of the Mangrove forest	0.0247	4	0.0988	3	0.0741
S10	The villagers are interested to share their knowledge with others	0.0242	3	0.0726	4	0.0968
S11	The local people like to share their knowledge about birds with others	0.0244	3	0.0732	4	0.0976
S12	The local people like to protect the environment	0.025	3	0.075	4	0.1
S13	The villagers know that the Mangrove Forest can control the effects of tsunami	0.0262	3	0.0786	3	0.0786
S14	The local people are interested to know more about the Mangrove Forest	0.0238	2	0.0476	3	0.0714
S15	The local people are aware of the Mangrove forest areas in Malaysia	0.024	2	0.048	1	0.024
S16	The villagers have not used Mangrove resources for any medical purpose	0.0226	1	0.0226	2	0.0452
S17	The local people like to work in a group for conservation of the Mangrove forest	0.0233	4	0.0932	4	0.0932

QSPM Matrix (the Matang Mangrove Forest), Continued.

S18	The local people go for harvesting less than 10 times in a month	0.0204	2	0.0408	2	0.0408
S19	The villagers select trees (for any possible use) when they are matured	0.0221	2	0.0442	2	0.0442
W1	Some of the local people did not know about the Mangrove Forest	0.0237	2	0.0474	1	0.0237
W2	The villagers are fishing and harvesting anywhere from the Mangrove	0.0122	1	0.0122	2	0.0244
W3	The local people do harvesting near the Mangrove Forest	0.0126	2	0.0252	3	0.0378
W4	Selling is the most purpose of harvesting for villagers	0.0122	1	0.0122	1	0.0122
W5	The villagers use the Mangrove wood for fuel	0.0122	1	0.0122	2	0.0244
W6	The local people did not share their knowledge with others	0.023	1	0.0123	2	0.0246
W7	The villagers didn't know about Matang which has the best plan for conserve the Mangrove in the world	0.0119	2	0.0238	2	0.0238
W8	The local people are not familiar with the Forestry House in Matang	0.0126	1	0.0126	1	0.0126
W9	The villagers are not familiar with bird watchers	0.0121	1	0.0121	2	0.0242

QSPM Matrix (the Matang Mangrove Forest), Continued.

W10	The local people are not interested to share their knowledge about birds with others	0.0126	1	0.0126	2	0.0252
W11	The villagers have no idea about the high season for bird watching	0.0128	1	0.0128	2	0.0256
W12	The local people did not know about the wildlife in Matang	0.0127	1	0.0127	2	0.0254
W13	The mere existence of charcoal factories	0.0123	1	0.0123	1	0.0123
W14	Some villagers do not want to be in a group for conservation of the Mangrove Forest.	0.0126	2	0.0252	1	0.0126
W15	The local people do irregular harvesting	0.0127	2	0.0254	3	0.0381
W16	The villagers' life is related to the Mangrove Forest	0.0122	3	0.0366	3	0.0366
O1	Tourists have some knowledge about the Mangrove Forest	0.124	1	0.0125	1	0.0125
O2	Tourists like to share their knowledge with the local people	0.115	1	0.0116	1	0.0116
O3	The Forestry Department of Perak	0.104	3	0.0315	3	0.0315
O4	People who work for the Government	0.113	2	0.0228	2	0.0228
O5	The existence of the Forestry House	0.014	1	0.0098	1	0.0098

QSPM Matrix (the Matang Mangrove Forest), Continued.

O6	The mere existence of a management plan for the Matang Mangrove Forest	0.0132	3	0.0285	3	0.0285
O7	Academic researchers	0.0245	3	0.0741	4	0.0988
O8	Malaysian universities	0.0249	3	0.0753	4	0.1004
O9	Tourists who come to visit Matang	0.0253	2	0.051	1	0.0255
O10	International agencies have some projects in the Matang Mangrove Forest	0.0253	3	0.0765	3	0.0765
T1	Tourists do not share their knowledge with local people	0.0252	0	0	0	0
T2	The threat of Earthquake	0.0251	0	0	1	0.0253
T3	Climate Change (in general)	0.0249	1	0.0251	2	0.0502
T4	Risk of the tsunami	0.0258	1	0.0261	2	0.0522
T5	Oil pollutions from ships	0.0257	1	0.0259	2	0.0518
				2.082		**2.348**

QSPM Matrix (the Matang Mangrove Forest)

St5. Help and educate villagers to make a group to protect the Mangrove Forest

St6. Increase the villagers' knowledge and awareness about Mangrove Forest and its role to control the Tsunami effects through holding workshop by FDP, MU and IA.

	Determinant Factors	**Wi**	**St5**		**St6**	
			AS5	**WiAS5**	**AS6**	**WiAS6**
S1	Most of the local people have been living here above 10 years	0.0271	3	0.0813	3	0.0813
S2	The villagers have formal level of education	0.0235	3	0.0705	3	0.0705
S3	The villagers are familiar with the Mangrove forest since their childhood	0.0261	3	0.0783	3	0.0783
S4	The local people know that the Mangrove Forest can control the effects of erosion	0.0263	3	0.0789	3	0.0789
S5	The villagers' life is related to the Mangrove Forest	0.0247	4	0.0988	3	0.0741
S6	The local people know about the function of the Mangrove	0.0254	3	0.0762	3	0.0762
S7	The villagers have accommodation facilities in their villages	0.0247	2	0.0494	2	0.0494

QSPM Matrix (the Matang Mangrove Forest), Continued.

S8	The local people know about what time tourists come to their villages for visiting the Mangrove Forest	0.0239	1	0.0239	2	0.0478
S9	The villagers are interested in conservation of the Mangrove forest	0.0247	4	0.0988	3	0.0741
S10	The villagers are interested to share their knowledge with others	0.0242	4	0.0968	4	0.0968
S11	The local people like to share their knowledge about birds with others	0.0244	3	0.0732	3	0.0732
S12	The local people like to protect the environment	0.025	4	0.1	3	0.075
S13	The villagers know that the Mangrove Forest can control the effects of tsunami	0.0262	4	0.1048	3	0.0786
S14	The local people are interested to know more about the Mangrove Forest	0.0238	4	0.0952	3	0.0714
S15	The local people are aware of the Mangrove forest areas in Malaysia	0.024	2	0.048	2	0.048
S16	The villagers have not used Mangrove resources for any medical purpose	0.0226	1	0.0226	1	0.0226
S17	The local people like to work in a group for conservation of the Mangrove forest	0.0233	4	0.0932	3	0.0699

S18	The local people go for harvesting less than 10 times in a month	0.0204	2	0.0408	2	0.0408
S19	The villagers select trees (for any possible use) when they are matured	0.0221	3	0.0663	2	0.0442
W1	Some of the local people did not know about the Mangrove Forest	0.0237	1	0.0237	1	0.0237
W2	The villagers are fishing and harvesting anywhere from the Mangrove	0.0122	2	0.0244	1	0.0122
W3	The local people do harvesting near the Mangrove Forest	0.0126	2	0.0252	2	0.0252
W4	Selling is the most purpose of harvesting for villagers	0.0122	2	0.0244	1	0.0122
W5	The villagers use the Mangrove wood for fuel	0.0122	2	0.0244	1	0.0122
W6	The local people did not share their knowledge with others	0.023	2	0.0246	2	0.0246
W7	The villagers didn't know about Matang which has the best plan for conserve the Mangrove in the world	0.0119	2	0.0238	2	0.0238
W8	The local people are not familiar with the Forestry House in Matang	0.0126	1	0.0126	2	0.0252
W9	The villagers are not familiar with bird watchers	0.0121	2	0.0242	1	0.0121

QSPM Matrix (the Matang Mangrove Forest), Continued.

W10	The local people are not interested to share their knowledge about birds with others	0.0126	2	0.0252	2	0.0252
W11	The villagers have no idea about the high season for bird watching	0.0128	2	0.0256	1	0.0128
W12	The local people did not know about the wildlife in Matang	0.0127	2	0.0254	2	0.0254
W13	The mere existence of charcoal factories	0.0123	1	0.0123	0	0
W14	Some villagers do not want to be in a group for conservation of the Mangrove Forest.	0.0126	1	0.0126	1	0.0126
W15	The local people do irregular harvesting	0.0127	3	0.0381	2	0.0254
W16	The villagers' life is related to the Mangrove Forest	0.0122	3	0.0366	3	0.0366
O1	Tourists have some knowledge about the Mangrove Forest	0.124	1	0.0125	1	0.0125
O2	Tourists like to share their knowledge with the local people	0.115	1	0.0116	1	0.0116
O3	The Forestry Department of Perak	0.104	3	0.0315	2	0.021
O4	People who work for the Government	0.113	2	0.0228	2	0.0228
O5	The existence of the Forestry House	0.014	1	0.0098	1	0.0098

QSPM Matrix (the Matang Mangrove Forest), Continued.

O6	The mere existence of a management plan for the Matang Mangrove Forest	0.0132	3	0.0285	3	0.0285
O7	Academic researchers	0.0245	4	0.0988	3	0.0741
O8	Malaysian universities	0.0249	4	0.1004	3	0.0753
O9	Tourists who come to visit Matang	0.0253	1	0.0255	1	0.0255
O10	International agencies have some projects in the Matang Mangrove Forest	0.0253	3	0.0765	2	0.051
T1	Tourists do not share their knowledge with local people	0.0252	0	0	0	0
T2	The threat of Earthquake	0.0251	0	0	1	0.0253
T3	Climate Change (in general)	0.0249	1	0.0251	2	0.0502
T4	Risk of the tsunami	0.0258	1	0.0261	2	0.0522
T5	Oil pollutions from ships	0.0257	1	0.0259	2	0.0518
				2.275		**2.072**

QSPM Matrix (the Matang Mangrove Forest)

St7. Reduce the effects of erosion by the FDP and IA in cooperation with the local people

St8. Local groups can do some activities to protect the Mangrove Forest to control any possible tsunami disaster.

	Determinant Factors	**Wi**	**St7**		**St8**	
			AS7	**WiAS7**	**AS8**	**WiAS8**
S1	Most of the local people have been living here above 10 years	0.0271	2	0.0542	2	0.0542
S2	The villagers have formal level of education	0.0235	3	0.0705	2	0.047
S3	The villagers are familiar with the Mangrove forest since their childhood	0.0261	3	0.0783	2	0.0522
S4	The local people know that the Mangrove Forest can control the effects of erosion	0.0263	3	0.0789	3	0.0789
S5	The villagers' life is related to the Mangrove Forest	0.0247	4	0.0988	2	0.0494
S6	The local people know about the function of the Mangrove	0.0254	3	0.0762	2	0.0508
S7	The villagers have accommodation facilities in their villages	0.0247	1	0.0247	1	0.0247

QSPM Matrix (the Matang Mangrove Forest), Continued.

S8	The local people know about what time tourists come to their villages for visiting the Mangrove Forest	0.0239	1	0.0239	1	0.0239
S9	The villagers are interested in conservation of the Mangrove forest	0.0247	4	0.0988	3	0.0741
S10	The villagers are interested to share their knowledge with others	0.0242	4	0.0968	2	0.0484
S11	The local people like to share their knowledge about birds with others	0.0244	3	0.0732	2	0.0488
S12	The local people like to protect the environment	0.025	4	0.1	4	0.1
S13	The villagers know that the Mangrove Forest can control the effects of tsunami	0.0262	3	0.0786	4	0.1048
S14	The local people are interested to know more about the Mangrove Forest	0.0238	3	0.0714	3	0.0714
S15	The local people are aware of the Mangrove forest areas in Malaysia	0.024	3	0.072	2	0.048
S16	The villagers have not used Mangrove resources for any medical purpose	0.0226	1	0.0226	1	0.0226
S17	The local people like to work in a group for conservation of the Mangrove forest	0.0233	4	0.0932	4	0.0932

QSPM Matrix (the Matang Mangrove Forest), Continued.

S18	The local people go for harvesting less than 10 times in a month	0.0204	2	0.0408	1	0.0204
S19	The villagers select trees (for any possible use) when they are matured	0.0221	2	0.0442	2	0.0442
W1	Some of the local people did not know about the Mangrove Forest	0.0237	1	0.0237	1	0.0237
W2	The villagers are fishing and harvesting anywhere from the Mangrove	0.0122	1	0.0122	1	0.0122
W3	The local people do harvesting near the Mangrove Forest	0.0126	2	0.0252	1	0.0126
W4	Selling is the most purpose of harvesting for villagers	0.0122	1	0.0122	1	0.0122
W5	The villagers use the Mangrove wood for fuel	0.0122	2	0.0244	1	0.0122
W6	The local people did not share their knowledge with others	0.023	2	0.0246	1	0.0123
W7	The villagers didn't know about Matang which has the best plan for conserve the Mangrove in the world	0.0119	2	0.0238	1	0.0119
W8	The local people are not familiar with the Forestry House in Matang	0.0126	1	0.0126	1	0.0126
W9	The villagers are not familiar with bird watchers	0.0121	1	0.0121	1	0.0121

QSPM Matrix (the Matang Mangrove Forest), Continued.

W10	The local people are not interested to share their knowledge about birds with others	0.0126	2	0.0252	1	0.0126
W11	The villagers have no idea about the high season for bird watching	0.0128	1	0.0128	1	0.0128
W12	The local people did not know about the wildlife in Matang	0.0127	1	0.0127	1	0.0127
W13	The mere existence of charcoal factories	0.0123	0	0	1	0.0123
W14	Some villagers do not want to be in a group for conservation of the Mangrove Forest.	0.0126	1	0.0126	1	0.0126
W15	The local people do irregular harvesting	0.0127	1	0.0127	1	0.0127
W16	The villagers' life is related to the Mangrove Forest	0.0122	3	0.0366	2	0.0244
O1	Tourists have some knowledge about the Mangrove Forest	0.124	1	0.0125	1	0.0125
O2	Tourists like to share their knowledge with the local people	0.115	1	0.0116	1	0.0116
O3	The Forestry Department of Perak	0.104	3	0.0315	2	0.021
O4	People who work for the Government	0.113	2	0.0228	1	0.0114
O5	The existence of the Forestry House	0.014	1	0.0098	1	0.0098

QSPM Matrix (the Matang Mangrove Forest), Continued.

O6	The mere existence of a management plan for the Matang Mangrove Forest	0.0132	3	0.0285	2	0.019
O7	Academic researchers	0.0245	3	0.0741	2	0.0494
O8	Malaysian universities	0.0249	3	0.0753	2	0.0502
O9	Tourists who come to visit Matang	0.0253	0	0	1	0.0255
O10	International agencies have some projects in the Matang Mangrove Forest	0.0253	2	0.051	3	0.0765
T1	Tourists do not share their knowledge with local people	0.0252	0	0	0	0
T2	The threat of Earthquake	0.0251	0	0	0	0
T3	Climate Change (in general)	0.0249	1	0.0251	2	0.0502
T4	Risk of the tsunami	0.0258	1	0.0261	1	0.0261
T5	Oil pollutions from ships	0.0257	1	0.0259	1	0.0259
				1.974		**1.668**

QSPM Matrix (the Matang Mangrove Forest)

St9. Reduce the amount of Mangrove wood used by the local people

St10. FDP should make a document to show the places where local people can

go fishing or harvesting

	Determinant Factors	**Wi**	**St9**		**St10**	
			AS9	**WiAS9**	**AS10**	**WiAS10**
S1	Most of the local people have been living here above 10 years	0.0271	2	0.0542	2	0.0542
S2	The villagers have formal level of education	0.0235	2	0.047	2	0.047
S3	The villagers are familiar with the Mangrove forest since their childhood	0.0261	2	0.0522	3	0.0783
S4	The local people know that the Mangrove Forest can control the effects of erosion	0.0263	3	0.0789	4	0.1052
S5	The villagers' life is related to the Mangrove Forest	0.0247	3	0.0741	2	0.0494
S6	The local people know about the function of the Mangrove	0.0254	3	0.0762	3	0.0762
S7	The villagers have accommodation facilities in their villages	0.0247	1	0.0247	1	0.0247

QSPM Matrix (the Matang Mangrove Forest), Continued.

S8	The local people know about what time tourists come to their villages for visiting the Mangrove Forest	0.0239	1	0.0239	1	0.0239
S9	The villagers are interested in conservation of the Mangrove forest	0.0247	4	0.0988	3	0.0741
S10	The villagers are interested to share their knowledge with others	0.0242	3	0.0726	2	0.0484
S11	The local people like to share their knowledge about birds with others	0.0244	1	0.0244	2	0.0488
S12	The local people like to protect the environment	0.025	4	0.1	3	0.075
S13	The villagers know that the Mangrove Forest can control the effects of tsunami	0.0262	4	0.1048	3	0.0786
S14	The local people are interested to know more about the Mangrove Forest	0.0238	3	0.0714	4	0.0952
S15	The local people are aware of the Mangrove forest areas in Malaysia	0.024	2	0.048	2	0.048

QSPM Matrix (the Matang Mangrove Forest), Continued.

S16	The villagers have not used Mangrove resources for any medical purpose	0.0226	1	0.0226	0	0
S17	The local people like to work in a group for conservation of the Mangrove forest	0.0233	4	0.0932	3	0.0699
S18	The local people go for harvesting less than 10 times in a month	0.0204	2	0.0408	2	0.0408
S19	The villagers select trees (for any possible use) when they are matured	0.0221	2	0.0442	2	0.0442
W1	Some of the local people did not know about the Mangrove Forest	0.0237	1	0.0237	1	0.0237
W2	The villagers are fishing and harvesting anywhere from the Mangrove	0.0122	2	0.0244	2	0.0244
W3	The local people do harvesting near the Mangrove Forest	0.0126	2	0.0252	2	0.0252
W4	Selling is the most purpose of harvesting for villagers	0.0122	2	0.0244	2	0.0244
W5	The villagers use the Mangrove wood for fuel	0.0122	2	0.0244	2	0.0244
W6	The local people did not share their knowledge with others	0.023	2	0.0246	1	0.0123

QSPM Matrix (the Matang Mangrove Forest), Continued.

W7	The villagers didn't know about Matang which has the best plan for conserve the Mangrove in the world	0.0119	1	0.0119	1	0.0119
W8	The local people are not familiar with the Forestry House in Matang	0.0126	1	0.0126	1	0.0126
W9	The villagers are not familiar with bird watchers	0.0121	1	0.0121	1	0.0121
W10	The local people are not interested to share their knowledge about birds with others	0.0126	1	0.0126	1	0.0126
W11	The villagers have no idea about the high season for bird watching	0.0128	1	0.0128	1	0.0128
W12	The local people did not know about the wildlife in Matang	0.0127	1	0.0127	1	0.0127
W13	The mere existence of charcoal factories	0.0123	2	0.0246	1	0.0123
W14	Some villagers do not want to be in a group for conservation of the Mangrove Forest.	0.0126	1	0.0126	1	0.0126
W15	The local people do irregular harvesting	0.0127	2	0.0254	2	0.0254

QSPM Matrix (the Matang Mangrove Forest), Continued.

W16	The villagers' life is related to the Mangrove Forest	0.0122	2	0.0244	1	0.0122
O1	Tourists have some knowledge about the Mangrove Forest	0.124	2	0.025	1	0.0125
O2	Tourists like to share their knowledge with the local people	0.115	1	0.0116	1	0.0116
O3	The Forestry Department of Perak	0.104	2	0.021	2	0.021
O4	People who work for the Government	0.113	3	0.0342	3	0.0342
O5	The existence of the Forestry House	0.014	0	0	1	0.0098
O6	The mere existence of a management plan for the Matang Mangrove Forest	0.0132	2	0.019	2	0.019
O7	Academic researchers	0.0245	4	0.0988	4	0.0988
O8	Malaysian universities	0.0249	4	0.1004	4	0.1004
O9	Tourists who come to visit Matang	0.0253	0	0	1	0.0255
O10	International agencies have some projects in the Matang Mangrove Forest	0.0253	2	0.051	2	0.051
T1	Tourists do not share their knowledge with local people	0.0252	0	0	0	0

QSPM Matrix (the Matang Mangrove Forest), Continued.

T2	The threat of Earthquake	0.0251	1	0.0253	1	0.0253
T3	Climate Change (in general)	0.0249	1	0.0251	1	0.0251
T4	Risk of the tsunami	0.0258	1	0.0261	1	0.0261
T5	Oil pollutions from ships	0.0257	1	0.0259	1	0.0259
				1.923		**1.84**

QSPM Matrix (the Matang Mangrove Forest)

St11. Change the livelihood of the villagers to use the natural resources in Matang in a sustainable way by FDP, GOV, NGOs and IA.

St12. Support the local people who are interested to continue their education by MU, FDP, GOV and IA

	Determinant Factors	**Wi**	**St11**		**St12**	
			AS11	**WiAS11**	**AS12**	**WiAS12**
S1	Most of the local people have been living here above 10 years	0.0271	2	0.0542	3	0.0813
S2	The villagers have formal level of education	0.0235	3	0.0705	3	0.0705
S3	The villagers are familiar with the Mangrove forest since their childhood	0.0261	2	0.0522	3	0.0783
S4	The local people know that the Mangrove Forest can control the effects of erosion	0.0263	2	0.0526	3	0.0789
S5	The villagers' life is related to the Mangrove Forest	0.0247	3	0.0741	3	0.0741
S6	The local people know about the function of the Mangrove	0.0254	2	0.0508	3	0.0762
S7	The villagers have accommodation facilities in their villages	0.0247	2	0.0494	4	0.0988

QSPM Matrix (the Matang Mangrove Forest), Continued.

S8	The local people know about what time tourists come to their villages for visiting the Mangrove Forest	0.0239	2	0.0478	1	0.0239
S9	The villagers are interested in conservation of the Mangrove forest	0.0247	3	0.0741	3	0.0741
S10	The villagers are interested to share their knowledge with others	0.0242	3	0.0726	4	0.0968
S11	The local people like to share their knowledge about birds with others	0.0244	2	0.0488	3	0.0732
S12	The local people like to protect the environment	0.025	3	0.075	3	0.075
S13	The villagers know that the Mangrove Forest can control the effects of tsunami	0.0262	3	0.0786	3	0.0786
S14	The local people are interested to know more about the Mangrove Forest	0.0238	2	0.0476	3	0.0714
S15	The local people are aware of the Mangrove forest areas in Malaysia	0.024	2	0.048	2	0.048

QSPM Matrix (the Matang Mangrove Forest), Continued.

S16	The villagers have not used Mangrove resources for any medical purpose	0.0226	1	0.0226	1	0.0226
S17	The local people like to work in a group for conservation of the Mangrove forest	0.0233	3	0.0699	3	0.0699
S18	The local people go for harvesting less than 10 times in a month	0.0204	2	0.0408	2	0.0408
S19	The villagers select trees (for any possible use) when they are matured	0.0221	1	0.0221	2	0.0442
W1	Some of the local people did not know about the Mangrove Forest	0.0237	1	0.0237	2	0.0474
W2	The villagers are fishing and harvesting anywhere from the Mangrove	0.0122	2	0.0244	2	0.0244
W3	The local people do harvesting near the Mangrove Forest	0.0126	2	0.0252	3	0.0378
W4	Selling is the most purpose of harvesting for villagers	0.0122	2	0.0244	2	0.0244
W5	The villagers use the Mangrove wood for fuel	0.0122	2	0.0244	3	0.0366

QSPM Matrix (the Matang Mangrove Forest), Continued.

W6	The local people did not share their knowledge with others	0.023	1	0.0123	4	0.0492
W7	The villagers didn't know about Matang which has the best plan for conserve the Mangrove in the world	0.0119	1	0.0119	1	0.0119
W8	The local people are not familiar with the Forestry House in Matang	0.0126	1	0.0126	1	0.0126
W9	The villagers are not familiar with bird watchers	0.0121	1	0.0121	1	0.0121
W10	The local people are not interested to share their knowledge about birds with others	0.0126	1	0.0126	1	0.0126
W11	The villagers have no idea about the high season for bird watching	0.0128	2	0.0256	2	0.0256
W12	The local people did not know about the wildlife in Matang	0.0127	2	0.0254	2	0.0254
W13	The mere existence of charcoal factories	0.0123	2	0.0246	2	0.0246
W14	Some villagers do not want to be in a group for conservation of the Mangrove Forest.	0.0126	1	0.0126	2	0.0252

QSPM Matrix (the Matang Mangrove Forest), Continued.

W15	The local people do irregular harvesting	0.0127	1	0.0127	2	0.0254
W16	The villagers' life is related to the Mangrove Forest	0.0122	1	0.0122	2	0.0244
O1	Tourists have some knowledge about the Mangrove Forest	0.124	1	0.0125	1	0.0125
O2	Tourists like to share their knowledge with the local people	0.115	1	0.0116	1	0.0116
O3	The Forestry Department of Perak	0.104	2	0.021	2	0.021
O4	People who work for the Government	0.113	2	0.0228	2	0.0228
O5	The existence of the Forestry House	0.014	0	0	0	0
O6	The mere existence of a management plan for the Matang Mangrove Forest	0.0132	2	0.019	2	0.019
O7	Academic researchers	0.0245	3	0.0741	3	0.0741
O8	Malaysian universities	0.0249	2	0.0502	4	0.1004
O9	Tourists who come to visit Matang	0.0253	1	0.0255	1	0.0255
O10	International agencies have some projects in the Matang Mangrove Forest	0.0253	3	0.0765	2	0.051

QSPM Matrix (the Matang Mangrove Forest), Continued.

T1	Tourists do not share their knowledge with local people	0.0252	0	0	0	0
T2	The threat of Earthquake	0.0251	1	0.0253	1	0.0253
T3	Climate Change (in general)	0.0249	1	0.0251	1	0.0251
T4	Risk of the tsunami	0.0258	1	0.0261	1	0.0261
T5	Oil pollutions from ships	0.0257	1	0.0259	1	0.0259
				1.764		**2.137**

QSPM Matrix (the Matang Mangrove Forest)

St13. FDP should inform the local people about the negative effects of irregular fishing on the environment

St14. FDP should supervise on charcoal factories in Matang

	Determinant Factors	Wi	St13		St14	
			AS13	WiAS13	AS14	WiAS14
S1	Most of the local people have been living here above 10 years	0.0271	3	0.0813	3	0.0813
S2	The villagers have formal level of education	0.0235	3	0.0705	3	0.0705
S3	The villagers are familiar with the Mangrove forest since their childhood	0.0261	4	0.1044	3	0.0783
S4	The local people know that the Mangrove Forest can control the effects of erosion	0.0263	3	0.0789	3	0.0789
S5	The villagers' life is related to the Mangrove Forest	0.0247	3	0.0741	3	0.0741
S6	The local people know about the function of the Mangrove	0.0254	3	0.0762	3	0.0762
S7	The villagers have accommodation facilities in their villages	0.0247	3	0.0741	3	0.0741

QSPM Matrix (the Matang Mangrove Forest), Continued.

S8	The local people know about what time tourists come to their villages for visiting the Mangrove Forest	0.0239	1	0.0239	1	0.0239
S9	The villagers are interested in conservation of the Mangrove forest	0.0247	4	0.0988	3	0.0741
S10	The villagers are interested to share their knowledge with others	0.0242	4	0.0968	3	0.0726
S11	The local people like to share their knowledge about birds with others	0.0244	3	0.0732	3	0.0732
S12	The local people like to protect the environment	0.025	4	0.1	3	0.075
S13	The villagers know that the Mangrove Forest can control the effects of tsunami	0.0262	3	0.0786	3	0.0786
S14	The local people are interested to know more about the Mangrove Forest	0.0238	3	0.0714	3	0.0714
S15	The local people are aware of the Mangrove forest areas in Malaysia	0.024	2	0.048	2	0.048

QSPM Matrix (the Matang Mangrove Forest), Continued.

S16	The villagers have not used Mangrove resources for any medical purpose	0.0226	1	0.0226	1	0.0226
S17	The local people like to work in a group for conservation of the Mangrove forest	0.0233	3	0.0699	3	0.0699
S18	The local people go for harvesting less than 10 times in a month	0.0204	2	0.0408	2	0.0408
S19	The villagers select trees (for any possible use) when they are matured	0.0221	2	0.0442	2	0.0442
W1	Some of the local people did not know about the Mangrove Forest	0.0237	2	0.0474	2	0.0474
W2	The villagers are fishing and harvesting anywhere from the Mangrove	0.0122	2	0.0244	2	0.0244
W3	The local people do harvesting near the Mangrove Forest	0.0126	3	0.0378	3	0.0378
W4	Selling is the most purpose of harvesting for villagers	0.0122	3	0.0366	2	0.0244
W5	The villagers use the Mangrove wood for fuel	0.0122	2	0.0244	3	0.0366

QSPM Matrix (the Matang Mangrove Forest), Continued.

W6	The local people did not share their knowledge with others	0.023	2	0.0246	2	0.0246
W7	The villagers didn't know about Matang which has the best plan for conserve the Mangrove in the world	0.0119	1	0.0119	1	0.0119
W8	The local people are not familiar with the Forestry House in Matang	0.0126	1	0.0126	1	0.0126
W9	The villagers are not familiar with bird watchers	0.0121	1	0.0121	1	0.0121
W10	The local people are not interested to share their knowledge about birds with others	0.0126	1	0.0126	1	0.0126
W11	The villagers have no idea about the high season for bird watching	0.0128	1	0.0128	1	0.0128
W12	The local people did not know about the wildlife in Matang	0.0127	1	0.0127	1	0.0127
W13	The mere existence of charcoal factories	0.0123	1	0.0123	1	0.0123
W14	Some villagers do not want to be in a group for conservation of the Mangrove Forest.	0.0126	1	0.0126	1	0.0126

QSPM Matrix (the Matang Mangrove Forest), Continued.

W15	The local people do irregular harvesting	0.0127	1	0.0127	1	0.0127
W16	The villagers' life is related to the Mangrove Forest	0.0122	1	0.0122	1	0.0122
O1	Tourists have some knowledge about the Mangrove Forest	0.124	1	0.0125	2	0.025
O2	Tourists like to share their knowledge with the local people	0.115	1	0.0116	1	0.0116
O3	The Forestry Department of Perak	0.104	2	0.021	3	0.0315
O4	People who work for the Government	0.113	2	0.0228	3	0.0342
O5	The existence of the Forestry House	0.014	1	0.0098	1	0.0098
O6	The mere existence of a management plan for the Matang Mangrove Forest	0.0132	2	0.019	3	0.0285
O7	Academic researchers	0.0245	4	0.0988	3	0.0741
O8	Malaysian universities	0.0249	4	0.1004	2	0.0502
O9	Tourists who come to visit Matang	0.0253	1	0.0255	1	0.0255
O10	International agencies have some projects in the Matang Mangrove Forest	0.0253	2	0.051	2	0.051

QSPM Matrix (the Matang Mangrove Forest), Continued.

T1	Tourists do not share their knowledge with local people	0.0252	0	0	0	0
T2	The threat of Earthquake	0.0251	1	0.0253	1	0.0253
T3	Climate Change (in general)	0.0249	1	0.0251	1	0.0251
T4	Risk of the tsunami	0.0258	1	0.0261	1	0.0261
T5	Oil pollutions from ships	0.0257	1	0.0259	1	0.0259
				2.122		**1.991**

QSPM Matrix (the Matang Mangrove Forest)

St15. Decrease the amount of harvesting to control the tsunami disaster

St16. Decrease the amount of irregular fishing

	Determinant Factors	Wi	St15		St16	
			AS15	WiAS15	AS16	WiAS16
S1	Most of the local people have been living here above 10 years	0.0271	3	0.0813	3	0.0813
S2	The villagers have formal level of education	0.0235	3	0.0705	3	0.0705
S3	The villagers are familiar with the Mangrove forest since their childhood	0.0261	3	0.0783	4	0.1044
S4	The local people know that the Mangrove Forest can control the effects of erosion	0.0263	4	0.1052	4	0.1052
S5	The villagers' life is related to the Mangrove Forest	0.0247	4	0.0988	4	0.0988
S6	The local people know about the function of the Mangrove	0.0254	4	0.1016	3	0.0762
S7	The villagers have accommodation facilities in their villages	0.0247	3	0.0741	3	0.0741

QSPM Matrix (the Matang Mangrove Forest), Continued.

S8	The local people know about what time tourists come to their villages for visiting the Mangrove Forest	0.0239	1	0.0239	1	0.0239
S9	The villagers are interested in conservation of the Mangrove forest	0.0247	4	0.0988	4	0.0988
S10	The villagers are interested to share their knowledge with others	0.0242	3	0.0726	3	0.0726
S11	The local people like to share their knowledge about birds with others	0.0244	3	0.0732	3	0.0732
S12	The local people like to protect the environment	0.025	4	0.1	3	0.075
S13	The villagers know that the Mangrove Forest can control the effects of tsunami	0.0262	4	0.1048	3	0.0786
S14	The local people are interested to know more about the Mangrove Forest	0.0238	4	0.0952	3	0.0714
S15	The local people are aware of the Mangrove forest areas in Malaysia	0.024	2	0.048	2	0.048

QSPM Matrix (the Matang Mangrove Forest), Continued.

S16	The villagers have not used Mangrove resources for any medical purpose	0.0226	1	0.0226	1	0.0226
S17	The local people like to work in a group for conservation of the Mangrove forest	0.0233	3	0.0699	3	0.0699
S18	The local people go for harvesting less than 10 times in a month	0.0204	2	0.0408	2	0.0408
S19	The villagers select trees (for any possible use) when they are matured	0.0221	2	0.0442	2	0.0442
W1	Some of the local people did not know about the Mangrove Forest	0.0237	2	0.0474	2	0.0474
W2	The villagers are fishing and harvesting anywhere from the Mangrove	0.0122	2	0.0244	2	0.0244
W3	The local people do harvesting near the Mangrove Forest	0.0126	3	0.0378	3	0.0378
W4	Selling is the most purpose of harvesting for villagers	0.0122	2	0.0244	2	0.0244
W5	The villagers use the Mangrove wood for fuel	0.0122	2	0.0244	3	0.0366

QSPM Matrix (the Matang Mangrove Forest), Continued.

W6	The local people did not share their knowledge with others	0.023	2	0.0246	2	0.0246
W7	The villagers didn't know about Matang which has the best plan for conserve the Mangrove in the world	0.0119	1	0.0119	1	0.0119
W8	The local people are not familiar with the Forestry House in Matang	0.0126	1	0.0126	1	0.0126
W9	The villagers are not familiar with bird watchers	0.0121	1	0.0121	1	0.0121
W10	The local people are not interested to share their knowledge about birds with others	0.0126	1	0.0126	1	0.0126
W11	The villagers have no idea about the high season for bird watching	0.0128	1	0.0128	1	0.0128
W12	The local people did not know about the wildlife in Matang	0.0127	1	0.0127	1	0.0127
W13	The mere existence of charcoal factories	0.0123	1	0.0123	1	0.0123
W14	Some villagers do not want to be in a group for conservation of the Mangrove Forest.	0.0126	1	0.0126	1	0.0126

QSPM Matrix (the Matang Mangrove Forest), Continued.

W15	The local people do irregular harvesting	0.0127	1	0.0127	1	0.0127
W16	The villagers' life is related to the Mangrove Forest	0.0122	1	0.0122	2	0.0244
O1	Tourists have some knowledge about the Mangrove Forest	0.124	1	0.0125	1	0.0125
O2	Tourists like to share their knowledge with the local people	0.115	1	0.0116	1	0.0116
O3	The Forestry Department of Perak	0.104	1	0.0105	2	0.021
O4	People who work for the Government	0.113	3	0.0342	2	0.0228
O5	The existence of the Forestry House	0.014	1	0.0098	0	0
O6	The mere existence of a management plan for the Matang Mangrove Forest	0.0132	2	0.019	2	0.019
O7	Academic researchers	0.0245	4	0.0988	4	0.0988
O8	Malaysian universities	0.0249	3	0.0753	3	0.0753
O9	Tourists who come to visit Matang	0.0253	1	0.0255	1	0.0255
O10	International agencies have some projects in the Matang Mangrove Forest	0.0253	3	0.0765	2	0.051

QSPM Matrix (the Matang Mangrove Forest), Continued.

T1	Tourists do not share their knowledge with local people	0.0252	0	0	0	0
T2	The threat of Earthquake	0.0251	1	0.0253	1	0.0253
T3	Climate Change (in general)	0.0249	1	0.0251	1	0.0251
T4	Risk of the tsunami	0.0258	2	0.0522	0	0
T5	Oil pollutions from ships	0.0257	1	0.0259	1	0.0259
				2.213		**2.075**

4.9. Prioritizing Key Strategies

After processing the QSPM questionnaires filled by the experts, the researchers could have a prioritized list of the above-mentioned strategies (Table 4.6) based on the scores calculated by SPSS software.

Table 4.6: Prioritize Key strategies (the Matang Mangrove Forest)

	Strategies	Score	%
1	**St1.** The Local people, tourists and academic researchers can share their knowledge on Mangrove in Malaysia	3.335	9.49%
2	**St2.** The Local people can be involved as tour guides (general and professional)	3.324	9.46%
3	**St3.** FDP and IA can employ the local people as volunteer in their projects for conservation of the Mangrove Forest	2.082	5.92%
4	**St4.** The local people can collaborate and participate with IA and researchers to protect the migratory birds in the Matang Mangrove Forest	2.348	6.68%
5	**St5.** Help and educate villagers to make a group to protect the Mangrove Forest	2.275	6.47%
6	**St6.** Increase the villagers' knowledge and awareness about Mangrove Forest and its role to control the Tsunami effects through holding workshop by FDP, MU and IA.	2.072	5.90%
7	**St7.** Reduce the effects of erosion by the FDP and IA in cooperation with the local people	1.974	5.62%

8	**St8.** Local groups can do some activities to protect the Mangrove Forest to control any possible tsunami disaster.	1.668	4.75%
9	**St9.** Reduce the amount of Mangrove wood used by the local people	1.923	5.47%
10	**St10.** FDP should make a document to show the places where local people can go fishing or harvesting	1.840	5.24%
11	**St11.** Change the livelihood of the villagers to use the natural resources in Matang in a sustainable way by FDP, GOV, NGOs and IA.	1.764	5.02%
12	**St12.** Support the local people who are interested to continue their education by MU, FDP, GOV and IA	2.137	6.08%
13	**St13.** FDP should inform the local people about the negative effects of irregular fishing on the environment	2.122	6.04%
14	**St14.** FDP should supervise on charcoal factories in Matang	1.991	5.67%
15	**St15.** Decrease the amount of harvesting to control the tsunami disaster	2.213	6.30%
16	**St16.** Decrease the amount of irregular fishing	2.075	5.90%
	Total	**35.143**	**100%**

In Figure 4.2. it is clear that the first two strategies have obtained higher scores. The first refers to a multi-stakeholder knowledge sharing and the second indicates the local people's participation in tourism.
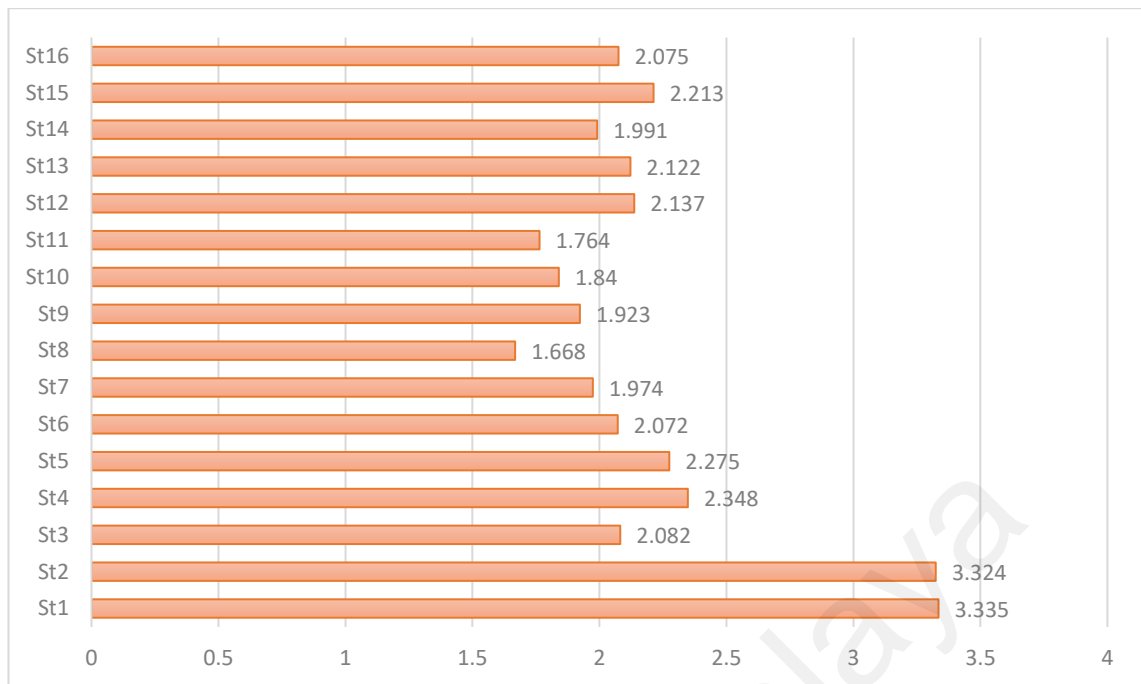
Figure 4.2: Prioritize Key strategies (the Matang Mangrove Forest)

4.10. Classification of strategies

Based on the percentage of the score, the strategies are classified. The first two are the important strategies since they have obtained the higher percentage. However, the next three have lesser percentage but in comparison with the others, they are still high, and therefore, the first five are the important strategies. The next nine strategies are the intermediate strategies and the last two are the weak ones.

Table 4.7: Strategies Classification (Matang)

Important Strategies			
1	**St1.** The Local people, tourists and academic researchers can share their knowledge on Mangrove in Malaysia	3.335	9.49%
2	**St2.** The Local people can be involved as tour guides (general and professional)	3.324	9.46%

Table 4.7, Continued.

3	**St4.** The local people can collaborate and participate with IA and researchers to protect the migratory birds in the Matang Mangrove Forest	2.348	6.68%
4	**St5.** Help and educate villagers to make a group to protect the Mangrove Forest	2.275	6.47%
5	**St15.** Decrease the amount of harvesting to control the tsunami disaster	2.213	6.30%
		13.495	**38.40%**
Intermediate Strategies			
6	**St12.** Support the local people who are interested to continue their education by MU, FDP, GOV and IA	2.137	6.08%
7	**St13.** FDP should inform the local people about the negative effects of irregular fishing on the environment	2.122	6.04%
8	**St3.** FDP and IA can employ the local people as volunteer in their projects for conservation of the Mangrove Forest	2.082	5.92%
9	**St16.** Decrease the amount of irregular fishing	2.075	5.90%
10	**St6.** Increase the villagers' knowledge and awareness about Mangrove Forest and its role to control the Tsunami effects through holding workshop by FDP, MU and IA.	2.072	5.90%
11	**St14.** FDP should supervise on charcoal factories in Matang	1.991	5.67%
12	**St7.** Reduce the effects of erosion by the FDP and IA in cooperation with the local people	1.974	5.62%

13	**St9.** Reduce the amount of Mangrove wood used by the local people	1.923	5.47%
14	**St10.** FDP should make a document to show the places where local people can go fishing or harvesting	1.840	5.24%
		18.216	**51.84%**
Weak Strategies			
15	**St11.** Change the livelihood of the villagers to use the natural resources in Matang in a sustainable way by FDP, GOV, NGOs and IA.	1.764	5.02%
16	**St8.** Local groups can do some activities to protect the Mangrove Forest to control any possible tsunami disaster.	1.668	4.75%
		3.432	9.77%
	Total	35.143	**100%**

The following spider diagram (Figure 4.3) gives a better separation of strategies in terms of their importance. These findings are discussed in details in the next chapter. However, we find out that how the local people are important actors in conservation of the mangrove forest in Matang.
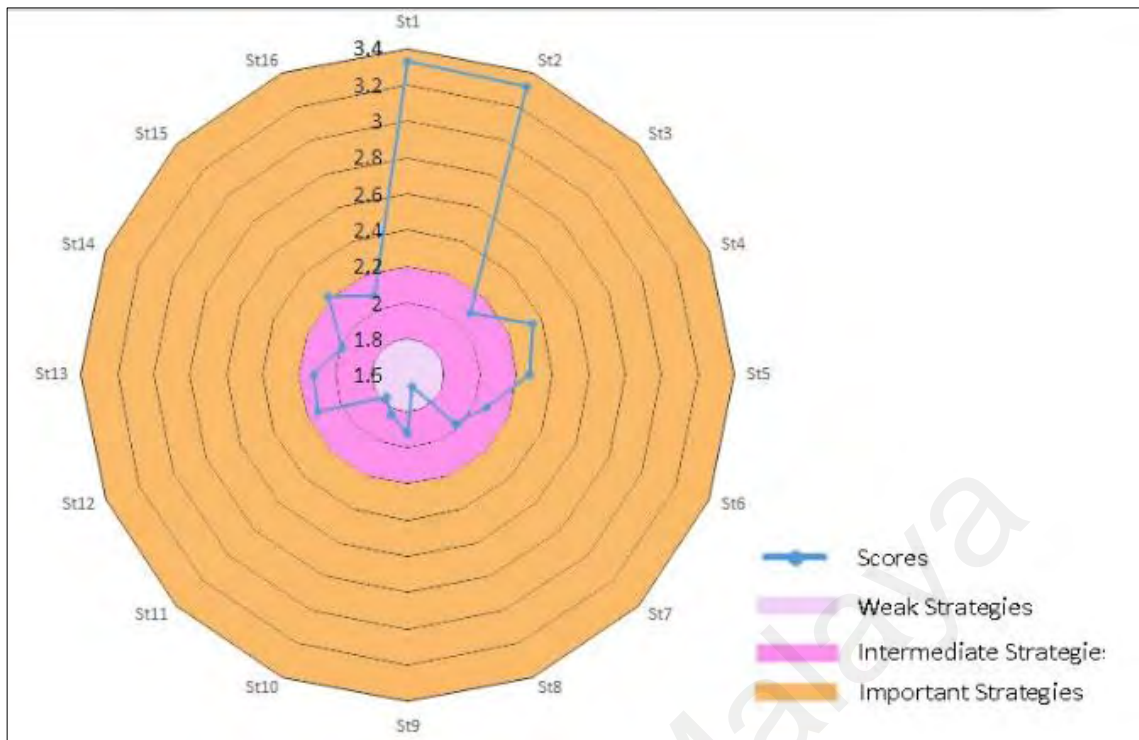
Figure 4.3: Strategies Classification (Matang)

4.11. Summary

This chapter provides the data resulted from the two managerial tools of SWOT and QSPM that have been prepared with participation of locals from three communities living near the Matang Mangrove Forest Reserve. After giving an overview of the forest in Matang area, it introduces the internal and external factors while giving two internal and external evaluations of the related factors. Then the SWOT Matrix and the strategies determined in the Matrix have been illustrated. Then the QSPM has been applied to show the attractiveness of each strategy to the four sets of factors. The result is a prioritized list of sixteen key strategies for the Matang Mangrove Forest Reserve. The chapter ends with the classification of the strategies into important, intermediate and weak strategies.

CHAPTER 5: RESULTS FROM THE CAREY ISLAND

5.1. Introduction

This chapter aims to provide the prioritized key strategies for the second case of the present research on the Carey Island. First, general information about the Mangrove Forest of the Carey Island is presented. The chapter continues with the results from the implementation of SWOT and QSPM matrices. A series of lists of internal and external factors, SWOT Matrix and the list of pairwise matching as well as the results from the QSPM are provided. The chapter finishes with a summary.

5.2. Carey Island

The Carey Island is one of the Mangrove Protected areas in the Malaysia which is situated in the state of Selangor, on the West coast of Peninsular Malaysia in south west of Kuala Lumpur (Affandi et al., 2010).

The Carey Island with total area of 16,187 hectares (10.521 ha planted with oil palm, 1876 ha Forest Reserve- mainly mangroves) is a large island and is an initial settlement area for Mah Meri who is one of the major tribes of aboriginal tribes of Malaysia (Affandi et al., 2010; Siti et al., 2009).

In the early 1900s, the Carey Island was known as Pulau Si Alang (some peoples refer Pulau Bangsar), located approximately 14km off Port Klang. It became the Carey Island after planter, an Englishman in the name of Edward Valentine John Carey has acquired an island from His Highness Sultan Sulaiman of Selangor to start rubber plantations and since then until now, the island is known as the Carey Island or Pulau Carey.

Table 5.1: An overview of the Carey Island (Siti et al., 2009)

Item	Explanation
Location	It is a large flat island off the west coast of Peninsula Malaysia in the Kuala Langat district of Selangor state.
Area	16.187 ha (10.521 ha planted with oil palm, 1876 ha Forest Reserve- mainly mangroves)
Wildlife Species	- 75 bird species (44 resident species, 12 migrant species, 7 species with both migratory and resident populations and two introduced species) - 41 species of butterflies - 26 Species of Dragonflies - 52 species of flora
Mangrove species	16 species from 5 families of Mangrove such as: *Rhizophora apiculate, R. macronata, Scyphiphora hydrophyllacea, Fageraea crenullatum, Lygodium salicifolium, Nepherolepis biserrata, Acrostichum aureum, Sonneratia alba* and *Avicennia alba*

A project of mangrove rehabilitation was carried out by the University of Malaya (UM), funded by Sime Darby Planation Sdn Bhd (SD). It was a three-year project that started in 2008. This project was implemented in the area that faces the Strait of Malacca, mostly because there was forest degradation and erosion. The aim of the project was to plan a shoreline protection. As a result, a detached breakwater was built. Later, a replantation of mangroves was planned. It has been reported that most of the planted mangroves died during the year after due to the high tides and waves. However, there have been natural growth of recruits and it means that the site is ready for mangrove rehabilitation (Motamedi et al., 2014).

5.2.1. About communities

Four villages have been selected as participants in the research. Kampung Sungai Bumbun, Kampung Orang Asli Sungai Judah, Kampung Sungai Rambai and Kampung Malayu.

Kampung Sungai Bumbun is important since the Mah Meri (pronounced Mak Miri) have been the original people of the Carey Island. The Mah Meri (Mah meaning people and Meri meaning forest), originally known as the Besisi, also call themselves Ma Betisek, which means, "people with fish scales". The Mah Meri are one of the nineteen Orang Asli people groups of Peninsular Malaysia. They are officially classified under Senoi subgroup.

Kampung Orang Asli Sungai Judah is located in the district of Kuala Langat Pealimen. Kuala Langat is one of nine districts in Selangor Darul Ehsan, approximately 44 km from Shah Alam, the capital of Selangor state. Kampung Orang Asli Sungai Judah is a traditional village that was first explored in 1920, by an individual named Chieftain East. He acted as Chairman of the Village and joined several other residents.

In the early stages of exploration, economic activity is based on subsistence agriculture such as crop cassava, vegetables and forest products such as rattan and palm fronds. Whereas the fishing activities conducted on a small scale. In 1953, residents of the area around Pulau Carey is increasing and they have been equally expanding settlements. Crops such as coconut, coffee and cocoa were cultivated after receiving the award of land reserves of natural persons.

The name 'Kampung Sungai Judah' taken after a river that became the waterways to the sea to look for livelihood at the time. According to the stories of our ancestors, in addition to agricultural activities, Aboriginal communities' formerly nomadic lifestyle

and one of the residents, East Penghulu decided 'Finisher' explore the village and added the word 'J', it gives birth to Sungai Judah.

5.3. Internal Factors

The same process was carried out for the Carey Island to determine the factors. As it was explained above, the main sources of data came from the four selected local communities (Kampong Sg. Bumbun, Kumpong Sg. Judah, Kampong Sg. Rambai and Kampong Malayu) as well as the Sime Darby local staff.

When an initial list of factors was prepared out of the interview contents, the second phase of the first stage started. The list was checked in a discussion group with a number of respondents during the next field trip (please see the chapter on research methodology for the detailed information on respondents); an open-ended questionnaire (see the Appendix B) was prepared to examine indirectly the factors. Based on the results from this questionnaire, the list of factors was finalized. The whole process of the first stage took about seven months (from March 2011 to October 2011). The following factors were the result of this stage.

5.3.1. Strengths (S)

Fourteen strengths were identified as the result of the first stage (open-ended questionnaire). All strengths are about the local villagers and their familiarity with the forest and wildlife especially migratory birds, the relationship of their life with the forest; what they know about it; interest to share their knowledge with others, their potentials and capacities in earning money from the forest and their interest in conservation of the Mangrove forest. The list of strengths are as follow:

S1. They are familiar with Mangrove Forest since they were child

S2. They know about the Mangrove Forest places in Malaysia

S3. They know about Migratory birds

S4. They didn't use Mangrove resources for medical purpose

S5. They like to conserve to the Mangrove forest

S6. They like to work in a group for conservation of Mangrove Forest

S7. Most people in the villages are young

S8. They do harvest more than 500 meters away from the Mangrove Forest

S9. They do harvest less than 10 times in a month

S10. They like to share their knowledge with others

S11. They have handicraft workshop in their village

S12. They sell handicrafts

S13. They have active women group in their village

S14. They select trees when they are matured

5.3.2. Weaknesses (W)

Eight weaknesses have been listed here. All of them are related to the local people, their role in conservation or use of mangrove forest and facilities in their village.

W1. They harvest Mangrove for wood, fire, fishing and hobbies

W2. They use of Mangrove for handicrafts

W3. Local people didn't share their knowledge with others

W4. They have no accommodation facilities in their village

W5. They have no formal level of education

W6. They didn't know about what time tourists come to their village for visiting Mangrove Forest

W7. They don't want to be in a group for conservation of Mangrove Forest

W8. Irregular fishing and harvesting

5.3.3. Internal Factor Evaluation (IFE)

The same process (as was explained in details in case of the Matang Mangrove Forest) was used to evaluate the internal factors (strengths and weaknesses). Table 5.2 shows IFE Matrix for the Carey Island Mangrove Forest. The total weighted score in this case is 1.729 that is below 2.5. This score will be later explained in the section on IE matrix.

Table 5.2: Internal Factor Evaluation (IFE) – the Carey Island (n=312)

	Internal Factor	Weight	Rating	Weighed Score
	Strengths			
S1	The villagers are familiar with Mangrove forest since their childhood.	0.0339	3	0.1017
S2	The local people are aware of the Mangrove forest areas in Malaysia.	0.0314	4	0.1256
S3	The villagers are aware of migratory birds in the Carey Island.	0.0283	3	0.0849
S4	The villagers have not used Mangrove resources for any medical purpose.	0.0287	3	0.0861

S5	The local people like to conserve the Mangrove forest.	0.0308	4	0.1232
S6	The local people like to work in a group for conservation of the Mangrove forest.	0.0303	4	0.1212
S7	Most local people in the villages are young.	0.0300	3	0.0900
S8	The villagers do harvest more than 500 meters away from the Mangrove forest.	0.0287	3	0.0861
S9	The local people go for harvesting less than 10 times in a month.	0.0282	3	0.0846
S10	The villagers like to share their knowledge with others.	0.0310	3	0.0930
S11	The local people have handicraft workshops in their village.	0.0324	4	0.1296
S12	The local people sell handicrafts.	0.0327	3	0.0981
S13	There are active women, members of a local group in their village.	0.0310	4	0.1240
S14	The villagers select trees (for any possible use) when they are matured.	0.0323	4	0.1292
	Weaknesses			
W1	The villagers harvest Mangrove for wood, fire, fishing and hobbies.	0.0211	1	0.0211
W2	The local people use Mangrove for making handicrafts.	0.0201	2	0.0402

Table 5.2, Continued.

W3	The local people have not shared their knowledge with others.	0.0188	2	0.0376
W4	The villagers have no accommodation facilities in their village.	0.0186	2	0.0372
W5	The local people have no formal level of education.	0.0199	2	0.0398
W6	The local people have no idea about what time tourists come to their village for visiting Mangrove forest.	0.0190	2	0.0380
W7	Some villagers do not want to be in a group for conservation of Mangrove forest.	0.0195	1	0.0195
W8	The local people do irregular fishing and harvesting	0.0187	1	0.0187
	Total Weighed Score			**1.729**

5.4. External Factors

For determining the external factors, the researcher went through the same process that was used for internal factors.

5.4.1. Opportunities (O)

O1. Tourist's knowledge about Mangrove Forest

O2. University of Malaya

O3. Water supply in the villages

O4. People who works for the Government

O5. Tourists

O6. Hari Muyang Celebration

O7. International agencies

O8. Mangrove Research Centre

O9. Academic Research

5.4.2. Threats (T)

T1. Tourists didn't share their knowledge with local people

T2. Palm Oil Plantation

T3. Highway and bridges

T4. Tsunami

T5. Oil pollutions from ships

T6. Climate Change (in general)

5.4.3. External Factor Evaluation (EFE)

The EFE matrix is shown in Table 5.3 that gives the weights and the ratings for the external factors (opportunities and threats) and the weighted score that is calculated by multiplying the weight and the rating.

Table 5.3: External Evaluation Factor (EFE) – the Carey Island (n=312)

	External Factors	**Weight**	**Rating**	**Weighed Score**
	Opportunities			
O1	Tourists have some knowledge about Mangrove forest.	0.0296	3	0.0888
O2	University of Malaya supports research on the mangrove forest.	0.0322	4	0.1288

Table 5.3, Continued.

O3	Villages in the Carey Island have water supply.	0.0353	3	0.1059
O4	Some villagers work for the Government.	0.0305	4	0.1220
O5	Tourists come to visit the Carey Island.	0.0336	4	0.1344
O6	The local people have an annual celebration called Ari Muyang.	0.0351	4	0.1404
O7	International agencies have some projects in the Carey Island.	0.0312	3	0.0936
O8	Mangrove Research Centre.	0.0312	4	0.1248
O9	Academic Researchers.	0.0311	4	0.1244
	Treats			
T1	Tourists do not share their knowledge with local people.	0.0204	2	0.0408
T2	Palm Oil Plantation (Sime Darby)	0.0211	1	0.0211
T3	Highway and bridges that pass through the middle of the forest.	0.0217	1	0.0217
T4	Risk of the tsunami.	0.0198	1	0.0198
T5	Oil pollutions from ships.	0.0198	2	0.0396
T6	Climate Change (in general)	0.0201	1	0.0201
	Total Weighted Score			**1.226**

According to the table 2, EEF is calculated as 1.226 and a review of the IFE and EFE for participatory mangrove management in the Carey Island, reveals that weaknesses dominate strengths (since IFE is less than 2.5) and threats dominate opportunities since EFE is less than 2.5 (Chang & Huang, 2006; Delavar, 2007; Moharram Nejad, 2012). It

shows that in the Carey Island the potentials were not enough to conserve the Mangrove forest, however the threats such as oil pollution, climate change, the highway and the bridge and the palm plantation were more powerful.

5.5. IE Matrix

The Internal-External (IE) matrix was explained in details in the related section in Chapter 4. When IFE and EFE matrices were formed and calculated (see Tables 5.2 and 5.3), it was found that the total weighted score of IFE was 1.729 and EFE was 1.226. Both scores were below 2.5. In this case, weaknesses and threats were superseding strengths and opportunities respectively (Figure 5.1). It means that the existing system of management in the Carey Island is internally weak while there are communities' potentials and at the same time the existing strategies are not appropriately designed to meet the external opportunities and protect the forest against threats.

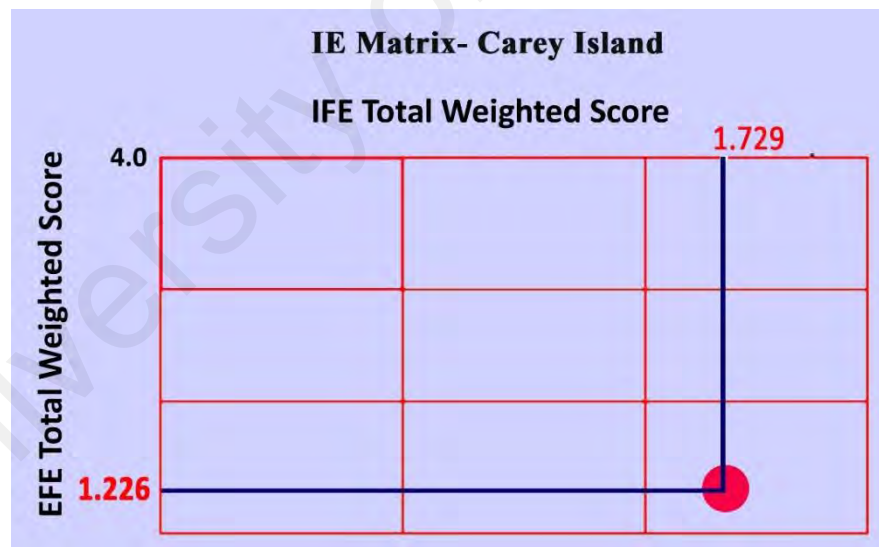**Figure 5.1**: IE Matrix- the Carey Island

It is clear from the IE Matrix that a change in policies is needed. It is important to remind that certain opportunities are referring to the involvement of local people and if a change of policy has to be decided, it is necessary to consider these opportunities.

5.6. SWOT Matrix

Based on comparing Internal and External factors, SWOT matrix as shown below:

Table 5.4: SWOT Matrix from with Identifying Possible Strategies (the Carey Island)

	Strengths - The villagers are familiar with Mangrove forest since their childhood. - The local people are aware of the Mangrove forest areas in Malaysia. - The villagers are aware of migratory birds in the Carey Island. - The villagers have not used Mangrove resources for any medical purpose. - The local people like to conserve the Mangrove forest. - The local people like to work in a group for conservation of the Mangrove forest. - Most local people in the villages are young. - The villagers do harvest more than 500 meters away from the Mangrove forest. - The local people go for harvesting less than 10 times in a month. - The villagers like to share their knowledge with others. - The local people have handicraft workshops in their village. - The local people sell handicrafts. - There are active women, members of a local group in their village. - The villagers select trees (for any possible use) when they are matured.	**Weaknesses** - The villagers harvest Mangrove for wood, fire, fishing and hobbies. - The local people use Mangrove for making handicrafts. - The local people have not shared their knowledge with others. - The villagers have no accommodation facilities in their village. - The local people have no formal level of education. - The local people have no idea about what time tourists come to their village for visiting Mangrove forest. - Some villagers do not want to be in a group for conservation of Mangrove forest. - The local people do irregular fishing and harvesting.
Opportunities - Tourists have some knowledge about Mangrove forest. - University of Malaya supports research on the mangrove forest. - Villages in the Carey Island have water supply. - Some villagers work for the Government. - Tourists come to visit the Carey Island. - The local people have an annual celebration called Ari Muyang. - International agencies have some projects in the Carey Island. - Mangrove Research Center. - Academic Researchers.	**SO strategies** 1) The Local people and tourists can share their knowledge on mangrove in Malaysia. 2) UM researchers and international agencies can use of the local people knowledge in their research and projects. 3) The Local people can be involved as tour guides (general and professional). 4) IMRC can employ the local people as volunteer in their projects. 5) The local people can participate in academic research. 6) University of Malaya can handle visits for the local people to other mangrove sites. 7) The local people can collaborate and participate with international agencies and researchers to protect the migratory birds in Heritage Island. 8) University of Malaya and other agencies are able to increase the awareness of the villagers to conserve the mangrove forest. 9) Tourists, University of Malaya and international agencies can help and educate the villagers to make a group to protect the Mangrove forest. 10) The villagers can share their knowledge with tourists who come for the celebration. 11) The local young villagers can participate in MRC and international agencies activities in the Carey Island. 12) The villagers can promote and sell their handicrafts to tourists. 13) The active women group is able to cooperate with academic researchers and international agencies. 14) International agencies and University of Malaya can be educated active women group to conserve the environment. 15) Active women group is able to educate the local people in their village to protect the environment. 16) Active women group can increase awareness of people and tourists about Mangrove through their celebrations in the village. 17) University of Malaya in cooperation with MRC and international agencies can increase the local people knowledge about mangrove through holding workshops.	**WO Strategies** 1) Reducing the use of Mangrove wood by the local people 2) The villagers can change their livelihood in the future by international agencies to protect the mangrove (alternate livelihood). 3) Using another kind of wood to make handicrafts. 4) Holding an exhibition in villages for selling handicrafts made from another kind of wood. 5) Supporting the villagers who are interested to continue their education by the related GOV bodies or NGOs. 6) Supporting villagers by the Government, MRC and international agencies to build accommodation facilities in the village. 7) The villagers get more familiar about tourism season by MRC. 8) The local people should be informed by GOV, International agencies, MRC and the University of Malaya about irregular fishing and harvesting effective on the environment.
Threats - Tourists do not share their knowledge with local people. - Palm Oil Plantation (Sime Darby) - Highway and bridges that pass through the middle of the forest. - Risk of the tsunami. - Oil pollutions from ships. - Climate Change (in general)	**ST Strategies** 1) Use of the local people knowledge by Sime Darby 2) Conserve the Mangrove to control the climate change effects by the local people knowledge. 3) Empowering tourists by the local group. 4) NGOs can negotiate with GOV to control the oil pollution from the ships. 5) Local group can do some activities to protect the Mangrove forest to control any possible Tsunami disaster.	**WT Strategies** 1) Decreasing the amount of harvesting by the local people to control the tsunami disaster effects. 2) Reducing the amount of irregular fishing and harvesting.

5.7. Strategies from Pairwise Matching

The result of the SWOT matrix was a list of 32 strategies was produced. These strategies were compared and merged and, as a result, the following sixteen strategies were proposed.

St1. The Local people, tourists and academic researchers can share their knowledge on Mangrove in Malaysia

St2. The Local people can be involved as tour guides (general and professional)

St3. UM researcher, MRC and IA can employ the local people as volunteer in their projects and academic research for conserving of the Mangrove Forest

St4. The local people can collaborate and participate with IA and researchers to protect the migratory birds in the Heritage Island

St5. Increase the WAG's knowledge and awareness about Mangrove Forest and its role to educate local people to protect the environment through holding workshop by UM, MRC and IA

St6. Increase awareness of the local people and tourists about conserving of Mangrove through the local celebration called "Hari Muyang"

St7. UM in cooperation with MRC and IA can increase the local people knowledge about mangrove through holding workshops

St8. Local groups can do some activities to protect the Mangrove Forest to control any possible tsunami disaster

St9. Control the oil pollution from the ships by the GOV and related Organization

St10. Reduce the amount of Mangrove wood used by the local people

St11. Change the livelihood of villagers to use the natural resources in the Carey Island in a sustainable way by NGOs, GOV, SD, MRC and IA

St12. Holding an exhibition in the Carey Island for selling handicrafts and fundraising to conserve the environment

St13. Support the local people who are interested to continue their education by UM, SD, IA and GOV

St14. Inform the local people about the negative effects of irregular fishing on the environment

St15. Decrease the amount of harvesting to control the tsunami disaster

St16. Decrease the amount of irregular fishing

5.8. Quantitative Strategic Planning Matrix

The third stage of the research methodology focused on decision making where the Quantitative Strategic Planning Matrix (QSPM) was used for prioritizing strategies. A third questionnaire (see Appendix E) was designed for weighing thirty-seven against sixteen strategies by giving an attractiveness score of 1 to 4 – which meant 592 comparisons had to be made. The questionnaire was filled by 23 experts in mangrove ecosystem conservation. The data were entered into SPSS for the calculation of the mean scores for each factor. After that, for each strategy, a table of factors were drawn in which the attractiveness scores were multiplied by the weight previously calculated based on the data from the SWOT questionnaire (see Appendix D), and then all the thirty-seven results for one strategy were added up. This sum was the relative attractiveness of each strategy. At this point, the strategies were re-arranged. Following pages will show the results from QSPM.

QSPM Matrix (the Carey Island)

St1. The Local people, tourists and academic researchers can share their knowledge on Mangrove in Malaysia

St2. The Local people can be involved as tour guides (general and professional)

	Determinant Factors	Wi	St1		St2	
			AS1	WiAS1	AS2	WiAS2
S1	The villagers are familiar with Mangrove forest since their childhood.	0.0339	4	0.1356	3	0.1017
S2	The local people are aware of the Mangrove forest areas in Malaysia.	0.0314	4	0.1256	4	0.1256
S3	The villagers are aware of migratory birds in the Carey Island.	0.0283	2	0.0566	3	0.0849
S4	The villagers have not used Mangrove resources for any medical purpose.	0.0287	2	0.0574	2	0.0574
S5	The local people like to conserve the Mangrove forest.	0.0308	2	0.0616	3	0.0924
S6	The local people like to work in a group for conservation of the Mangrove forest.	0.0303	2	0.0606	3	0.0909
S7	Most local people in the villages are young.	0.03	2	0.06	2	0.06

S8	The villagers do harvest more than 500 meters away from the Mangrove forest.	0.0287	2	0.0574	2	0.0574
S9	The local people go for harvesting less than 10 times in a month.	0.0282	2	0.0564	3	0.0846
S10	The villagers like to share their knowledge with others.	0.031	3	0.093	3	0.093
S11	The local people have handicraft workshops in their village.	0.0324	2	0.0648	3	0.0972
S12	The local people sell handicrafts.	0.0327	3	0.0981	3	0.0981
S13	There are active women, members of a local group in their village.	0.031	3	0.093	3	0.093
S14	The villagers select trees (for any possible use) when they are matured.	0.0323	3	0.0969	3	0.0969
W1	The villagers harvest Mangrove for wood, fire, fishing and hobbies.	0.0211	2	0.0422	2	0.0422
W2	The local people use Mangrove for making handicrafts.	0.0201	4	0.0804	3	0.0603
W3	The local people have not shared their knowledge with others.	0.0188	1	0.0188	1	0.0188
W4	The villagers have no accommodation facilities in their village.	0.0186	1	0.0186	2	0.0372

W5	The local people have no formal level of education.	0.0199	1	0.0199	1	0.0199
W6	The local people have no idea about what time tourists come to their village for visiting Mangrove forest.	0.019	1	0.019	2	0.038
W7	Some villagers do not want to be in a group for conservation of Mangrove forest.	0.0195	1	0.0195	2	0.039
W8	The local people do irregular fishing and harvesting	0.0187	3	0.0561	2	0.0374
O1	Tourists have some knowledge about Mangrove forest.	0.0296	3	0.0888	2	0.0592
O2	University of Malaya supports research on the mangrove forest.	0.0322	4	0.1288	3	0.0966
O3	Villages in the Carey Island have water supply.	0.0353	1	0.0353	0	0
O4	Some villagers work for the Government.	0.0305	3	0.0915	2	0.061
O5	Tourists come to visit the Carey Island.	0.0336	4	0.1344	3	0.1008
O6	The local people have an annual celebration called Ari Muyang.	0.0351	2	0.0702	1	0.0351
O7	International agencies have some projects in the Carey Island.	0.0312	2	0.0624	1	0.0312

QSPM Matrix (the Carey Island), Continued.

O8	Mangrove Research Centre.	0.0312	2	0.0624	2	0.0624
O9	Academic Researchers.	0.0311	3	0.0933	1	0.0311
T1	Tourists do not share their knowledge with local people.	0.0204	1	0.0204	1	0.0204
T2	Palm Oil Plantation (Sime Darby)	0.0211	3	0.0633	2	0.0422
T3	Highway and bridges that pass through the middle of the forest.	0.0217	1	0.0217	0	0
T4	Risk of the tsunami.	0.0198	2	0.0396	0	0
T5	Oil pollutions from ships.	0.0198	2	0.0396	0	0
T6	Climate Change (in general)	0.0201	1	0.0201	0	0
				2.363		**2.065**

<p align="center">**QSPM Matrix (the Carey Island)**</p>

St3. UM researcher, MRC and IA can employ the local people as volunteer in their projects and academic research for conserving of the Mangrove Forest

St4. The local people can collaborate and participate with IA and researchers to protect the migratory birds in the Heritage Island

	Determinant Factors	**Wi**	**St3**		**St4**	
			AS3	**WiAS3**	**AS4**	**WiAS4**
S1	The villagers are familiar with Mangrove forest since their childhood.	0.0339	4	0.1356	4	0.1356
S2	The local people are aware of the Mangrove forest areas in Malaysia.	0.0314	4	0.1256	1	0.0314
S3	The villagers are aware of migratory birds in the Carey Island.	0.0283	4	0.1132	3	0.0849
S4	The villagers have not used Mangrove resources for any medical purpose.	0.0287	2	0.0574	1	0.0287
S5	The local people like to conserve the Mangrove forest.	0.0308	3	0.0924	3	0.0924
S6	The local people like to work in a group for conservation of the Mangrove forest.	0.0303	3	0.0909	2	0.0606
S7	Most local people in the villages are young.	0.03	3	0.09	2	0.06

QSPM Matrix (the Carey Island), Continued.

S8	The villagers do harvest more than 500 meters away from the Mangrove forest.	0.0287	2	0.0574	2	0.0574
S9	The local people go for harvesting less than 10 times in a month.	0.0282	2	0.0564	2	0.0564
S10	The villagers like to share their knowledge with others.	0.031	3	0.093	3	0.093
S11	The local people have handicraft workshops in their village.	0.0324	2	0.0648	1	0.0324
S12	The local people sell handicrafts.	0.0327	2	0.0654	1	0.0327
S13	There are active women, members of a local group in their village.	0.031	2	0.062	1	0.031
S14	The villagers select trees (for any possible use) when they are matured.	0.0323	3	0.0969	1	0.0323
W1	The villagers harvest Mangrove for wood, fire, fishing and hobbies.	0.0211	2	0.0422	2	0.0422
W2	The local people use Mangrove for making handicrafts.	0.0201	1	0.0201	2	0.0402
W3	The local people have not shared their knowledge with others.	0.0188	2	0.0376	2	0.0376
W4	The villagers have no accommodation facilities in their village.	0.0186	1	0.0186	2	0.0372

QSPM Matrix (the Carey Island), Continued.

W5	The local people have no formal level of education.	0.0199	1	0.0199	2	0.0398
W6	The local people have no idea about what time tourists come to their village for visiting Mangrove forest.	0.019	1	0.019	1	0.019
W7	Some villagers do not want to be in a group for conservation of Mangrove forest.	0.0195	2	0.039	2	0.039
W8	The local people do irregular fishing and harvesting	0.0187	1	0.0187	1	0.0187
O1	Tourists have some knowledge about Mangrove forest.	0.0296	2	0.0592	2	0.0592
O2	University of Malaya supports research on the mangrove forest.	0.0322	4	0.1288	4	0.1288
O3	Villages in the Carey Island have water supply.	0.0353	1	0.0353	0	0
O4	Some villagers work for the Government.	0.0305	3	0.0915	2	0.061
O5	Tourists come to visit the Carey Island.	0.0336	3	0.1008	2	0.0672
O6	The local people have an annual celebration called Ari Muyang.	0.0351	2	0.0702	1	0.0351
O7	International agencies have some projects in the Carey Island.	0.0312	3	0.0936	3	0.0936

O8	Mangrove Research Centre.	0.0312	4	0.1248	1	0.0312
O9	Academic Researchers.	0.0311	4	0.1244	4	0.1244
T1	Tourists do not share their knowledge with local people.	0.0204	0	0	0	0
T2	Palm Oil Plantation (Sime Darby)	0.0211	0	0	0	0
T3	Highway and bridges that pass through the middle of the forest.	0.0217	0	0	0	0
T4	Risk of the tsunami.	0.0198	0	0	0	0
T5	Oil pollutions from ships.	0.0198	0	0	0	0
T6	Climate Change (in general)	0.0201	0	0	0	0
				2.244		**1.703**

St5. Increase the WAG's knowledge and awareness about Mangrove Forest and its role to educate local people to protect the environment through holding workshop by UM, MRC and IA

St6. Increase awareness of the local people and tourists about conserving of Mangrove through the local celebration called "Hari Muyang"

	Determinant Factors	**Wi**	**St5**		**St6**	
			AS5	**WiAS5**	**AS6**	**WiAS6**
S1	The villagers are familiar with Mangrove forest since their childhood.	0.0339	2	0.0678	3	0.1017
S2	The local people are aware of the Mangrove forest areas in Malaysia.	0.0314	2	0.0628	3	0.0942
S3	The villagers are aware of migratory birds in the Carey Island.	0.0283	2	0.0566	2	0.0566
S4	The villagers have not used Mangrove resources for any medical purpose.	0.0287	1	0.0287	1	0.0287
S5	The local people like to conserve the Mangrove forest.	0.0308	3	0.0924	3	0.0924
S6	The local people like to work in a group for conservation of the Mangrove forest.	0.0303	3	0.0909	2	0.0606
S7	Most local people in the villages are young.	0.03	2	0.06	2	0.06

QSPM Matrix (the Carey Island), Continued.

S8	The villagers do harvest more than 500 meters away from the Mangrove forest.	0.0287	2	0.0574	2	0.0574
S9	The local people go for harvesting less than 10 times in a month.	0.0282	2	0.0564	2	0.0564
S10	The villagers like to share their knowledge with others.	0.031	3	0.093	3	0.093
S11	The local people have handicraft workshops in their village.	0.0324	2	0.0648	2	0.0648
S12	The local people sell handicrafts.	0.0327	2	0.0654	2	0.0654
S13	There are active women, members of a local group in their village.	0.031	3	0.093	3	0.093
S14	The villagers select trees (for any possible use) when they are matured.	0.0323	3	0.0969	2	0.0646
W1	The villagers harvest Mangrove for wood, fire, fishing and hobbies.	0.0211	2	0.0422	2	0.0422
W2	The local people use Mangrove for making handicrafts.	0.0201	2	0.0402	2	0.0402
W3	The local people have not shared their knowledge with others.	0.0188	2	0.0376	1	0.0188
W4	The villagers have no accommodation facilities in their village.	0.0186	2	0.0372	2	0.0372

W5	The local people have no formal level of education.	0.0199	2	0.0398	2	0.0398
W6	The local people have no idea about what time tourists come to their village for visiting Mangrove forest.	0.019	1	0.019	1	0.019
W7	Some villagers do not want to be in a group for conservation of Mangrove forest.	0.0195	2	0.039	2	0.039
W8	The local people do irregular fishing and harvesting	0.0187	1	0.0187	2	0.0374
O1	Tourists have some knowledge about Mangrove forest.	0.0296	1	0.0296	3	0.0888
O2	University of Malaya supports research on the mangrove forest.	0.0322	4	0.1288	3	0.0966
O3	Villages in the Carey Island have water supply.	0.0353	0	0	0	0
O4	Some villagers work for the Government.	0.0305	2	0.061	1	0.0305
O5	Tourists come to visit the Carey Island.	0.0336	1	0.0336	1	0.0336
O6	The local people have an annual celebration called Ari Muyang.	0.0351	1	0.0351	3	0.1053
O7	International agencies have some projects in the Carey Island.	0.0312	4	0.1248	2	0.0624

QSPM Matrix (the Carey Island), Continued.

O8	Mangrove Research Centre.	0.0312	4	0.1248	2	0.0624
O9	Academic Researchers.	0.0311	3	0.0933	3	0.0933
T1	Tourists do not share their knowledge with local people.	0.0204	0	0	0	0
T2	Palm Oil Plantation (Sime Darby)	0.0211	0	0	2	0.0422
T3	Highway and bridges that pass through the middle of the forest.	0.0217	1	0.0217	1	0.0217
T4	Risk of the tsunami.	0.0198	3	0.0594	2	0.0396
T5	Oil pollutions from ships.	0.0198	1	0.0198	1	0.0198
T6	Climate Change (in general)	0.0201	1	0.0201	2	0.0402
				2.018		**1.9998**

QSPM Matrix (the Carey Island)

St7. UM in cooperation with MRC and IA can increase the local people knowledge about mangrove through holding workshops

St8. Local groups can do some activities to protect the Mangrove Forest to control any possible tsunami disaster

	Determinant Factors	Wi	St7		St8	
			AS7	WiAS7	AS8	WiAS8
S1	The villagers are familiar with Mangrove forest since their childhood.	0.0339	3	0.1017	3	0.1017
S2	The local people are aware of the Mangrove forest areas in Malaysia.	0.0314	3	0.0942	3	0.0942
S3	The villagers are aware of migratory birds in the Carey Island.	0.0283	3	0.0849	2	0.0566
S4	The villagers have not used Mangrove resources for any medical purpose.	0.0287	3	0.0861	2	0.0574
S5	The local people like to conserve the Mangrove forest.	0.0308	3	0.0924	3	0.0924
S6	The local people like to work in a group for conservation of the Mangrove forest.	0.0303	3	0.0909	3	0.0909
S7	Most local people in the villages are young.	0.03	3	0.09	2	0.06

QSPM Matrix (the Carey Island), Continued.

S8	The villagers do harvest more than 500 meters away from the Mangrove forest.	0.0287	3	0.0861	2	0.0574
S9	The local people go for harvesting less than 10 times in a month.	0.0282	3	0.0846	2	0.0564
S10	The villagers like to share their knowledge with others.	0.031	3	0.093	2	0.062
S11	The local people have handicraft workshops in their village.	0.0324	2	0.0648	2	0.0648
S12	The local people sell handicrafts.	0.0327	3	0.0981	2	0.0654
S13	There are active women, members of a local group in their village.	0.031	3	0.093	2	0.062
S14	The villagers select trees (for any possible use) when they are matured.	0.0323	3	0.0969	3	0.0969
W1	The villagers harvest Mangrove for wood, fire, fishing and hobbies.	0.0211	3	0.0633	3	0.0633
W2	The local people use Mangrove for making handicrafts.	0.0201	3	0.0603	2	0.0402
W3	The local people have not shared their knowledge with others.	0.0188	2	0.0376	2	0.0376
W4	The villagers have no accommodation facilities in their village.	0.0186	1	0.0186	0	0

QSPM Matrix (the Carey Island), Continued.

W5	The local people have no formal level of education.	0.0199	2	0.0398	1	0.0199
W6	The local people have no idea about what time tourists come to their village for visiting Mangrove forest.	0.019	0	0	0	0
W7	Some villagers do not want to be in a group for conservation of Mangrove forest.	0.0195	2	0.039	2	0.039
W8	The local people do irregular fishing and harvesting	0.0187	3	0.0561	2	0.0374
O1	Tourists have some knowledge about Mangrove forest.	0.0296	1	0.0296	0	0
O2	University of Malaya supports research on the mangrove forest.	0.0322	4	0.1288	3	0.0966
O3	Villages in the Carey Island have water supply.	0.0353	0	0	0	0
O4	Some villagers work for the Government.	0.0305	2	0.061	1	0.0305
O5	Tourists come to visit the Carey Island.	0.0336	1	0.0336	0	0
O6	The local people have an annual celebration called Ari Muyang.	0.0351	2	0.0702	0	0
O7	International agencies have some projects in the Carey Island.	0.0312		0	2	0.0624

QSPM Matrix (the Carey Island), Continued.

O8	Mangrove Research Centre.	0.0312	3	0.0936	2	0.0624
O9	Academic Researchers.	0.0311	4	0.1244	3	0.0933
T1	Tourists do not share their knowledge with local people.	0.0204	0	0	0	0
T2	Palm Oil Plantation (Sime Darby)	0.0211	0	0	0	0
T3	Highway and bridges that pass through the middle of the forest.	0.0217	0	0	0	0
T4	Risk of the tsunami.	0.0198	1	0.0198	3	0.0594
T5	Oil pollutions from ships.	0.0198	0	0	0	0
T6	Climate Change (in general)	0.0201	0	0	0	0
				2.132		**1.660**

QSPM Matrix (the Carey Island)

St9. Control the oil pollution from the ships by the GOV and related Organization

St10. Reduce the amount of Mangrove wood used by the local people

	Determinant Factors	Wi	St9		St10	
			AS9	WiAS9	AS10	WiAS10
S1	The villagers are familiar with Mangrove forest since their childhood.	0.0339	1	0.0339	2	0.0678
S2	The local people are aware of the Mangrove forest areas in Malaysia.	0.0314	1	0.0314	2	0.0628
S3	The villagers are aware of migratory birds in the Carey Island.	0.0283	0	0	0	0
S4	The villagers have not used Mangrove resources for any medical purpose.	0.0287	1	0.0287	2	0.0574
S5	The local people like to conserve the Mangrove forest.	0.0308	1	0.0308	3	0.0924
S6	The local people like to work in a group for conservation of the Mangrove forest.	0.0303	0	0	2	0.0606
S7	Most local people in the villages are young.	0.03	0	0	1	0.03

QSPM Matrix (the Carey Island), Continued.

S8	The villagers do harvest more than 500 meters away from the Mangrove forest.	0.0287	0	0	3	0.0861
S9	The local people go for harvesting less than 10 times in a month.	0.0282	0	0	2	0.0564
S10	The villagers like to share their knowledge with others.	0.031	1	0.031	2	0.062
S11	The local people have handicraft workshops in their village.	0.0324	0	0	2	0.0648
S12	The local people sell handicrafts.	0.0327	0	0	2	0.0654
S13	There are active women, members of a local group in their village.	0.031	0	0	2	0.062
S14	The villagers select trees (for any possible use) when they are matured.	0.0323	0	0	3	0.0969
W1	The villagers harvest Mangrove for wood, fire, fishing and hobbies.	0.0211	1	0.0211	4	0.0844
W2	The local people use Mangrove for making handicrafts.	0.0201	1	0.0201	2	0.0402
W3	The local people have not shared their knowledge with others.	0.0188	0	0	2	0.0376
W4	The villagers have no accommodation facilities in their village.	0.0186	0	0	0	0

QSPM Matrix (the Carey Island), Continued.

W5	The local people have no formal level of education.	0.0199	0	0	1	0.0199
W6	The local people have no idea about what time tourists come to their village for visiting Mangrove forest.	0.019	0	0	0	0
W7	Some villagers do not want to be in a group for conservation of Mangrove forest.	0.0195	1	0.0195	2	0.039
W8	The local people do irregular fishing and harvesting	0.0187	1	0.0187	2	0.0374
O1	Tourists have some knowledge about Mangrove forest.	0.0296	0	0	0	0
O2	University of Malaya supports research on the mangrove forest.	0.0322	2	0.0644	4	0.1288
O3	Villages in the Carey Island have water supply.	0.0353	1	0.0353	1	0.0353
O4	Some villagers work for the Government.	0.0305	2	0.061	2	0.061
O5	Tourists come to visit the Carey Island.	0.0336	1	0.0336	0	0
O6	The local people have an annual celebration called Ari Muyang.	0.0351	1	0.0351	0	0
O7	International agencies have some projects in the Carey Island.	0.0312	3	0.0936	3	0.0936

QSPM Matrix (the Carey Island), Continued.

O8	Mangrove Research Centre.	0.0312	3	0.0936	3	0.0936
O9	Academic Researchers.	0.0311	3	0.0933	3	0.0933
T1	Tourists do not share their knowledge with local people.	0.0204	0	0	0	0
T2	Palm Oil Plantation (Sime Darby)	0.0211	2	0.0422	3	0.0633
T3	Highway and bridges that pass through the middle of the forest.	0.0217	0	0	2	0.0434
T4	Risk of the tsunami.	0.0198	0	0	1	0.0198
T5	Oil pollutions from ships.	0.0198	4	0.0792	0	0
T6	Climate Change (in general)	0.0201	2	0.0402	2	0.0402
				0.906		**1.795**

QSPM Matrix (the Carey Island)

St11. Change the livelihood of villagers to use the natural resources in the Carey Island in a sustainable way by NGOs, GOV, SD, MRC and IA

St12. Holding an exhibition in the Carey Island for selling handicrafts and fundraising to conserve the environment

	Determinant Factors	Wi	St11		St12	
			AS11	WiAS11	AS12	WiAS12
S1	The villagers are familiar with Mangrove forest since their childhood.	0.0339	2	0.0678	1	0.0339
S2	The local people are aware of the Mangrove forest areas in Malaysia.	0.0314	2	0.0628	0	0
S3	The villagers are aware of migratory birds in the Carey Island.	0.0283	1	0.0283	0	0
S4	The villagers have not used Mangrove resources for any medical purpose.	0.0287	1	0.0287	0	0
S5	The local people like to conserve the Mangrove forest.	0.0308	3	0.0924	3	0.0924
S6	The local people like to work in a group for conservation of the Mangrove forest.	0.0303	2	0.0606	2	0.0606

QSPM Matrix (the Carey Island), Continued.

S7	Most local people in the villages are young.	0.03	1	0.03	3	0.09
S8	The villagers do harvest more than 500 meters away from the Mangrove forest.	0.0287	2	0.0574	1	0.0287
S9	The local people go for harvesting less than 10 times in a month.	0.0282	2	0.0564	1	0.0282
S10	The villagers like to share their knowledge with others.	0.031	1	0.031	2	0.062
S11	The local people have handicraft workshops in their village.	0.0324	1	0.0324	4	0.1296
S12	The local people sell handicrafts.	0.0327	2	0.0654	4	0.1308
S13	There are active women, members of a local group in their village.	0.031	1	0.031	1	0.031
S14	The villagers select trees (for any possible use) when they are matured.	0.0323	2	0.0646	4	0.1292
W1	The villagers harvest Mangrove for wood, fire, fishing and hobbies.	0.0211	4	0.0844	4	0.0844
W2	The local people use Mangrove for making handicrafts.	0.0201	2	0.0402	4	0.0804

QSPM Matrix (the Carey Island), Continued.

W3	The local people have not shared their knowledge with others.	0.0188	1	0.0188	2	0.0376
W4	The villagers have no accommodation facilities in their village.	0.0186	0	0	0	0
W5	The local people have no formal level of education.	0.0199	1	0.0199	0	0
W6	The local people have no idea about what time tourists come to their village for visiting Mangrove forest.	0.019	0	0	1	0.019
W7	Some villagers do not want to be in a group for conservation of Mangrove forest.	0.0195	1	0.0195	1	0.0195
W8	The local people do irregular fishing and harvesting	0.0187	1	0.0187	1	0.0187
O1	Tourists have some knowledge about Mangrove forest.	0.0296	1	0.0296	0	0
O2	University of Malaya supports research on the mangrove forest.	0.0322	2	0.0644	2	0.0644
O3	Villages in the Carey Island have water supply.	0.0353	1	0.0353	1	0.0353
O4	Some villagers work for the Government.	0.0305	3	0.0915	0	0

O5	Tourists come to visit the Carey Island.	0.0336	0	0	1	0.0336
O6	The local people have an annual celebration called Ari Muyang.	0.0351	0	0	1	0.0351
O7	International agencies have some projects in the Carey Island.	0.0312	3	0.0936	3	0.0936
O8	Mangrove Research Centre.	0.0312	2	0.0624	3	0.0936
O9	Academic Researchers.	0.0311	3	0.0933	3	0.0933
T1	Tourists do not share their knowledge with local people.	0.0204	0	0	0	0
T2	Palm Oil Plantation (Sime Darby)	0.0211	0	0	1	0.0211
T3	Highway and bridges that pass through the middle of the forest.	0.0217	0	0	0	0
T4	Risk of the tsunami.	0.0198	1	0.0198	0	0
T5	Oil pollutions from ships.	0.0198	0	0	0	0
T6	Climate Change (in general)	0.0201	1	0.0201	1	0.0201
				1.420		**1.566**

QSPM Matrix (the Carey Island)

St13. Support the local people who are interested to continue their education by UM, SD, IA and GOV

St14. Inform the local people about the negative effects of irregular fishing on the environment

	Determinant Factors	Wi	St13		St14	
			AS13	WiAS13	AS14	WiAS14
S1	The villagers are familiar with Mangrove forest since their childhood.	0.0339	1	0.0339	1	0.0339
S2	The local people are aware of the Mangrove forest areas in Malaysia.	0.0314	2	0.0628	1	0.0314
S3	The villagers are aware of migratory birds in the Carey Island.	0.0283	0	0	0	0
S4	The villagers have not used Mangrove resources for any medical purpose.	0.0287	1	0.0287	0	0
S5	The local people like to conserve the Mangrove forest.	0.0308	2	0.0616	2	0.0616
S6	The local people like to work in a group for conservation of the Mangrove forest.	0.0303	1	0.0303	1	0.0303

QSPM Matrix (the Carey Island), Continued.

S7	Most local people in the villages are young.	0.03	3	0.09	2	0.06
S8	The villagers do harvest more than 500 meters away from the Mangrove forest.	0.0287	0	0	1	0.0287
S9	The local people go for harvesting less than 10 times in a month.	0.0282	0	0	1	0.0282
S10	The villagers like to share their knowledge with others.	0.031	1	0.031	3	0.093
S11	The local people have handicraft workshops in their village.	0.0324	1	0.0324	1	0.0324
S12	The local people sell handicrafts.	0.0327	0	0	1	0.0327
S13	There are active women, members of a local group in their village.	0.031	1	0.031	1	0.031
S14	The villagers select trees (for any possible use) when they are matured.	0.0323	0	0	1	0.0323
W1	The villagers harvest Mangrove for wood, fire, fishing and hobbies.	0.0211	1	0.0211	1	0.0211
W2	The local people use Mangrove for making handicrafts.	0.0201	1	0.0201	0	0

QSPM Matrix (the Carey Island), Continued.

W3	The local people have not shared their knowledge with others.	0.0188	0	0	0	0
W4	The villagers have no accommodation facilities in their village.	0.0186	0	0	0	0
W5	The local people have no formal level of education.	0.0199	2	0.0398	1	0.0199
W6	The local people have no idea about what time tourists come to their village for visiting Mangrove forest.	0.019	0	0	0	0
W7	Some villagers do not want to be in a group for conservation of Mangrove forest.	0.0195	2	0.039	2	0.039
W8	The local people do irregular fishing and harvesting	0.0187	1	0.0187	3	0.0561
O1	Tourists have some knowledge about Mangrove forest.	0.0296	0	0	0	0
O2	University of Malaya supports research on the mangrove forest.	0.0322	3	0.0966	2	0.0644
O3	Villages in the Carey Island have water supply.	0.0353	1	0.0353	0	0
O4	Some villagers work for the Government.	0.0305	1	0.0305	0	0

QSPM Matrix (the Carey Island), Continued.

O5	Tourists come to visit the Carey Island.	0.0336	1	0.0336	0	0
O6	The local people have an annual celebration called Ari Muyang.	0.0351	0	0	0	0
O7	International agencies have some projects in the Carey Island.	0.0312	3	0.0936	2	0.0624
O8	Mangrove Research Centre.	0.0312	3	0.0936	1	0.0312
O9	Academic Researchers.	0.0311	3	0.0933	3	0.0933
T1	Tourists do not share their knowledge with local people.	0.0204	0	0	0	0
T2	Palm Oil Plantation (Sime Darby)	0.0211	0	0	0	0
T3	Highway and bridges that pass through the middle of the forest.	0.0217	1	0.0217	0	0
T4	Risk of the tsunami.	0.0198	1	0.0198	0	0
T5	Oil pollutions from ships.	0.0198	0	0	0	0
T6	Climate Change (in general)	0.0201	1	0.0201	0	0
				1.078		**0.882**

St15. Decrease the amount of harvesting to control the tsunami disaster

St16. Decrease the amount of irregular fishing

	Determinant Factors	**Wi**	**St15**		**St16**	
			AS15	**WiAS15**	**AS16**	**WiAS16**
S1	The villagers are familiar with Mangrove forest since their childhood.	0.0339	1	0.0339	1	0.0339
S2	The local people are aware of the Mangrove forest areas in Malaysia.	0.0314	0	0	0	0
S3	The villagers are aware of migratory birds in the Carey Island.	0.0283	0	0	0	0
S4	The villagers have not used Mangrove resources for any medical purpose.	0.0287	0	0	1	0.0287
S5	The local people like to conserve the Mangrove forest.	0.0308	3	0.0924	3	0.0924
S6	The local people like to work in a group for conservation of the Mangrove forest.	0.0303	1	0.0303	1	0.0303
S7	Most local people in the villages are young.	0.03	1	0.03	1	0.03

S8	The villagers do harvest more than 500 meters away from the Mangrove forest.	0.0287	2	0.0574	1	0.0287
S9	The local people go for harvesting less than 10 times in a month.	0.0282	3	0.0846	1	0.0282
S10	The villagers like to share their knowledge with others.	0.031	1	0.031	1	0.031
S11	The local people have handicraft workshops in their village.	0.0324	2	0.0648	0	0
S12	The local people sell handicrafts.	0.0327	2	0.0654	0	0
S13	There are active women, members of a local group in their village.	0.031	2	0.062	2	0.062
S14	The villagers select trees (for any possible use) when they are matured.	0.0323	3	0.0969	0	0
W1	The villagers harvest Mangrove for wood, fire, fishing and hobbies.	0.0211	4	0.0844	2	0.0422
W2	The local people use Mangrove for making handicrafts.	0.0201	3	0.0603	0	0

QSPM Matrix (the Carey Island), Continued.

W3	The local people have not shared their knowledge with others.	0.0188	0	0	0	0
W4	The villagers have no accommodation facilities in their village.	0.0186	0	0	0	0
W5	The local people have no formal level of education.	0.0199	0	0	0	0
W6	The local people have no idea about what time tourists come to their village for visiting Mangrove forest.	0.019	0	0	0	0
W7	Some villagers do not want to be in a group for conservation of Mangrove forest.	0.0195	1	0.0195	0	0
W8	The local people do irregular fishing and harvesting	0.0187	3	0.0561	4	0.0748
O1	Tourists have some knowledge about Mangrove forest.	0.0296	0	0	0	0
O2	University of Malaya supports research on the mangrove forest.	0.0322	2	0.0644	2	0.0644
O3	Villages in the Carey Island have water supply.	0.0353	1	0.0353	1	0.0353
O4	Some villagers work for the Government.	0.0305	1	0.0305	1	0.0305

QSPM Matrix (the Carey Island), Continued.

O5	Tourists come to visit the Carey Island.	0.0336	0	0	0	0
O6	The local people have an annual celebration called Ari Muyang.	0.0351	0	0	0	0
O7	International agencies have some projects in the Carey Island.	0.0312	3	0.0936	3	0.0936
O8	Mangrove Research Centre.	0.0312	3	0.0936	2	0.0624
O9	Academic Researchers.	0.0311	3	0.0933	3	0.0933
T1	Tourists do not share their knowledge with local people.	0.0204	0	0	0	0
T2	Palm Oil Plantation (Sime Darby)	0.0211	2	0.0422	2	0.0422
T3	Highway and bridges that pass through the middle of the forest.	0.0217	3	0.0651	1	0.0217
T4	Risk of the tsunami.	0.0198	4	0.0792	0	0
T5	Oil pollutions from ships.	0.0198	0	0	1	0.0198
T6	Climate Change (in general)	0.0201	3	0.0603	3	0.0603
				1.526		**1.005**

5.9. Prioritizing Key Strategies

After processing the QSPM questionnaires filled by the experts, the researchers could have a prioritized list of the above-mentioned strategies (Table 5.5) based on the scores calculated by Excel software.

Table 5.5: Prioritize Key Strategies (the Carey Island)

	Strategies	Score	%
1	**St1.** The Local people, tourists and academic researchers can share their knowledge on Mangrove in Malaysia	2.363	9.00
2	**St2.** The Local people can be involved as tour guides (general and professional)	2.065	7.87
3	**St3.** UM researcher, MRC and IA can employ the local people as volunteer in their projects and academic research for conserving of the Mangrove Forest	2.244	8.55
4	**St4.** The local people can collaborate and participate with IA and researchers to protect the migratory birds in the Heritage Island	1.703	6.49
5	**St5.** Increase the WAG's knowledge and awareness about Mangrove Forest and its role to educate local people to protect the environment through holding workshop by UM, MRC and IA	1.971	7.51
6	**St6.** Increase awareness of the local people and tourists about conserving of Mangrove through the local celebration called "Hari Muyang"	1.938	7.38
7	**St7.** UM in cooperation with MRC and IA can increase the local people knowledge about mangrove through holding workshops	2.132	8.12
8	**St8.** Local groups can do some activities to protect the Mangrove Forest to control any possible tsunami disaster	1.66	6.32

Table 5.5, Continued.

9	**St9.** Control the oil pollution from the ships by the GOV and related Organization	0.906	3.45
10	**St10.** Reduce the amount of Mangrove wood used by the local people	1.795	6.84
11	**St11.** Change the livelihood of villagers to use the natural resources in the Carey Island in a sustainable way by NGOs, GOV, SD, MRC and IA	1.42	5.41
12	**St12.** Holding an exhibition in the Carey Island for selling handicrafts and fundraising to conserve the environment	1.566	5.96
13	**St13.** Support the local people who are interested to continue their education by UM, SD, IA and GOV	1.078	4.11
14	**St14.** Inform the local people about the negative effects of irregular fishing on the environment	0.882	3.36
15	**St15.** Decrease the amount of harvesting to control the tsunami disaster	1.526	5.81
16	**St16.** Decrease the amount of irregular fishing	1.005	3.83
	Total	**26.254**	**100%**

As it is shown in Figure 5.2., the first and the third strategies are of higher scores than others. The first is about sharing knowledge by the local people and the third is about their involvement in research by academicians. Both are forms of local participation in the Carey Island forest.
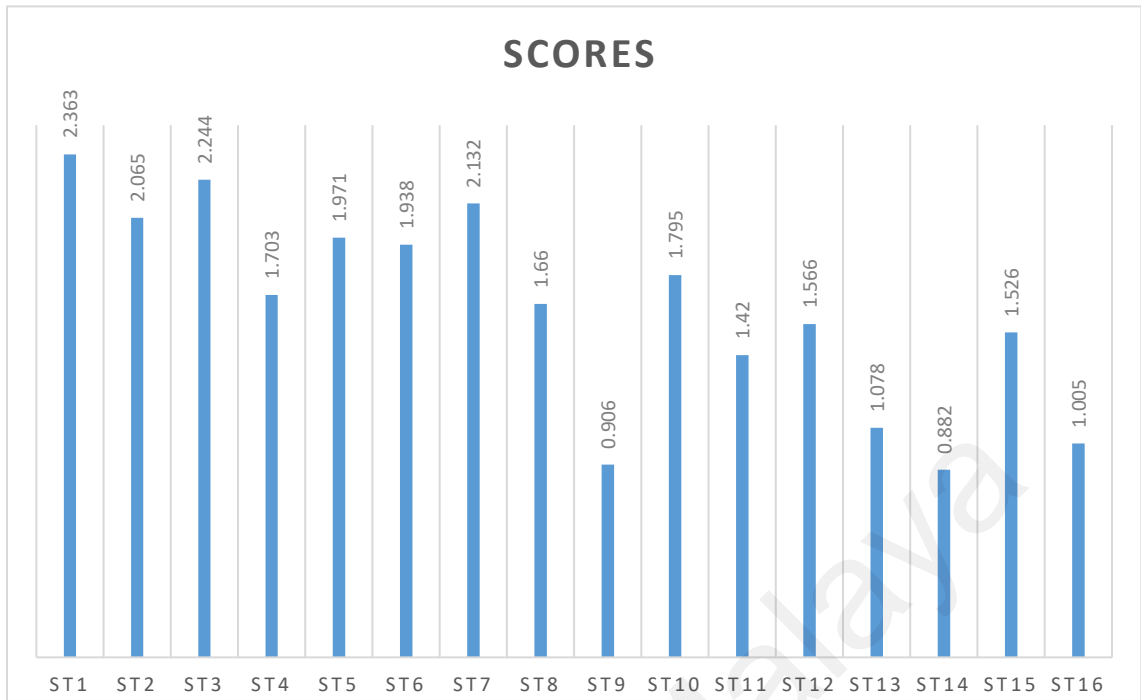
Figure 5.2: Prioritize Key Strategies (the Carey Island)

5.10. Classification of strategies

Based on the percentage of the score, the strategies are classified. The first two are the important strategies since they have obtained the higher percentage. However the next three have lesser percentage but in comparison with the others, they are still high, and therefore, the first four are the important strategies. The next eight strategies are the intermediate strategies and the last four are the weak ones.

Table 5.6: Strategies Classification (the Carey Island)

	Strategies	Score	%
Important Strategies			
1	**St1.** The Local people, tourists and academic researchers can share their knowledge on Mangrove in Malaysia	2.363	9.00%
2	**St3.** UM researcher, MRC and IA can employ the local people as volunteer in their projects and academic research for conserving of the Mangrove Forest	2.244	8.55%

Table 5.6, Continued.

3	**St7.** UM in cooperation with MRC and IA can increase the local people knowledge about mangrove through holding workshops	2.132	8.12%
4	**St2.** The Local people can be involved as tour guides (general and professional)	2.065	7.87%
		8.804	**33.54%**
Intermediate Strategies			
5	**St5.** Increase the WAG's knowledge and awareness about Mangrove Forest and its role to educate local people to protect the environment through holding workshop by UM, MRC and IA	1.971	7.51%
6	**St6.** Increase awareness of the local people and tourists about conserving of Mangrove through the local celebration called "Hari Muyang"	1.938	7.38%
7	**St10.** Reduce the amount of Mangrove wood used by the local people	1.795	6.84%
8	**St4.** The local people can collaborate and participate with IA and researchers to protect the migratory birds in the Heritage Island	1.703	6.49%
9	**St8.** Local groups can do some activities to protect the Mangrove Forest to control any possible tsunami disaster	1.66	6.32%
10	**St12.** Holding an exhibition in the Carey Island for selling handicrafts and fundraising to conserve the environment	1.566	5.96%
11	**St15.** Decrease the amount of harvesting to control the tsunami disaster	1.526	5.81%

Table 5.6, Continued.

12	**St11.** Change the livelihood of villagers to use the natural resources in the Carey Island in a sustainable way by NGOs, GOV, SD, MRC and IA	1.42	5.41%
		13.579	**51.72%**
Weak Strategies			
13	**St13.** Support the local people who are interested to continue their education by UM, SD, IA and GOV	1.078	4.11%
14	**St16.** Decrease the amount of irregular fishing	1.005	3.83%
15	**St9.** Control the oil pollution from the ships by the GOV and related Organization	0.906	3.45%
16	**St14.** Inform the local people about the negative effects of irregular fishing on the environment	0.882	3.36%
		3.871	**14.75%**
	Total	**26.254**	**100%**

The figure 5.3., depicts a diagram of the strategies and the related scores. The three sets of strategies are separated by colour. Here, the two other important strategies are indicative of the role of the university in increasing the local people knowledge about mangroves and also the local people's participation in tourism. It seems the four important strategies are about an interaction for participation in conservation of mangrove forest in the Carey Island.
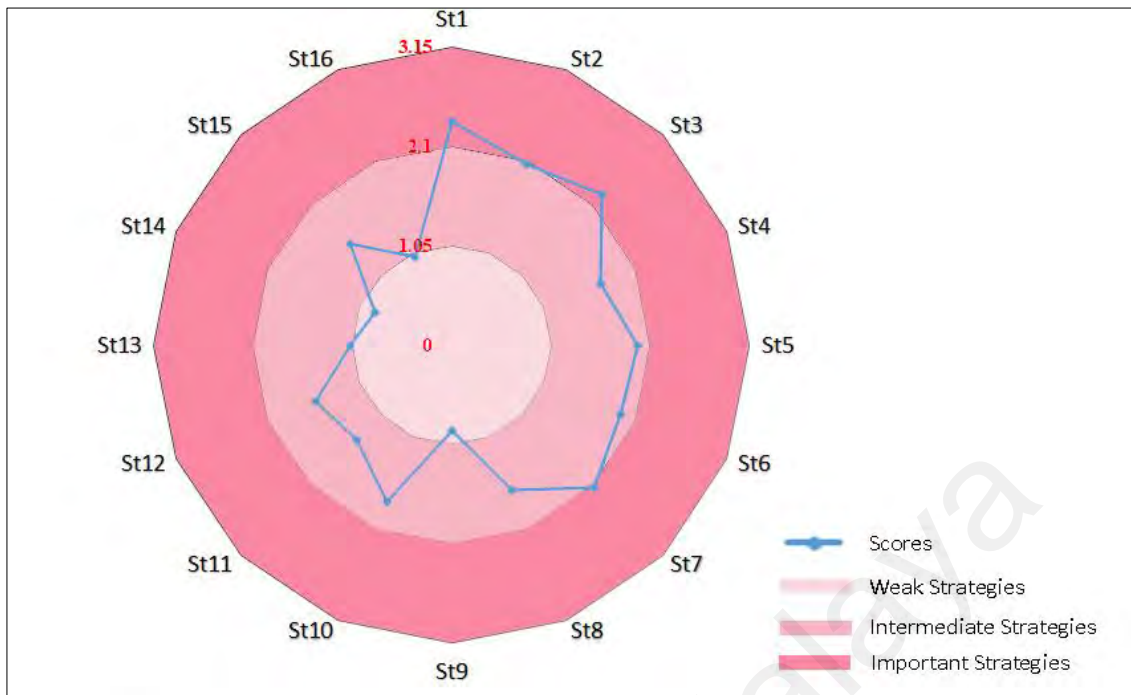
Figure 5.3: Strategies Classification (the Carey Island)

5.11. Summary

This chapter presents the data resulted from the two managerial tools of SWOT and QSPM. The data for SWOT was prepared with participation of locals from four communities living near the Carey Island as well as the staff from Sime Darby. The attractiveness scoring for QSPM was done by the experts in mangrove ecosystem. Also, the chapter provides an overview of the forest in the Carey Island area. The result is a prioritized list of sixteen key strategies for the Carey Island forest. The chapter ends with the classification of the strategies into important, intermediate and weak strategies.

CHAPTER 6: DISCUSSION ON TWO CASES OF THE MATANG AND THE CAREY ISLAND MANGROVE FORESTS

6.1. Introduction

Chapter six discusses the data results of the two previous chapters from the two cases of the Matang Mangroves Forest Reserve and the Carey Island Mangroves Forest. The chapter starts with the data from the Matang Case and then continues with the Carey Island. In each case, three sets of results namely factors, strategies and prioritized strategies will be discussed. The chapter continues with certain comparisons between the two cases and finishes with a summary. The purpose of the present discussion is not only to understand the importance of the involvement of local people in codification of prioritized strategies for the management of a mangrove but to examine how they define their roles in conservation and use of the forest, especially multi-use management.

6.2. Discussion on the Matang Case

6.2.1. Factors

All the strengths are about the potentials of people in local communities. It shows that they know mangrove forest (S3, S4, S6, S8, S10, S11, S13 and S15) and are interested to know more (S14), be involved in conservation (S9 and S17), ecotourism (S7, S8 and S11).

Weaknesses are again about the behaviour of local people regarding the mangrove forest. It refers to harvesting wood for various purposes (W2, W3, W4, W5, W13 and W15), their little knowledge about the forest (W1) and forestry (W7 and W8), bird-watching (W11) and wildlife (W12).

There are certain apparent disparities between strengths and weaknesses. For instance while we have this statement that "the villagers are familiar with the Mangrove forest since their childhood" (S3) as a strength, there is another similar statement among weaknesses that mentions: "Some of the local people did not know about the Mangrove Forest" (W1). The same is with this statement "the villagers are interested to share their knowledge with others" (S10) among strengths, and the statement "the local people did not share their knowledge with others" (W6) as a weakness, and also S11 and W10 (regarding sharing knowledge about birds). In fact, they are not contradictory; they complete each other. For instance, while the villagers are familiar with the forest, some of them they do not know about it. It helped that the statements of strengths lose their absolute tone and a more realistic picture of the situation arise.

Tourists (O1, O2, O9), Forestry Department (O3, O5) and the management plan (O6), the government (O4), researchers (O7), universities (O8) and international agencies (O10) are among the opportunities for the Matang forest management, while the respondents have referred to five threats: tourists may not share their information with local people (T1), three natural threats of earthquake, climate change and tsunami (T2, T3 and T5) and the oil pollutions from ships (T5).

It is important to remind that the average score in an IFE and EFE matrices is 2.5 (within a range from a low score of 1.0 to a high score of 4.0). In an IFE matrix, a total weighted score below 2.5 refer to weak internal factors and a score above 2.5 indicates that strong internal factors are involved. In the present case, based on the results from the IFEM and EFEM review, weaknesses override strengths (since IFE is less than 2.5) and threats supersede opportunities since EFE is less than 2.5 (Chang & Huang, 2006; Delavar, 2007; Moharram Nejad, 2012). It means that there are not enough internal strengths and opportunities to protect the Mangrove forest, since the threats such as

climate change, oil pollution and risk of tsunami were more powerful. However, the list of strengths and opportunities showed that there were potentials to act on.

As it was explained in the methodology, the researchers used the scores from IFE and EFE in an IE matrix (Figure 6.1). The point in this matrix referred to the third region which belong to the strategies of "harvest or divest". It indicated that a change in policies has to be decided. The result from this matrix was used by the researchers in pair matching of the strategies, trying to focus on strategies of change – more or less moving from the existing top-down planning to a bottom-up planning. Most of the positive factors (in particular strengths and some of the opportunities) referred to the involvement of local people.
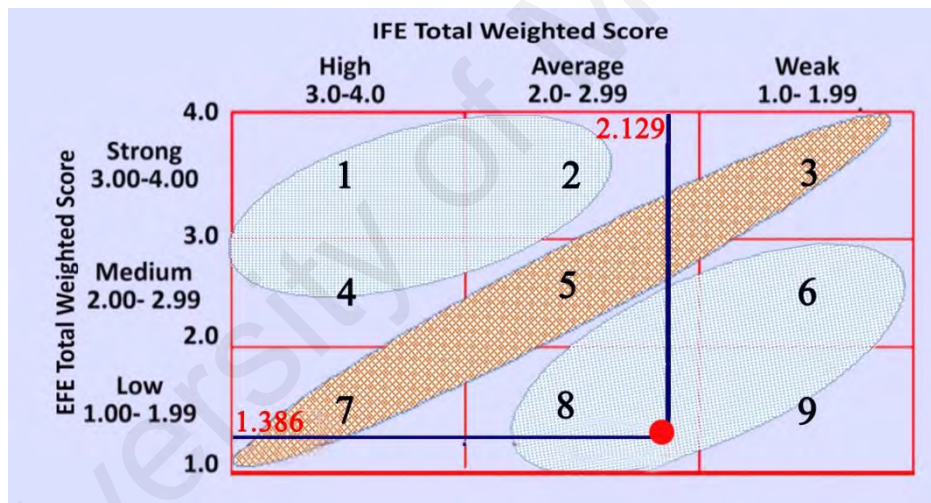
Figure 6.1: IE matrix-The Matang Mangrove Forest Reserve

Datta et al. (2012) in their paper on community-based mangrove management refer to the issue of local mobilization and social components of the communities living near mangrove forests and mention that there are various social elements that affect the mangrove forest management. Indicators such as the interest of the community in participating in management, women's participation, and the level of people mobilization and issues such as social capital and quality of life are important and have to be considered. Menawhile, due to the uniqueness of these forests (as ecotone zone), there

are various cultural patterns among local communities and therefore, this forest is regarded as a special identity among people, and therefore, there is more possibility for the people to conserve this ecosystem (Datta et al., 2012). The strengths and opportunities in the present research prove that people are much interested to be involved in community-based management and therefore, this is a great chance for the government to change their policies regarding the Matang Mangrove Forest.

6.2.2. Strategies

These strategies can be categorized in three groups: (a) strategies focused on protective measures such as those related with the use of wood (St3, St5, St9, St10, St14), fishing (St13, St16), migratory birds (St4), erosion (St7), and tsunami (St8, St15); (b) the second group consisting of two strategies on sustainable ways of using mangrove forest that promotes alternative livelihoods (St11) and ecotourism (St2); (c) there are two strategies regarding awareness raising that refer to the strategy for information sharing (St1), increase of knowledge among locals (St6) and education (St12). The strategies can also be divided based on involvement of various stakeholders (local people, local groups, the Forestry Department, the government, Malaysian universities, non-governmental organizations and the International agencies). As the whole SWOT process started with local people, they are involved in most of the strategies. There are two strategies that propose the establishment of a community group for conservation of mangrove forest (St5 and St8).

Results at this stage prove an approach based on stakeholders' involvement has to be applied in any future planning for Matang. In this approach, various stakeholders can be involved while the local people living around the Matang Reserve play a major role; the government, especially the local government as well as the local Forestry Department can work hand in hand with local people. A series of mobilization activities are needed with

an aim to establish one local group from among interested people. This is while Malaysian universities and non-governmental organizations can be involved and fill the gap of academic research for conservation of mangrove as well as involvement in alternative livelihood and training of people for eco-tourism in the Matang. International agencies such as United Nations (GEF/SGP) can be involved as supportive bodies in such community-based endeavour.

In fact, these strategies emphasis on the application of a multi-stakeholder approach in mangrove forest management. While the involvement of communities living around the forest is necessary, especially in designing and implementation as recommended by Getzner and Islam (2013) in their research on the Sundarbans Reserved Forest in Bangladesh, the other stakeholders can play major role in strategy development, fund-raising, conservation activities, research, and other related tasks and responsibilities. Agrawal et al. (2011) recommend that interests and capacities of various partner have to be planned in a way that they complete each other. Therefore, it is necessary when the forest plan is being prepared, a balance can be kept between various stakeholders in terms of their interests, responsibilities and returns. For instance, the results of the research by Ha et al. (2014) in Mekong Delta proves there is an imbalance between the two major actors of the mangrove forest management: state forest companies and farmers in terms of their powers, income and access to markets.

A review of the whole sixteen strategies show that, all in all, they are helpful for generating a community-based planning for management of the Matang Mangrove Forest Management. In the Matang Working Plan, there is no reference to community-based conservation while there are defined zoning based on the plan with a productive forest (for timber and charcoal production) and a non-productive forest for the purpose of biodiversity conservation, and of course, the local community's needs have been considered (Azhar & Nik, 2003).

6.2.3. Prioritized strategies

The first priority strategy is the knowledge sharing about Mangrove among stakeholders. An approach of stakeholders' involvement could be applied since any change in the management plan of the forest requires all involved groups to come together and find out how they can contribute. Seemingly, such knowledge sharing can be helpful since while the locals are much interested to know more (S14) and share knowledge (S10, S11 and S15) while there have been specific research activities by universities on various fauna and flora species, and the local Forestry Department has been involved in management of the forest since long time ago.

The next priority strategy referred to the participation of the local people in projects carried out by the international agencies and researchers to conserve the migratory birds as a one of the most important wildlife in the Matang mangrove forest. As Matang is a wintering site for migratory birds, the third strategy encouraged local people to be trained as tour guides, especially for bird watchers. There are certain tour guides in the area, however, it could be institutionalized as a livelihood while there is a relationship between this strategy and the fifth one regarding the formation of local groups. These local groups could be both protection groups for mangrove and the wildlife while they can be involved in eco-tourism. The fourth strategy was to decrease the amount of harvesting by local people to control the tsunami effects. This may need a series of local mobilization activities so that the people themselves decide to change their behaviour and decrease logging. It is important to mention here that Goessens et al. (2014) in the conclusion of their research have referred to this point that a social survey is needed among other things about local cutters to see if the forest is rejuvenating in a sustainable way. Atheull et al. (2009) in a research in Cameron, show that local communities living around the Wouri estuary and the Douala-Edea reserve depend on mangrove forest in two ways: subsistence and commercial needs. Logs are sold in wood markets while they are commonly used as

fuel. That why the researchers recommend small-scale plans for mangrove reforestation and afforestation while there is a need for law enforcement and awareness raising. More than others, these are the local people who should understand the importance of mangrove forest, and therefore, awareness raising among loggers seems to be highly necessary.

6.3. Discussion on Carrey Island Case

6.3.1. Factors

Internal and external factors were listed through interviews with the experts of the Mangrove Research Centre (MRC) as well as local villagers in the Carey Island and based on the results of 312 questionnaires. These factors are examined with an aim to have a better overview of them.

All strengths are about the local people. A closer look at the list of strengths reveal that they are telling us a story: The local people like to conserve mangrove forest (S5) and for that they would like to work in groups (S6); they harvest cautiously (S8, S9) and they select the trees that are matured enough (S14); they do not use mangroves for medical purposes (S4); there are interested young people (S7) while there are people who are familiar with the forest (S1, S2) and are aware of migratory birds (S3); there are active women who members of a local group (S13), they produce handicrafts in their workshops (S11) and are able to sell them (S12). They are ready to share their knowledge (S10).

Respondents have referred to eight weaknesses. The villagers harvest Mangrove for wood, fire, fishing and hobbies (W1), and also they use it for producing handicrafts (W2) while they do irregular fishing and harvesting (W8). Some villagers do not want to be in a group for conservation of Mangrove forest (W7) and they have not shared their knowledge with others (W3). In fact, the local people have no formal level of education (W5). Regarding ecotourism, the local people have no idea about what time tourists come

to their village for visiting Mangrove forest (W6) and they do not have accommodation facilities in their village (W4).

There are certain disparities between the strengths and the weaknesses. For instance, while they like to share their knowledge (S10), they have not shared the knowledge by now (W3). Also, while there are people who are not interested to be in a group to conserve mangroves, there are others who would like to work in groups (S6). This shows that these weaknesses can change into a strength if an appropriate strategy can be adopted.

There are nine opportunities for the mangrove forest in the Carey Island. These opportunities are offered by the tourists (O1, O5, O6), University of Malaya (O2), the Government (O4), International agencies (O7), Mangrove Research Center (O8) and academic researchers (O9). Here, in this model of planning, these opportunities should help the local people to be more involved in conservation and find practical solutions for their livelihood needs. The threats are about the tourists who do not share their knowledge with the local people (T1), and issue of palm oil plantation managed by Sime Darby (T2) and the existence of highways and bridges in the forest (T3), risk of the tsunami (T4), oil pollution from ships (T5) and the climate change (T6). Some of the threats are challenging such as the case of tourists that can change into an opportunity if an appropriate strategy is adopted. Some of the strategies such tsunami or the climate change need actions by the government at national level. Others need suitable strategies by various stakeholders such as the oil pollution from ships or the issue of palm oil plantation.

These factors represented as input information for SWOT matrix. Based on the internal factors, IFE matrix was formulated and the result is 1.729. Also EFE was calculated as 1.226 and a review of the IFE and EFE for participatory mangrove
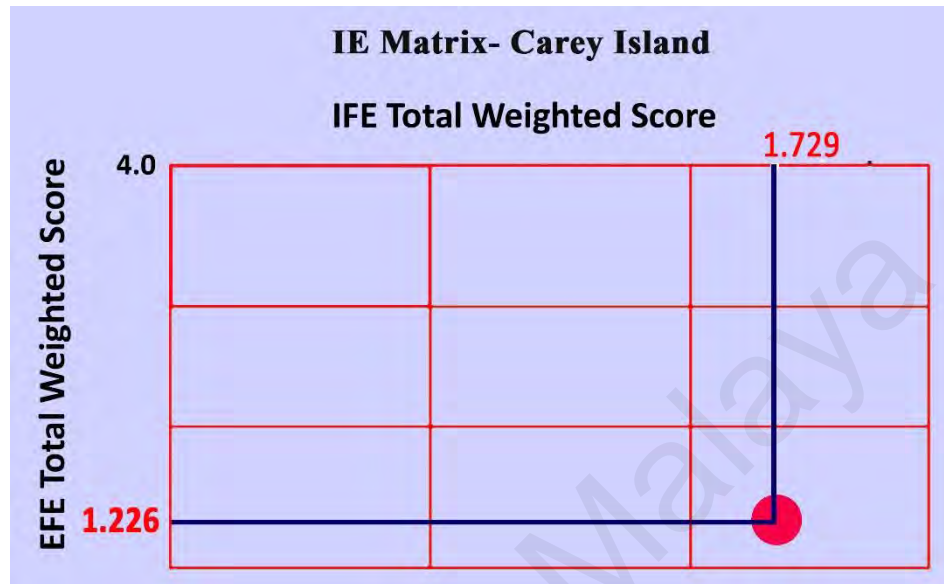

Figure 6.2: IE matrix-The Carey Island

management in the Carey Island, reveals that weaknesses dominate strengths (since IFE is less than 2.5) and threats dominate opportunities since EFE is less than 2.5 (Chang & Huang, 2006; Delavar, 2007; Moharram Nejad, 2012). It shows that in the Carey Island the potentials were not enough to conserve the Mangrove forest, however the threats such as oil pollution, climate change, the highway and the bridge and the palm plantation were more powerful.

6.3.2. Strategies

At this phase based on a comparison of the internal and external factors, the SWOT matrix was shaped to generate strategies and sixteen strategies (St) were proposed as follow.

St1. The local people, tourists and academic researchers can share their knowledge on Mangrove in Malaysia.

St2. The local people can be involved as tour guides (general and professional).

176

St3. UM researcher, MRC and IA can employ the local people as volunteers in their projects and academic research for conserving of the Mangrove forest.

St4. The local people can collaborate and participate with IA and researchers to protect the migratory birds in the Heritage Island.

St5. Increase the WAG's knowledge and awareness about Mangrove Forest and its role to educate local people to protect the environment through holding a workshop by UM, MRC and IA.

St6. Increase awareness of the local people and tourists about conserving of Mangrove through the local celebration called "Hari Muyang".

St7. UM in cooperation with MRC and IA can increase the local people knowledge about mangrove through holding workshops.

St8. Local groups can do some activities to protect the Mangrove Forest to control any possible tsunami disaster.

St9. Control the oil pollution from the ships by the GOV and related Organization.

St10. Reduce the amount of Mangrove wood used by the local people.

St11. Change the livelihood of the villagers to use the natural resources in the Carey Island in a sustainable way by NGOs, GOV, SD, MRC and IA.

St12. Holding an exhibition in the Carey Island for selling handicrafts and fundraising to conserve the environment.

St13. Support the local people who are interested to continue their education by UM, SD, IA and GOV.

St14. Inform the local people about the negative effects of irregular fishing on the environment.

St15. Decrease the amount of harvesting to control the tsunami disaster.

St16. Decrease the amount of irregular fishing.

A closer look at the strategies, reveals that they are about "conservation of mangroves", "ecotourism", "local economy and livelihoods", "awareness raising, knowledge sharing and education", "oil pollution", "tsunami effects", "fishing", "harvesting" and "migratory birds". While in all strategies local people have a major role, the issue of "conservation of mangroves" is more important. It repeats in various strategies (St3, St4, St8, St9, St10, St11, St12, St16), and it can be realized through various activities: research activities for conservation of mangroves (St3); protection of migratory birds (St4); protect mangroves against tsunami (St8); decreasing irregular fishing (St16) and protection against oil pollution (St9); change in livelihoods (St11 and St12); and through reducing the wood used by locals (St10). In fact, local people have depicted the various aspects of conservation of mangrove forests in the Carey Island.

The strategies can be categorized in four groups: a) the strategies referring to conservation of mangrove forests (St3, St4, St8, St9, St10, St11, St12, St16); b) the strategies referring to sustainable livelihood and sustainable use of forest (St2. St4, St6, St9, St10, St11, St12, St14, St15, St16); and c) the strategies on protection against tsunami (St8, St15); and d) the strategies on knowledge sharing, awareness raising and education (St1, St5, St6, St7, St13 and St14).

The resulted strategies can also be divided, in a different way, according to the involvement of various stakeholders: local people; local groups; women's active group in Sungai Bum Bun; international agencies; the government, Malaysian universities especially UM; non-governmental organizations; Sime Darby; tourists; Mangrove Research Centre; and academic researchers. It shows that an involvement of various stakeholders is a pre-condition for any planning for conservation of mangroves in the Carey Island. Any stakeholder may play a different role, however if they can come together and define common vision for the area and a participatory planning can be

organized, the solutions for a better conserved area, based on the existing capacities and potentials among stakeholders, can be suggested. An approach of multi-stakeholder involvement is discussed above in studying the strategies of the Matang Forest. Various researchers have shown such requirement in designing forest plans as well as in implementation phase (Ha et al., 2014; Getzner and Islam, 2013; Agrawal et al., 2011).

Meanwhile, in fourteen strategies out of sixteen, there is a reference to the role or capacity of local communities. With their involvement, the impact of the forest management would be more sustainable. Erftemeijer and Bualuang (2002) in their examination of a project of local involvement from three villages in mangrove forest management in Pattani Bay in Thailand with an aim restore a degraded area emphasize on local ownership that lead to sustainable impacts in mangrove rehabilitation and conservation. Adeel and Pomeroy (2002) in their study of the coastal habitats at risk in various countries in East and Southeast Asia emphasize on policies involving participatory approaches.

6.3.3. Prioritized Strategies

To start discussion, the first important strategy is about knowledge sharing on Mangrove. It seems this strategy can contribute to the protection of environment by locals and tourists, since they have to be aware of the knowledge produced by the researchers. The second important strategy refers to the involvement of the locals as volunteers in research and academic activities. The third strategy to follow is about the training of local people to increase their knowledge about mangrove (that could be done by UM in cooperation with MRC and IA); in fact, if the people know more about the importance of mangrove and their habitat, then there will be more possibility that they may change their behaviour. Moreover, based on existing local knowledge on birds, local people can be

involved as tour guides (general or professional); and that will be appropriate enough to pave the way for people to have more tenure on the Carey Island and its environment.

In fact, these strategies confirm that people have to feel that they are the real owners of mangrove. In other words, the local villagers must consider mangrove forest an exclusive natural resource of the Carey Island, which belongs to the next generation as well. There are various research studies on the issue of ownership. While there are management plans that give the local people the right to use, there are others that recognize the ownership by local people. For instance, Ha et al. (2012) in a research in Vietnam, conclude that if mangrove forests are managed by farmers with full rights, responsibility and benefits over forest products, then the forests are well conserved. As Ha et al. (2014) show, the new legal framework in Vietnam recognize the ownership of local communities in protection and use of forests, it does not refer to the right of ownership. In fact, such ownership is not only a feeling by local communities. Institutional arrangement and polices are required to define such rights of ownership. As Pagdee et al. (2006) mention in their research on successful community forest management, forest users without defined rights of ownership may be involved in overuse of forest products or even it may lead in local conflicts.

6.4. Comparison of priority strategies

The aim of the study is not to compare the two cases. This part has been done with an aim to have a deeper knowledge about the two cases. Table 6.1 shows a comparison of the priority strategies for both cases. For the Carey Island Mangrove Forest, there are four strategies and for the Matang Forest, there are five strategies. In both cases, the first strategy is about sharing knowledge. It seems that various stakeholders are not working together to create a common pool of knowledge. The knowledge, if shared, can help the local people as well as the tourists and the academia to behave the forest in a more

sustainable way. It seems the Carey Island needs more academic research and if people at local level are involved as volunteers, it can be helpful not only for the local people, but also for the academia to have facts in hand to move forward. However, the second priority strategy for Matang is about the involvement of local people as tour guides. Of course, both forests receive tourists. For Matang, to be guide, can be a livelihood alternative which is more in line with conservation of the forest. The third priority strategy in the Carey Island is about increasing the knowledge of local people while in Matang, it refers to a collaboration between various stakeholders to conserve the migratory birds. The last priority strategy in the Carey Island is about the involvement of locals as tour guides, the same as the second priority strategy in Matang. However, the last two priority strategies in Matang are about a group to protect the Mangrove Forest (institutionalizing the protection in civil society) and decreasing the amount of harvesting for controlling the tsunami disaster.

There are three common strategies: sharing knowledge; involvement of local people in tourism and conservation (in the Carey Island through research and in the Matang Forest through forming a group). While Matang has two other major issues: migratory birds and decreasing the amount of harvesting by locals and the Carey Island has only one different strategy of increasing the local knowledge. These aspects also reveal that the working plan for Matang should have effective socio-economic components.

Table 6.1: Comparison of the strategies for the Matang Mangrove Forest and the Carey Island

Carey Island	Matang
St1. The Local people, tourists and academic researchers can share their knowledge on Mangrove in Malaysia	**St1.** The Local people, tourists and academic researchers can share their knowledge on Mangrove in Malaysia
St3. UM researcher, MRC and IA can employ the local people as volunteer in their projects and academic research for conserving of the Mangrove Forest	**St2.** The Local people can be involved as tour guides (general and professional)
St7. UM in cooperation with MRC and IA can increase the local people knowledge about mangrove through holding workshops	**St4.** The local people can collaborate and participate with IA and researchers to protect the migratory birds in the Matang Mangrove Forest
St2. The Local people can be involved as tour guides (general and professional)	**St5.** Help and educate villagers to make a group to protect the Mangrove Forest
	St15. Decrease the amount of harvesting to control the tsunami disaster

One major issue in these two cases is the community organizations. In both cases, there are local organizations, however, they are not involved in any activity regarding mangrove management. In a paper, Tavorn et al. (2013) have done a research on the establishment of community organizations and their involvement in mangrove forest management in Thailand. They have recognized two kinds of organizations: direct groups involved in managing activities, and indirect ones that help the management of the forest in an indirect way. It seems that the organizations in these two cases can be involved

indirectly in mangrove forest management by the time there is not a place for them to involve.

In another paper, Webb and Sudtongkong (2008) have carried out a comparison between the forests managed by the State and those of communities in Thailand. They have concluded the management system is more sustainable in communities. The reasons for such sustainability are mostly due to the connection between local livelihood and the resources, and the involvement of local people in decision-making, the high level of social capital, defined user groups, monitoring activities, and an effective leadership (more or less for conflict resolution), and the assistance from external NGOs (Webb & Sudtongkong, 2008). This also shows that a series of social mobilization has to be done in both cases if they are going to be involved in mangrove forest management. The preparedness of people is a major requirement for community involvement. Also, Erftemeijer and Bualuang (2002) presented a three-year project in which the local ownership has led to sustainable impacts in mangrove rehabilitation and conservation. They have also referred to capacity-building as a needed process for the involvement of the local people. Again, it seems this is also required to be planned in the two selected cases in the present research.

6.5. Summary

The chapter starts with certain general information about the Matang Mangrove Forest and the Carey Island Mangrove Forest. The two cases were then examined through studying the internal and external factors, the resulted strategies by SWOT pair-wise matching and the prioritized strategies through QSPM. The chapter ends with certain comparisons between the two cases in terms of priority strategies.

CHAPTER 7: CONCLUSION

7.1. Introduction

Four priority strategies for the Carey Island Mangrove Forest and five priority strategies for the Matang Mangrove Forests Reserve prove that participation of people in management of forests has to be highly considered. Without people, a sustainable conservation cannot be realized. The four key questions of the research that were raised in the first chapter of the research are focused on participation of people in coastline communities who are living close to mangrove forests in Malaysia. These questions have been raised with an aim to find out a method of planning in which people can participate and as a result, they will be involved in conservation of the mangrove forests. The four questions were:

1. Have the people who are living in coastline communities been involved in participatory environmental management of mangrove ecosystem in the Carey Island and the Matang Mangrove Forest?

2. What are the opportunities, threats, strengths and weaknesses in communities around Mangrove forest regarding conservation of this habitat?

3. Is there any bottom-up approach for formulation of projects carried on these habitats?

4. What would be possible management strategies for that selected area?

As conclusion, it was found out that the people in coastline communities are not involved in participatory management of mangrove forests in the Carey Island and the Matang Mangrove Forest. The opportunities, threats, strengths and weaknesses were listed using a participatory methodology. SWOT and QSPM was introduced as a method for formulation of strategies for any project that can be designed for conservation of these two forests, and as the answer to the final question, four priority strategies for the Carey Island Mangrove forest and five priority strategies for the Matang Mangrove forest were

determined. While, the questions were responded during the research, a deeper understanding of the participatory management is required to be presented here.

7.2. Participatory management

Participatory management is not a new managerial approach in conservation of the forests in the world. Various studies are available on participatory management of forests, especially in mangrove management. For instance, Ha et al. (2014) show how livelihood improvement in mangrove-shrimp farming in four communities in two provinces of Ca Mau and Bac Lieu in Vietnam is related to the mangrove conservation. The researcher proves that while aquaculture can be income-generating, mangrove management can be necessary at the same time and harvesting can maximize the income and therefore farmers have to conserve the mangrove forest and as a result a win-win strategy is followed. In both cases of Matang and the Carey Island studied in the present research, no strategy of involving local people in forest management has been followed up. A close look into the factors of weaknesses reveals in both selected areas of the research (see table 7.1) people are not involved, or not aware and do whatever they can do without any plan while they are harvesting the forest or doing aquaculture. Experiences of participatory management of mangrove forests in other countries such as Vietnam (Dat & Yoshino, 2013; Ha et al., 2014; Ha et al., 2012; Nguyen, 2014), Thailand (Erftemeijer & Bualuang, 2002; Tavorn et al., 2013; Webb & Sudtongkong, 2008), Bangladesh (Getzner & Islam, 2013; Iftekhar & Islam, 2004; Islam & Wahab, 2005; Jashimuddin & Inoue, 2012) and Pakistan (Amjad et al., 2007; Memon, 2012) prove that the approach can be regarded as a sustainable model for mangrove management and conservation.

Table 7.1: Factors of weaknesses in SWOT of the two cases

Weaknesses in	Matang	Carey Island
Knowledge	Some of the local people did not know about the Mangrove Forest	The local people have no idea about what time tourists come to their village for visiting Mangrove forest.
	The local people did not share their knowledge with others	The local people have not shared their knowledge with others.
	The villagers didn't know about Matang which has the best plan for conserve the Mangrove in the world	The local people have no formal level of education.
	The local people are not familiar with the Forestry House in Matang	
	The villagers are not familiar with bird watchers	
	The local people are not interested to share their knowledge about birds with others	
	The villagers have no idea about the high season for bird watching	
	The local people did not know about the wildlife in Matang	

Management Plan	The villagers are fishing and harvesting anywhere from the Mangrove	The local people do irregular fishing and harvesting
	Selling is the most purpose of harvesting for villagers	The local people use Mangrove for making handicrafts.
	The villagers use the Mangrove wood for fuel	The villagers harvest Mangrove for wood, fire, fishing and hobbies.
	The local people do irregular harvesting	
	The local people do harvesting near the Mangrove Forest	
	The villagers' life is related to the Mangrove Forest	
Group activities for conservation	Some villagers do not want to be in a group for conservation of the Mangrove Forest.	Some villagers do not want to be in a group for conservation of Mangrove forest.
Charcoal factories	The mere existence of charcoal factories	
Access to facilities for tourists		The villagers have no accommodation facilities in their village.

In participatory models, people have access to a plan and use the forest or the shrimp (or aquaculture) according to a plan – while they know that they have to conserve the

area. Their involvement in forest management helps them to have regular income from the forest, while they are responsible for forest conservation. That is why that a clear policy is needed for forest management in which rights, responsibilities and benefit-sharing are defined and it can contribute to the successful mangrove conservation, as it has been shown by Nguyen (2014). Nguyen (2014) in a study on coastal mangrove forest in Vietnam mentions that clear policies are required for local participation in sustainable mangrove management. As IE Matrices for both Matang and the Carey Island indicate that a change of policy is needed. It is important to bear in mind that the Malaysian National Policy on the Environment (2002) and the Malaysia National Policy on Climate Change (2009) encourage "effective participation" however, it seems such policies or the related regulations have to define exactly how the State deals with the issues of rights, responsibilities and benefits in mangrove forest management.

Through literature review in the chapter two, it was found out that in many countries, for protection of forests and mangroves, focus has changed from the ecological view to participatory management. Benefits from the latter approach have been shown and conservation has been more effective. Even though Malaysia has a strong governmental structure in the region and has the best managed mangrove forests (Matang) in the world, but unfortunately no study has been conducted on participatory mangrove management. Therefore, to achieve sustainable development for managing mangrove forests, participatory methods must be implemented which could make the local participants the best protector of these forests.

7.3. IFE, EFE and IE matrix

For both cases, IFE and EFE have been less than 2.5 which means weaknesses override strengths and threats supersede opportunities from participatory management approach (see the below table).

Table 7.2: Results of IEF and EFE for the Carey Island and the Matang Mangrove Forests

	IFE	EFE
The Carey Island case	1.729	1.226
The Matang case	2.129	1.386

This could be very important since it helps us to understand the existing situation of the two cases. Communities' participation can be helpful in decreasing the weaknesses and minimizing the threats. Any possible management plan in future has to take the advantage of the strengths as well as the opportunities.

Also, based on IE Matrices for both cases, the points are referring to the third region of the matrix which means a strategy of "harvest or divest" is required to be followed, and therefore, there is a need for a policy change in management of Mangrove forests in the two cases. Since most of the positive factors (in particular strengths and some of the opportunities) referred to the involvement of local people, and based on the priority strategies, the future planning could be based on a bottom-up approach where local people and other stakeholders would play a major role.

7.4. QSPM

QSPM as the final part of the research methodology helped the researcher to evaluate the strategies and to prioritize them. In Matang, according to the results, the priority strategies highlight the role of people's participation in conservation of the Mangrove forests. This is clear in the results gained from the questionnaires however there is no place for local communities in decision-making processes for the Matang forest while the Malaysian National Policy on the Environment (2002) encourages "effective participation". The priority strategies show that local people's role in conservation is necessary and serious. An approach of stakeholders' involvement, as Siry (2006) has

emphasized, can be applied in any future planning for the Matang forest. Local people living around the Reserve, the local government, the local Forestry Department, forestry departments in Malaysian universities, and environmental non-governmental organizations can be among the major stakeholders.

The awareness of the people regarding conservation has to be considered in management policies. As Jusoff and Taha (2008) showed, awareness of people is a major factor and as it is clear from the priority strategy for Matang (St.1. regarding knowledge sharing among local people, researchers and tourists), people who know more, will participate deeply in the process of knowledge sharing. Therefore, training of local people and their empowerment and mobilization can lead into a more highlighted role not only in knowledge sharing but also in forest management and decision-making especially on issues of conservation of the forest, eco-tourism, use of wood, fishing, protection of migratory birds and bird watching activities, erosion and Tsunami.

In the case of the Carey Island Mangrove Forest, according to the results of this study, irregular fishing and harvesting by local people, lack of formal education among villagers, palm oil plantation, oil pollution and climate change are among the weaknesses and threats. For the protection of the mangrove forests and inhibition of deforestation in Malaysia, especially in the Carey Island, an effective and comprehensive method that gives attention to the particular contribution of stakeholders should be followed.

Based on the analysis of the strengths, weaknesses, opportunities and threats, sixteen management strategies were planned among which all four "important" strategies were related to capacity building and involvement and participation of stakeholders in the process of the conservation of the mangrove forest. This study clarifies that mangrove forest management in Malaysia requires a participatory approach in a way that not only the amount of using of mangrove would be sustainably controlled, but stakeholders,

especially local villagers and groups, will be simultaneously empowered and take concern of the conservation of their habitat and its biodiversity in a sustainable way.

7.5. Contribution of the study

Two important contributions of the study are the two sets of priority strategies that have been designated for the Matang Mangrove Forests Reserve and the Carey Island Mangrove Forest. In fact, the related governmental bodies can consider and decide for a change in planning in future, and the present model and methodology can be useful for them. In fact, the results of this research could be helpful for the next working plan of the Matang Mangrove Forest Reserve (i.e. 2020–2029). In case of the Carey Island, the results of the research could be used by the research centres that have projects of mangrove conservation or even rehabilitation in that area.

7.6. Limitations and future studies

The present research focuses on the participation of local people in the management of two mangrove forests, and uses a participatory managerial tool with an aim to design priority strategies. Therefore, it is not a research on the ecological aspects of mangrove forests. Meanwhile, it does not study the effects of the present working plan in the Matang Mangrove Forests Reserve or the impact of the research projects in the Carey Island. However, for a comprehensive research, it is necessary to depict the impact of the existing plans and projects, especially on the life of the people who live in coastlines close to the mangrove forests. Meanwhile, it is recommended that new sections can be added to the working plans on economic and social status of the people who are in relationship with the forests. If the planners consider people as a major stakeholder in the process of planning, implementation and evaluation, therefore, certain tools such SWOT and QSPM could be helpful to apply with an aim to be certain that people are participating in the process.

7.7. Summary

In summary, it was found that in the Matang Mangrove Forests Reserve, according to the results, the priority strategies highlight the role of people's participation in conservation of the Mangrove forests. For the Carey Island, this study clarifies that mangrove forest management in Malaysia requires a participatory approach in a way that not only the amount of using of mangrove would be sustainably controlled, but stakeholders, especially local villagers and groups, will be simultaneously empowered and take concern of the conservation of their habitat and its biodiversity in a sustainable way.

REFERENCES

Adeel, Z., & Pomeroy, R. (2002). Assessment and management of mangrove ecosystems in developing countries. *Trees - Structure and Function, 16*(2), 235-238.

Affandi, N. A. M., Kamali, B., Rozainah, M. Z., Tamin, N. M., & Hashim, R. (2010). Early growth and survival of *Avicennia alba* seedlings under excessive sedimentation. *Scientific Research and Essays, 5*(18), 2801-2805.

Agrawal, A., Nepstad, D., & Chhatre, A. (2011). Reducing emissions from deforestation and forest degradation. *Annual Review of Environment and Resources*, *36*, 373-396.

Ahmad, S. (2009). Recreational values of mangrove forest in Larut Matang, Perak. *Journal of Tropical Forest Science, 21*(2), 81-87.

Ali Ahmadi, A. (2007). *A comprehensive attitude towards strategic management* (10th Ed), in cooperation with Mehdi Fathollah, and Iraj Tajeddin. Tehran: Knowledge Production Publication (Entesharat Toolid-e Danesh).

Ali, T., Ahmad, M., Shahbaz, B., & Suleri, A. (2007). Impact of participatory forest management on financial assets of rural communities in Northwest Pakistan. *Ecological Economics, 63*(2–3), 588-593.

Almasi, M. (2010). *Formulation of management strategy for Persian wild ass (Equus hemionus onager) in Touran Biosphere Reserve.* (unpublished master thesis), Islamic Azad University, Science and Research Campus Tehran.

Almasi, M., Pakzadmanesh, P., & Ameri, M. A. (2011). Formulation of management strategy for Persian wild ass (*Equus hemionus onager*) in Touran Biosphere Reserve. *Proceedings of International Conference on Environmental Aspects of Bangladesh*, (p. 60) Fukuoka, Japan.

Alongi, D. M. (2002). Present state and future of the world's mangrove forests. *Environmental Conservation, 29*(03), 331-349.

Altomare, A., Cascarano, G., Giacovazzo, C., & Viterbo, D. (1991). E-map improvement in direct procedures. *Acta Crystallographica Section A: Foundations of Crystallography, 47*(6), 744-748.

Amanor, K. S. (2004). *Natural and cultural assets and participatory forest management in West Africa*. Paper presented at the International Conference on Natural Assets, Tagaytay City, The Philippines.

Amir, A. A. (2012). Canopy gaps and the natural regeneration of Matang mangroves. *Forest Ecology and Management, 269*(0), 60-67.

Amjad, R., Shah, A., & Jusoff, K. (2007). Mangrove conservation through community participation in Pakistan: The case of Sonmiani Bay. *In The 5th WSEAS International Conference on Environment, Ecosystems and Development (EED'07)*, Puerto De La Cruz, Tenerife, Canary Islands, Spain.

Ananda, J., & Herath, G. (2009). A critical review of multi-criteria decision making methods with special reference to forest management and planning. *Ecological Economics, 68(10),* 2535-2548.

Ashton, E., Hogarth, P., & Ormond, R. (1999). Breakdown of mangrove leaf litter in a managed mangrove forest in Peninsular Malaysia. *Hydrobiologia, 413*, 77-88.

Atheull, A. N., Din, N., Longonje, S. N., Koedam, N., & Dahdouh-Guebas, F. (2009). Commercial activities and subsistence utilization of mangrove forests around the Wouri estuary and the Douala-Edea reserve (Cameroon). *Journal of Ethnobiology and Ethnomedicine*, *5*(1), 35.

Azhar, M., & Nik, M. S. (2003). *A working plan for the Matang Mangrove Forest Reserves, Perak: The third 10-years period (2000-2009) of the second rotation.*, State Forestry Department of Perak Darul Ridzuan.

Baby, S. (2013). AHP modeling for multicriteria decision-making and to optimise strategies for protecting coastal landscape resources. *International Journal of Innovation*, *4* (2), 218-227.

Bandaranayake, W. M. (1998). Traditional and medicinal uses of mangroves. *Mangroves and Salt Marshes, 2*(3), 133-148.

Butarbutar, R. R., Purnomo, M., Hakim, L., & Rochdjatun, S. (2014). Strategic development of nature tourism based on plant species at the Mahawu mountainous region, North Sulawesi, Indonesia. *Journal of Biodiversity and Environmental Sciences (JBES), 5*(5), 241-252.

Casagrande, J., Pike, M., & Smith, P. (1978). An improved approximate formula for calculating sample sizes for comparing two binomial distributions. *Biometrics, 34*(3), 483-486.

Chang, H.-H., & Huang, W.-C. (2006). Application of a quantification SWOT analytical method. *Mathematical and Computer Modelling, 43*(1), 158-169.

Chong, V. C. (2006). Sustainable utilization and management of Mangrove ecosystems of Malaysia. *Aquatic Ecosystem Health & Management, 9*(2), 249-260.

Choudhury, J. K. (1997). Sustainable management of coastal mangrove forest development and social needs *Proceedings of the XI World Forestry Congress*, *6*, 267-284. Rome: Food and Agriculture Organization of the United Nations.

Chowdhury, A. J. K. (2008). Seasonal bed sediment characteristics of the Kuala Sepetang river, Perak. *Sains Malaysiana, 37*(2), 143-147.

Đào, T. H., Nguyễn, M. H., & Phạm, T. T. V. (2002). *Báo Cáo Tư Vấn Xác Định Các Vấn Đề Bảo Tồn Từ Đồng Bào Dân Tộc Thiểu Số Và Phụ Nữ*: Strengthening Protected Area Management in Vietnam Project.

Dat, P. T., & Yoshino, K. (2013). Comparing mangrove forest management in Hai Phong City, Vietnam towards sustainable aquaculture. *Procedia Environmental Sciences, 17*(0), 109-118.

Datta, D., Chattopadhyay, R., & Guha, P. (2012). Community based mangrove management: A review on status and sustainability. *Journal of Environmental Management, 107*, 84-95.

David, M. E., David, F. R., & David, F. R. (2009). The quantitative strategic planning matrix (QSPM) applied to a retail computer store. *The Coastal Business Journal, 8*(1), 42-52.

Delavar, M. A. (2007). *Research and methodology*. Tehran: Nashre Virayesh.

Dilmaghani, Y. (2010). *Codification of mangrove forests management strategies (case study: Hara protected area-Iran)* (unpublished master thesis), Islamic Azad University, Tehran, Iran.

Dilmaghani, Y., Danehkar, A., Jozi, S. A., & Arjomandi, R. (2011). Codification of mangrove forests management strategies: Case study of Hara Protected Area, Iran. *Journal of Food Agriculture & Environment, 9*(2), 508-513.

Dwivedi, P., & Alavalapati, J. R. (2009). Stakeholders' perceptions on forest biomass-based bioenergy development in the southern US. *Energy Policy, 37*(5), 1999-2007.

Erftemeijer, P. L. A., & Bualuang, A. (2002). Participation of local communities in mangrove forest rehabilitation in Pattai Bay, Thailand: Learning from successes and failures. In M. Gawler (Ed.), *Strategies for wise use of wetlands: Best practices in participatory management: Proceedings of a Workshop on conservation strategies for migratory water birds held at the 2nd International Conference on Wetlands and Development (November 1998, Dakar, Senegal)* (pp. 27-36). Wageningen, the Netherlands: IUCN.

FAO. (1994). FAO Forestry Paper 117 *Mangrove forest management guidelines*. Rome, Italy: Food And Agriculture Organization Of The United Nations.

FAO. (1997). *Participation in practice lessons from the FAO people's participation programme.* Retrieved on May 2012 from http://www.fao.org/sd/PPdirect//PPre0044.htm

Getzner, M., & Islam, M. S. (2013). Natural resources, livelihoods, and reserve management: a case study from Sundarbans mangrove forests, Bangladesh. *International Journal of Sustainable Development and Planning, 8*(1), 75-87.

Ghasemi, S., Zakaria, M., Hazandy, A.-H., Ebil, Y., Danehkar, A., & Muhammad, N. R. (2010). A review of mangrove value and conservation strategy by local communities in Hormozgan province, Iran. *Journal of American Science, 6*(10), 329-338.

Gilmour, D., Malla, Y., & Nurse, M. (2004). *Linkages between community forestry and poverty.* Bangkok,Thailand. Regional Community Forestry Center for Asia and the Pacific, Kasetsart University.

Goessens, A., Satyanarayana, B., Van der Stocken, T., Zuniga, M. Q., Mohd-Lokman, H., Sulong, I., & Dahdouh-Guebas, F. (2014). Is Matang Mangrove Forest in Malaysia sustainably rejuvenating after more than a century of conservation and harvesting management? *PLOS ONE, 9*(8), e105069.

Guiang, E. S., Borlagdan, S. B., & Pulhin, J. M. (2001). Community-based forest management in the Philippines: A preliminary assessment. *Project Report. Quezon City: Institute of Philippine Culture, Ateneo de Manila University*.

Ha, T. T. P., van Dijk, H., & Visser, L. (2014). Impacts of changes in mangrove forest management practices on forest accessibility and livelihood: A case study in mangrove-shrimp farming system in Ca Mau Province, Mekong Delta, Vietnam. *Land Use Policy, 36*(0), 89-101.

Ha, T. T. T., van Dijk, H., & Bush, S. R. (2012). Mangrove conservation or shrimp farmer's livelihood? The devolution of forest management and benefit sharing in the Mekong Delta, Vietnam. *Ocean & Coastal Management, 69*(0), 185-193.

Hafezniya, M. (2009). *An introduction to research methodology in humanities*. Tehran: Samt publications.

Hamdan, O., Khairunnisa, M., Ammar, A., Hasmadi, I., & Aziz, H. (2013). Mangrove carbon stock assessment by optical satellite imagery. *Journal of Tropical Forest Science, 25(4),* 554-565.

Hamilton, L. S., Snedaker, S. C., Environment, E.-W., & Institute, P. (1984). *Handbook for mangrove area management*. Honolulu: East-West Environment and Policy Institute.

Haron, H. A. H. (1981). A working plan for the second 30 year rotation of the Matang Mangrove Forest Reserve, Perak. *Perak State Forestry Department, Ipoh, Malaysia, 115*.

Hong, C.-W., & Chan, N.-W. (2010). Strength-weakness-opportunities-threats analysis of Penang National Park for strategic ecotourism management. *World Applied Sciences Journal, 10,* 136-145.

Horigue, V., Aliño, P. M., & Pressey, R. L. (2014). Evaluating management performance of marine protected area networks in the Philippines. *Ocean & Coastal Management, 95*, 11-25.

Hosseini Nasab, H., & Milani, A. S. (2012). An improvement of quantitative strategic planning matrix using multiple criteria decision making and fuzzy numbers. *Applied Soft Computing, 12*(8), 2246-2253.

Iftekhar, M., & Islam, M. (2004). Managing mangroves in Bangladesh: A strategy analysis. *Journal of Coastal Conservation, 10*(1), 139-146.

Islam, M. S., & Wahab, M. A. (2005). A review on the present status and management of mangrove wetland habitat resources in Bangladesh with emphasis on mangrove fisheries and aquaculture. In Segers, H., & Martens, K. (Eds) *Aquatic biodiversity II* (pp. 165-190). Springer, Dordrecht.

Jairam, D., & Kiewra, K. A. (2009). An investigation of the SOAR study method. *Journal of Advanced Academics, 20(4),* 602-629.

Jashimuddin, M., & Inoue, M. (2012). Community forestry for sustainable forest management: Experiences from Bangladesh and policy recommendations. *Formath, 11*, 133-166.

Jie, Q. (2008). SWOT analysis of the development of forest tourism industry on the North Slope of Qinling Mountains. *Journal of Anhui Agricultural Sciences, 35*(28), 9074.

Jusoff, K., & Taha, D. (2008). Managing sustainable mangrove forests in Peninsular Malaysia. *Journal of Sustainable Development, 1*(1), 88-96.

Kairo, J. G., Dahdouh-Guebas, F., Bosire, J., & Koedam, N. (2001). Restoration and management of mangrove systems a lesson for and from the East African region. *South African Journal of Botany, 67*(3), 383-389.

Kamaruzaman, J., & Kasawani, I. (2007). Spectral signatures of some mangrove species in Malaysia. In The 5th WSEAS International Conference on Environment, Ecosystems and Development (EED'07), Puerto De La Cruz, Tenerife, Canary Islands, Spain.

Kay, R., & Alder, J. (1998). *Coastal planning and management*. CRC Press.

Khoon, G. W., & Eong, O. J. (1995). The use of demographic-studies in mangrove Silviculture. *Hydrobiologia, 295*(1-3), 255-261.

Lee, K.-l., & Lin, S.-c. (2008). A fuzzy quantified SWOT procedure for environmental evaluation of an international distribution center. *Information Sciences, 178*(2), 531-549.

Lee, S. Y., Primavera, J. H., Dahdouh-Guebas, F., McKee, K., Bosire, J. O., Cannicci, S., ... & Mendelssohn, I. (2014). Ecological role and services of tropical mangrove ecosystems: a reassessment. *Global Ecology and Biogeography*, *23*(7), 726-743.

Macintosh, D., & Ashton, E. (2002). A review of mangrove biodiversity conservation and management. *Centre for Tropical Ecosystems Research (center Aarhus),*. University of Aarhus, Denmark.

Malaysia, T. (2009). Malaysian Timber Council. Matang mangroves: A century of sustainable management. *Timber Malaysia 15*, 7-11.

Mangora, M. M., Shalli, M. S., Semesi, I. S., Njana, M. A., Mwainunu, E. J., Otieno, J. E., . . . Wambura, M. (2016). Designing a mangrove research and demonstration forest in the Rufiji delta, Tanzania. *Proceedings of the 5th Interagency Conference on Research in the Watersheds* (pp. 190-192). US Department of Agriculture Forest Service, Southern Research Station.

Margles, S. W., Masozera, M., Rugyerinyange, L., & Kaplin, B. A. (2010). Participatory planning: Using SWOT-AHP analysis in buffer zone management planning. *Journal of Sustainable Forestry, 29*(6-8), 613-637.

Masozera, M. K., Alavalapati, J. R., Jacobson, S. K., & Shrestha, R. K. (2006). Assessing the suitability of community-based management for the Nyungwe Forest Reserve, Rwanda. *Forest Policy and Economics, 8*(2), 206-216.

Memon, S. H. (2012). *An overview of mangrove restoration efforts in Pakistan. Sharing Lessons on Mangrove* Restoration. IUCN, Bangkok, Thailand.

Mendoza, G. A., Prabhu, R. (2005). Participatory modeling and analysis of sustainable forest management: experiences and lessons learned from case studies. In: Bevers, M. and Barrett, T. M. (Eds.). *System analysis in forest resources*: Proceedings of the 2003 symposium,Stevenson, WA.. (pp 49-57). Portland, OR, USA.

Moharram Nejad, N. (2012). *Environmental management and planning.* (2nd ed.). Tehran: Danesh-e Behbod.

Monavari, M., Abed, M. H., Karbassi, A., Farshchi, P., & Abedi, Z. (2013). Integrated coastal tourism zone management (ICTZM) as a basis for sustainable development of the south coastline of the Caspian Sea. *Indian Journal of Geo-Marine Sciences, 42*(5), 635-646.

Motamedi, S., Hashim, R., Zakaria, R., Song, K.-I., & Sofawi, B. (2014). Long-term assessment of an innovative mangrove rehabilitation project: Case study on Carey Island, Malaysia. *The Scientific World Journal,* e953830.

Nasuchon, N. (2009). *Coastal management and community management in Malaysia, Vietnam, Cambodia and Thailand, with a case study of Thai fisheries management.* [Powerpoint slides]. Retrieved from http://www.un.org/Depts/Ios/nippon/unnff_programme_home/fellows_pages/fellows_papers/nasuchon_0809_thailand_ppt.pdf, April 2015.

Nguyen, H.-H. (2014). The relation of coastal mangrove changes and adjacent land-use: A review in Southeast Asia and Kien Giang, Vietnam. *Ocean & Coastal Management, 90*, 1-10.

Nourbakhsh, S. Z., Shahba, S., & Mozafari, M. (2013). Using SWOT analysis and QSPM matrix for developing and evaluating strategies of ecotourism. *Caspian Journal of Applied Sciences Research, 2*(9), 116-125.

Nouri, J., Karbassi, A., & Mirkia, S. (2008). Environmental management of coastal regions in the Caspian Sea. *International Journal of Environmental Science & Technology, 5*(1), 43-52.

Nouri Neshat, S. (2009). *Facilitation in Community-Based Rehabilitation*. Tehran, Iran (in Farsi) : Parsoon publications.

Pagdee, A., Kim, Y. S., & Daugherty, P. J. (2006). What makes community forest management successful: a meta-study from community forests throughout the world. *Society and Natural Resources*, *19*(1), 33-52.

Panigrahi, J. K., & Mohanty, P. K. (2012). Effectiveness of the Indian coastal regulation zones provisions for coastal zone management and its evaluation using SWOT analysis. *Ocean & Coastal Management, 65*, 34-50.

Parsayan, A., & Aarabi, M. (2009). *Strategic management. (6th.Ed.)* Tehran: Cultural Studies Office.

Piran, P. (2003). Social policy, social development and its necessity for Iran. *Quarterly of Social Welfare, 10* (Special Issue: Social Policy), 121-154.

Pykäläinen, J., Hiltunen, V., & Leskinen, P. (2007). Complementary use of voting methods and interactive utility analysis in participatory strategic forest planning: Experiences gained from western Finland. *Canadian Journal of Forest Research, 37*(5), 853-865.

Rasolofo, M. V. (1997). Use of mangroves by traditional fishermen in Madagascar. *Mangroves and Salt Marshes, 1*(4), 243-253.

Rauch, P. (2007). SWOT analyses and SWOT strategy formulation for forest owner cooperations in Austria. *European Journal of Forest Research, 126*(3), 413-420.

Reihanian, A., Mahmood, N. Z. B., Kahrom, E., & Hin, T. W. (2012). Sustainable tourism development strategy by SWOT analysis: Boujagh National Park, Iran. *Tourism Management Perspectives, 4*, 223-228.

Rezazadeh, S., Jahani, A., Makhdoum, M., & Meigooni, H. G. (2017). Evaluation of the strategic factors of the management of protected areas using SWOT analysis. Case study: Bashgol Protected Area-Qazvin Province. *Open Journal of Ecology, 7*(1), 55.

Robins, L., & Dovers, S. (2007). Community-based NRM boards of management: Are they up to the task? *Australasian Journal of Environmental Management, 14*(2), 111-122.

Sariisik, M., Turkay, O., & Akova, O. (2011). How to manage yacht tourism in Turkey: A swot analysis and related strategies. *Procedia-Social and Behavioral Sciences, 24*, 1014-1025.

SGP-Malaysia. (2012). *Partners in sustainable development: Empowering civil societies through SGP Malaysia*, UNDP/GEF-SGP Malaysia.

Sheng, Y. P., & Zou, R. (2017). Assessing the role of mangrove forest in reducing coastal inundation during major hurricanes. *Hydrobiologia, 803*(1), 87-103.

Shtal, T. V., Buriak, M. M., Amirbekuly, Y., Ukubassova, G. S., Kaskin, T. T., & Toiboldinova, Z. G. (2018). Methods of analysis of the external environment of business activities. *Revista ESPACIOS, 39*(12), 22.

Siaosi, F., Huang, H.-W., & Chuang, C.-T. (2012). Fisheries development strategy for developing Pacific Island Countries: Case study of Tuvalu. *Ocean & Coastal Management, 66*, 28-35.

Siry, H. Y. (2006). Decentralized coastal zone management in Malaysia and Indonesia: a comparative perspective 1. *Coastal Management, 34*(3), 267-285.

Siti, Y., Khairudin, H., & Mohd, S. (2009). Biodiversity conservation in oil palm industry: A case study in Carey Island. *Proceedings of Biodiversity and National Development: Achievements, Opportunities And Challenges* (pp: 61-69). Kuala Lumpur, Malaysia,

Srivastava, P., Kulshreshtha, K., Mohanty, C., Pushpangadan, P., & Singh, A. (2005). Stakeholder-based SWOT analysis for successful municipal solid waste management in Lucknow, India. *Waste Management, 25*(5), 531-537.

Suh, J., & Emtage, N. F. (2005). *Identification of strengths, weaknesses, opportunities and threats of the community-based forest management program*. Paper presented at the ACIAR Smallholder Forestry Project ASEM/2000/088 Redevelopment.

Sukardjo, S. (2002). Integrated coastal zone management (ICZM) in Indonesia: A view from a mangrove ecologist. *Southeast Asian Studies, 40*(2), 200-218.

Tabibi M, Rohani A. (2011). Jet ski development strategies: The case of Caspian Sea's south-west beach. *Tourismos: An International Multidisciplinary Journal of Tourism*, *6*(2), 175-192

Tavallaei, M., Farshad, A. A., Liaghati, H., Nouri, J., & Salehi, G. H. (2013). Providing a conceptual model of Mmetropolises waste management (Case Study: Tehran, Iran). *Journal of Pure and Applied Microbiology, 9*(2), 1-9.

Tavorn, C., Srisontisuk, S., Suzuki, N., & Nanthabut, K. (2013). Community Organizations in Mangrove Forest Management, Paklok Bay, Phuket, Thailand. *Research on Humanities and Social Sciences*, *3(2)*, 20-26

Teh, E. (2014). *Coastal Blue Carbon: Exploring the Opportunities and Challenges for Malaysia*. Presented at the International Conference on Mangroves of Asia-Pacific Countries in view of Climate Change (MAPCVCC), Kuala Lumpur, Malaysia.

Tomlinson, P.B. (1987). *The Botany of Mangroves.* New york : Cambridge University Press.

Tsuchiya, M., Mimura, I., Yano, Y., Oldiais, N. W., Golbuu, Y., Fujita, Y., & Miyakuni, K. (2015). *Mangrove forest ecosystem services with reference to the transportation of organic materials to coral reefs: A preliminary study in Palau*. In J.C, Hubert., H, Yves., K, Yasukuki., K, Terushisa., S, Georges., & T, Marie-Helene (Eds), *Marine productivity: Perturbations and resilience of socio-ecosystems* (pp. 373-379). Switzerland : Springer, Cham.

UNDP. (2008). *Capacity development: Empowering people and institutions*. Retrieved from,http://www.undp.org/content/undp/en/home/librarypage/corporate/undp_in_action_2008.html, August 2014

Vafaei, F., & Harati, A. (2010). Strategic management in decision support system for coastal flood management. *International Journal of Environmental Research, 4*(1), 169-176.

Walters, B. (2004). Local management of mangrove forests in the Philippines: Successful conservation or efficient resource exploitation? *Human Ecology, 32*(2), 177-195.

Walters, B. B., Rönnbäck, P., Kovacs, J. M., Crona, B., Hussain, S. A., Badola, R., . . . Dahdouh-Guebas, F. (2008). Ethnobiology, socio-economics and management of mangrove forests: A review. *Aquatic Botany, 89*(2), 220-236.

Webb, E. L., & Sudtongkong, C. (2008). Outcomes of state-vs. community-based mangrove management in Southern Thailand. *Ecology and Society, 13(2)*.27

WWF, M. (2012). *Mangrove Forest.* Retrieved from http://www.wwf.org.my/about_wwf/what_we_do/forests_main/the_malaysian_rainforest/types_of_forests/mangrove_forests, October 2014

Zorini, L. O., Contini, C., Jiddawi, N., Ochiewo, J., Shunula, J., & Cannicci, S. (2004). Participatory appraisal for potential community-based mangrove management in East Africa. *Wetlands Ecology and Management, 12*(2), 87-102.