

**DEVELOPMENT OF AN INTEGRATIVE GOVERNANCE FRAMEWORK
FOR STAKEHOLDER MANAGEMENT IN MARINE SPACE
ADMINISTRATION**

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DEVELOPMENT OF AN INTEGRATIVE GOVERNANCE FRAMEWORK FOR
STAKEHOLDER MANAGEMENT IN MARINE SPACE ADMINISTRATION

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Specially dedicated to Mak

I've fulfilled my promise.

I really miss you.

-Al-Fatihah-

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ABSTRACT

In Malaysia, marine spaces are not managed by single public institution but involving several stakeholders. As a result, this will create complex, uncertain, conflicting, and overlapping scope of work. This study aims to develop a Marine Space Stakeholder Governance (MSSG) framework based on real Malaysian Marine Space Stakeholder Issues (MSSI). The study employs qualitative and quantitative approach using Grounded Theory method with focus group technique (GT-fg). This is followed by benchmarking, Fuzzy Delphi technique and finally, face-to-face interview for validation. GT-fg data were gathered through semi-structured interviews in groups incorporating the critical incidences technique. The study found out new issues in stakeholder management in Malaysia including power distance, bureaucracy, and organisation structure. Furthermore, the common issues such as identifying and engaging the stakeholders and data management are also derived from the GT-fg output. Then, a benchmarking study were conducted to the Indonesian Ministry of Marine Affairs and Fisheries (MMAF) to develop the Malaysian MSSG framework. This study involves 23 expert panels from various fields related to marine space governance to evaluate the framework using Fuzzy Delphi technique. The results show consensual agreement ($d = 77.17\%$) among the experts in terms of the selected nine elements of the framework. Each item reached an agreement with the value (A_{\max}) exceeding 0.60 defuzzification values. Only one item from the custodian element (The Prime Minister's Department should be the lead agency) where $A_{\max} = 0.32$ is not acceptable. Finally, face-to-face interviews were used to assess the acceptance of the framework from the marine space stakeholders. All interviewees agreed that the framework is vital to support the Malaysian MSSG strategic implementation and policy execution. These findings could become a foundation for the establishment of National Marine Planning Council. The results of this study could contribute to the development of MSSG framework, taking into account the new MSSI.

ABSTRAK

Di Malaysia, ruang marin tidak diuruskan oleh institusi tunggal tetapi melibatkan beberapa pihak berkepentingan. Perkara ini mewujudkan skop kerja yang kompleks, tidak menentu, bercanggah dan bertindih. Oleh itu, kajian ini bertujuan untuk membangunkan satu rangka kerja tadbir urus pihak berkepentingan ruang marin (MSSG) berdasarkan isu-isu sebenar pihak berkepentingan ruang marin Malaysia (MSSI). Kajian ini menggunakan pendekatan kualitatif dan kuantitatif dengan kaedah teori asas dan teknik kumpulan fokus (GT-fg). Ini diikuti dengan penandaarasan, teknik *Delphi* kabur dan akhir sekali, temubual bersemuka untuk pengesahan. Data GT-fg dikumpulkan melalui temubual separa berstruktur dalam kumpulan. Kajian ini menemukan isu-isu baharu dalam pengurusan pihak berkepentingan di Malaysia iaitu jurang kuasa, birokrasi, dan struktur organisasi. Tambahan pula, isu lazim seperti mengenal pasti, melibatkan dan mengurus data pihak berkepentingan juga diperolehi daripada GT-fg. Kemudian, kajian ini melaksanakan kajian penandaarasan terhadap Kementerian Kelautan dan Perikanan Indonesia (MMAF) untuk membangunkan rangka kerja MSSG di Malaysia. Kajian ini melibatkan 23 panel pakar daripada pelbagai bidang yang berkaitan dengan tadbir urus ruang marin untuk menilai rangka kerja menggunakan teknik *Delphi* kabur. Keputusan *Delphi* kabur menunjukkan persetujuan ($d = 77.17\%$) dalam kalangan pakar terhadap sembilan elemen yang dipilih daripada rangka kerja tersebut. Setiap item mencapai persetujuan dengan nilai (A_{\max}) melebihi 0.60 nilai penyahkaburan. Hanya satu item daripada elemen kustodian (Jabatan Perdana Menteri perlu menjadi agensi peneraju) iaitu $A_{\max} = 0.32$ tidak boleh diterima. Akhir sekali, pendekatan temubual bersemuka digunakan untuk menilai penerimaan rangka kerja daripada pihak berkepentingan ruang marin. Semua individu yang ditemubual bersetuju bahawa elemen rangka kerja ini penting untuk menyokong kepada pelaksanaan polisi dan pelaksanaan dasar strategik MSSG. Kajian ini boleh menjadi asas kepada penubuhan Majlis Perancangan Marin Negara. Hasil kajian ini akan menyumbang kepada pembangunan rangka kerja MSSG dengan mengambil kira MSSI yang baharu.

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LIST OF ABBREVIATIONS

ASEAN	-	Association of Southeast Asian Nations
BPN		National Land Agency
fg	-	focus group
GT-fg	-	Grounded Theory-focus group
GTM	-	Grounded Theory methodology
ICT	-	Information and Communications Technology
IT	-	Information Technology
IPB		Bogor Agriculture University
ITB		Bandung Institute of Technology
JPP	-	Department of Polytechnic Education
JUPEM	-	Department of Survey and Mapping Malaysia
KPM	-	Ministry of Education
MaCGDI	-	Malaysia Centre of Geospatial Data Infrastructure
MMAF		Ministry of Marine Affairs & Fisheries
MIMA	-	Maritime Institute of Malaysia
MOSTI	-	Ministry of Science, Technology and Innovation
MSSI	-	Marine Space Stakeholder Issues
MSSG	-	Marine Space Stakeholder Governance
MMSSG		Malaysia Marine space stakeholder governance
MSSM		Marine space stakeholder management
NAHRIM	-	National Hydraulic Research Institute of Malaysia
NRE	-	Ministry of Natural Resources and Environment
PTG	-	Department of Lands and Mines
UTM	-	Universiti Teknologi Malaysia

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This research explores the marine space governance practices in Malaysia. Currently, there is no accepted indicator of methodologies or established frameworks at the international level which facilitates the comparison of marine space stakeholder's management. This chapter has eleven sections, provides a foundation and overview of the research, a compressed introduction to the topic, and the motivation for the research. It states the problem that this thesis intends to solve, the aim, and scopes of the research. In this chapter also, the research approach is summarised and the thesis is outlined.

1.2 Research Background

This research aims to develop a marine space stakeholder's governance framework in Malaysia. The study utilised qualitative and quantitative methods to investigate marine space governance associated with stakeholders' issues.

In Malaysia, the governing of such activities involves various stakeholders and institutions. Governing is not only about managing, but also deals with decision making and distribution of knowledge which can influence the stakeholders' management and jurisdiction. Specifically, in marine space activities, the governing activities are shared by various stakeholders and overarching law concerning the use of the ocean (Teo and Fauzi, 2006).

Consequently, the marine space is not managed by a single public institution in Malaysia but involves several stakeholders (departments from the government and authorised individuals) who have interest in the marine space environment. This creates complex, uncertain and conflicting situations in determining a resolution in authority area of true governance. Therefore, it is important to establish a hierarchy of importance in authority area in order to meet the goals of economic, social, and political, as well as environmental issues (Nichols *et al.*, 2000). Good governance can mean different things to different people depending on one's perspective or goals (Sutherland and Nichols, 2006). Therefore, the foundation is the recognition of what is excluded and what is given priority in certain circumstances.

In this study, initial information on marine space management was obtained from three officials; each from different stakeholders. Unstructured interview were used during the initial stage. The officers also shared their concept of marine space governance as follows:

Marine space does not only refer to determining boundaries physically, as it might create some problems in administration. Therefore, it needs a clear definition to improve its organisation and marine space management. For example, in ensuring marine space safety in the sea area...there is no clear border in supervision and this creates conflicts between institutions such as the marine police and other enforcement agencies. This is due to the poor management of marine spaces by the authorities concerned to solve the conflicts and the development of marine

spaces between public authorities (Department of Lands and Mines -PTG, - JKPTG) and associated marine institutions...

(R1)

...when you talk about marine space, it is not as easy as the airspace... many parties are involved... airspace does not have many stakeholders, but in marine space, most of them want to claim their own ownership. Here, we will see the overlapping responsibilities and conflict of interests between the stakeholders, for example, the gazetted area for marine park. Before it is gazetted, everyone knows that an investigation has been done to determine whether that area is suitable for waterpark or not. But then, why there are still environmental issues such as oil spill? It is caused by ship movement along the waterway. ...What I mean here is, how can the ship pass through? Who gave them the permission? This shows that there is no coordination between the stakeholders. ...Perhaps, there is some agenda behind it... Yes. It is important to me because it is good to know that someone is trying to look into this stakeholder issues to find where we are lacking in our organisation...

(R2)

...so far, we will only be involved in marine space management issues. Although we make policies for them..., we still face challenges, in terms of many stakeholders to look up. Basically, the most difficult part in making policies is the overlapping responsibilities of the stakeholders. In this case, they will point fingers to each other because there are various stakeholders especially in the coastal areas. It will be good if you can come out with a stakeholders' management framework and how well it can be used...

(R3)

All issues that have been discussed above is illustrated by the distribution pattern of marine space stakeholder issues (MSSI) issue to understand the concept of marine space stakeholder governance (MSSG) as shown in Table 1.1 below.

Table 1.1: Distribution pattern of MSSSI understanding of the concept of MSSG issue

Number	Issues	R1	R2	R3
1	Overlapping		x	x
2	Conflict of interest	x	x	
3	Organization structure	x	x	x

Based on the facts disclosed by the participants, it can be concluded that the management of the marine environment in Malaysia has three major issues that need to be taken to ensure the universality of serious marine management. As can be seen in Table 1.1, the three issues that are of major conversation of the participants are overlapping, conflict of interest, and organisational structure. The most significant and the highest requirement issue is the organisational structure. All three participants stressed the need to study the organisational structure to ensure universal marine management. In addition, they argued that other issues can be overcome by the organisational structure.

Consequently, managing a marine space with its geographical space approximately 515,000 square kilometres of the maritime realm and 4,576 km in length of the coastline is a complicated task. Current development in marine and coastal areas has assumed a new dimension both nationally and internationally where oceans are seen as important assets with significant potential for economic growth and job creation (Heffernan, 2015). Therefore, as part of the South East Asian Region and a founding member of the Association of South East Asian Nations (ASEAN), the relationship with these nations should be of great importance as they are one of the stakeholders in Malaysia marine spaces (Figure 1.1).



Figure 1.1 Malaysia and its South East Asian Neighbours

The numbers of scholars who currently addressed the topic are increasing upon realizing the importance of marine space stakeholder governance framework for maritime nations. Tarmidi *et al.* (2016) and Tuda *et al.* (2014), for example, stressed that their research has considered the role of each stakeholder in marine administration to plan for a sustainable future framework for the best administration of marine space.

Keeping in mind that marine space governance is based on the recognition of the interests of all stakeholders and their inclusion, whenever possible, a look at Malaysia's perspective is necessary. Thus, a new framework using good governance concepts should be created. The framework should lead to the governance of current marine space, taking into account the stakeholder issues.

1.3 Problem Statement

The need to have a marine space stakeholder governance framework is vital for the maritime nations. Malaysia is one of the maritime nations and is approximately covered by 63, 665.30 metre squares of territorial waters (Zakaria and Adzhan, 2012); hence, the eminent need for governing the marine environment. In addition, maritime nations have witnessed a growing number of development in marine areas (van Leeuwen and van Tatenhove 2010; Pomeroy and Douvere 2008). Some activities that take place on marine spaces such as fisheries, transportation, tourism, safety, and natural resources exploration has incorporated stakeholders from different sectors.

When new uses and activities of marine environments emerge, stakeholders are regularly faced with societal conflict (Alexander *et al.*, 2016) and acceptance is important among the key players. Furthermore, the differences in regulations and preferences set by the stakeholders have caused conflicts on overlapping tasks and activities among the stakeholders. Hence, it is important to analyse the current rules, regulations, and relationships among the marine stakeholders in order to have directive policies and strategic plans. Heffernan (2015) stated that legislation is needed to identify the institutional and stakeholders directions to manage the marine spatial planning. As a consequence, stakeholder participation is considered as a fundamental to marine spatial planning. Therefore, the need for the marine space stakeholder governance is becoming a big agenda to this field.

Moreover, different human activities that can impact the marine ecosystems on the high seas might cause unclear or overlapping competencies. The mandate to regulate such human activities rests in the existing regional and global institutions (Kvalvik, 2012). This overlapping normally leads to confusion about the legal competency and authority of different stakeholders and institutions. Hence, there is a prevalence of work duplication, adoption of incoherent measures, complex implementation, and compliance processes. Conflicts between stakeholders and

degradation of the ecosystem are also frequent (Liu *et al.*, 2012). Such conflicts do however, tend to normally reduce the advancements of the Exclusive Economic Zones (EEZ) and the high seas, where economic activities are relatively limited and mostly confined to offshore fishing and mineral exploitation (Liu *et al.*, 2012).

The overlapping of the marine spatial governance activities such as data capturing, storage, process, and distribution often end up with a redundant phenomenon known as 'silo' (Ng'ang'a *et al.*, 2001; Binns *et al.*, 2003, Binns *et al.*, 2004). The 'silo' phenomenon refers to the same data redundancies collected by multiple institutions with the same means for stakeholder governance. This silo situation will consequently deflect the main idea of establishing strategic directive policies and a strategic plan by having analysis on the stakeholders' current direction. Furthermore, it is difficult to declare any general statements about the institutional change in relation to the sea due to the wide range of activities on the marine space. Institutional problems in the marine environment extend from global to remote issues with the involvement of stakeholders.

Another essential point that has been revealed from literature is that the overlapping and conflicting interest may pose threat to marine space (Tuda *et al.*, 2014; Pomeroy and Douvere, 2008; Hall *et al.*, 2013). It is also evident that land information system and marine space information systems where they exist are often operated separately (Medema *et al.*, 2014). This often resulted in conflicts within the coastal zone or land-sea interface. It is therefore imperative to manage, administer, and govern the coastal zone in a considerably sustainable and structured manner, in order to protect and nurture the environment.

Equally important is to consider the diversity uses of marine spaces. Several issues had been identified which may vary from country to country based on the governance strategies adopted. Therefore, being a maritime country with several maritime boundaries, Malaysia needs to identify its unique MSSSI.

As has been introduced in the background of the study, marine space stakeholder governance should be able to resolve the issues encompassing legal, technical, and institutional areas. In order to establish a stakeholder governance framework that will lead towards a sustainable environment, it is important to know the current institutional direction of the stakeholders.

Moreover, by studying the current direction among the marine space stakeholders, there is a need to investigate the real stakeholder issues that exist in the marine space environment. These processes are known as stakeholder's analysis. Since there are still gaps in integrating the stakeholder's analysis in marine space environment, it is expected that the research questions highlighted in this study will be answered.

By keeping in mind that Malaysia is a country with high water body, it is necessary to develop a governance framework for stakeholder's management towards marine space administrations. This framework will take into account the indicators towards the success of management in various aspects.

1.4 Knowledge Gap and Hypothesis

Malaysia is one of the maritime countries that should not neglected the MSSSI. There is a large volume of published studies on MSSSI (Chang *et al.*, 2014; Lane, 2008; Sutherland and Nichols, 2006; Sutherland *et al.*, 2004; Sutherland, 2011; Van Tatenhove , 2011). Nevertheless, the majority of these studies were conducted in western countries (Cook, 2014; Day *et al.*, 2008; Hirst *et al.*, 1999; McCrimmon and Fanning, 2010; Pascoe *et al.*, 2009) such as Canada, Australia, United Kingdom, and United States of America (Maguire *et al.*, 2012). Hence, most marine space stakeholders' issues were from the western economies.

Although studies on marine space stakeholders is lacking in the developing world (Tarmidi *et al.*, 2013), there are few studies on marine space governance (Freire-Gibb *et al.*, 2014; Cook, 2014; Day, *et al.*, 2008; Hirst *et al.*, 2010; Pascoe *et al.*, 2009; Nichols *et al.*, 2000) in Asia, East Europe, and Latin America. These were internationally considered to be comprehensive; hence, were able to identify the similarities and differences between the Eastern and Western issues in managing marine space stakeholder's management with regards to the nature of the marine environment. However, studies on these issues are minimal, if not none on small countries including Malaysia. The lack of study on the said issues can be considered as a gap in this field. Thus, to fill in the gap, this study aims to develop a framework in marine space stakeholder governance (MSSG) so the management of MSSG can be done systematically. This is the first attempt to focus on the MSSI, and is believed to be able to make a significant contribution to the knowledge within the MSSI field in general. It is also essential to examine the peculiar issues on marine space stakeholders concerning Malaysia.

Marine spaces are undergoing continual incremental changes in terms of social and economic purposes. From the foregoing problem, the hypothesis is: despite the fact that marine space environment appears to be the same all over the world, the activities and interactions of the stakeholders varies from country to country. It is therefore adequate to hypothetically stated that the marine space stakeholder issues are peculiar to different countries or regions of the world.

1.5 Research Questions

To address this peculiarity, the key research question to be answered in this study is:

Is MSSI essentially the same in every country across the globe?

Hence, the secondary questions are:

- i) What are the unique MSSSI in Malaysia?
- ii) What are the most important elements in managing marine space stakeholders?
- iii) How would the identified element enable the establishment of an objective and systematic selection framework?

1.6 Research Objectives

The aim of this research work is to develop a governance framework for Stakeholder Management towards sustainable marine space administration through systematic research methodology. The general aim of this research work is also to develop a marine space administration guideline for Malaysia in such a way that enhances coordination between stakeholder relationships while focusing on the stakeholder identification issues, effective stakeholder engagement issues, and managing stakeholder input.

To ensure a thorough and complete exploration of this research work, the following objectives are established:

- i. To explore the contributing elements of the Governance Stakeholder Management Issues.
- ii. To identify appropriate elements for Malaysia Governance Stakeholder Management based on input from Marine Space management experts.
- iii. To develop the Malaysia Governance Stakeholder Management framework and validate its reliability and applicability.

1.7 Scope of Research

The scopes of this study include:

- i. This research focuses on the marine space stakeholders in Malaysia. It identifies the expertise of marine space administrators. It aims at identifying the contributing elements of the marine space stakeholder governance. The respondents were chosen from the selected stakeholders in Peninsular Malaysia. In this research, the analysis of the data is to clear up any aspects that will generate doubts on the establishment of marine space stakeholder governance framework concept in the authority of several government and non-government agencies.
- ii. Grounded Theory with focus group approach (GT-fg) was used to identify the real Malaysian marine space stakeholder issues. Specifically, the study will explore the marine space stakeholder that is essential to find out the problem on marine space management.
- iii. Benchmarking of International Practices would be with experts in Indonesia. The justification of this choice was that there were relevant contact persons who were readily available in Indonesia. Besides, there are several reports on marine space governance studies in Indonesia, as published by a relevant journal (Putri *et al.*, 2009; Sazlan, 2000; Widodoc *et al.*, 2002). Reports showed that Indonesia has long practiced the marine space governance compared to Malaysia.
- iv. The method used was Fuzzy Delphi involving a panel of experts in the field of marine environment. The experts are from within and outside the country, who are involved in the academic field or directly involved in the field. Experts appointed should also have work experience of more than five years.

- v. This study used face-to-face interview to validate the output of the study. The process begins by gathering stakeholders, whose role are as implementers only. They consist of decision-makers.

1.8 Significance of Research

The significance of this research was triggered by the intense to encourage stakeholders to involve in marine space management. Stakeholder involvement is crucial when evaluating the development of the marine space as marine space is part of the national development program. In Malaysia, the development of marine space begins with the establishment of harbour, marina bay, and marine park, just to name a few. The awareness of managing the marine space in field of development has been raised not only at the organization level but it also includes national and international level as the development itself indirectly influences others stakeholder.

The major stakeholders that able to influence the Malaysian marine space are; Jabatan Ukur dan National Oceanography Directorate (NOD), Maritime Institute of Malaysia (MIMA), Malaysia Maritime Enforcement Agency (MMEA), Department of Fisheries (DoF) and The Royal Malaysia Navy, just to name a few. The stakeholders typically manage the marine space by theirs own. As a consequence, overlapping, consistency and conflict of interest may occur because to establish physical boundaries are difficult even though it applicable on paper. Thus, each stakeholder should be able to involve in every single of decision made by peers.

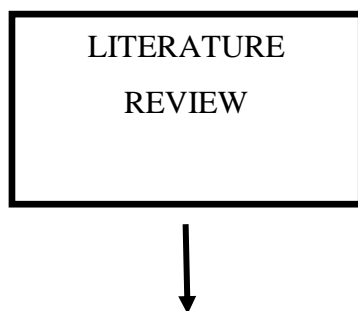
Since, the difficulty of managing the marine space take place internationally, therefore it is worth to work on determining the relationships between the stakeholders and marine space administration. This research may identify, support, enrich and generate awareness of having a proper and applicable of marine space management structure. Finally, it able to provide useful knowledge on factors that

might have impact and contribute to the successful adoption of marine space administration's development in marine space governance.

This research is the first step of an endeavour to embark a comprehensive study on marine space administration development for adoption in the marine space in Malaysia. This research will serve as a platform to solve the conflict of area in terms of marine governance among levels of stakeholder management in Malaysia, especially in marine environment. It is important to see the extent of adoption and organisational factors that influence the marine space administration practice in the marine environment.

1.9 General Methodology

The overall research methodology consists of literature review, face-to-face interview, Grounded Theory with focus group, Fuzzy Delphi questionnaire survey, benchmarking and face-to-face interview for validation which are designed specifically for achieving the stated research objectives. Both qualitative and quantitative measures for establishing the selection framework will be employed in this study. This study is conducted through the following methodology.



i. Literature review

An extensive literature review on the marine space stakeholders issues (MSSI) will be carried out. Literature review will involve gathering of secondary data from journals, conferences papers, books and research report.



ii. Qualitative (Interview face-to- face)

Gathering an information on MSGI, MSSSI and condition situations in managing marine space stakeholder in Malaysia by interviewing stakeholders.

iii. Grounded Theory with Focus group Technique (GT-fg)

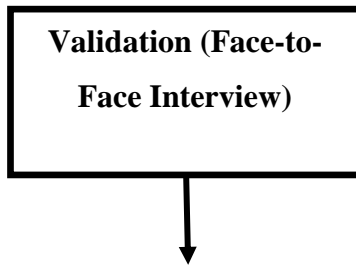
An list of existing problem on managing Malaysia marine space stakeholders management issues will be identified and Marine space governance framework emerged. This will be based a thorough literature study.

iv. Benchmark International Best Practice

The research marine space stakeholders issues identified was then benchmarked against the international practice of one maritime country in Indonesia. Visit the country will be made to gather data on how their manage the marine space. The aspects to be studied, compared and incorporated into the local outsourcing marine space management would cover the operation stage. The product of this exercise were the marine space organizational framework for managing the marine space stakeholders management outsourcing based on the international best practices.

v. Fuzzy Delphi Technique

The above research input will be used to conduct Fuzzy Delphi questionnaire. This technique will focus on experts opinions on selection element for marine space organizational framework.



vi. Validate The Marine Space organizational Framework

The final draft of the component of the marine space organizational framework identified from the analysis will then be validated by marine space stakeholders. The final result will be the outsourcing element for marine space organizational framework.

The specified objectives and the corresponding methodologies will be further discussed in greater details in Chapter 3.

1.10 Structure of Thesis

This study has been structured into five (5) chapters. The summary of the remaining chapters is outlined as follows:

Chapter 1 provides a brief review on the current state of marine space governance issues and briefly introduces stakeholder issues. The problem statements of the research were identified by constructing a clear objective and direction of the study.

An overview of the background of marine space governance with particular reference to the marine space stakeholder management (MSSM) would be reviewed. The MSSM involves three main issues which are identifying stakeholders, stakeholder engagement, and stakeholder data management. The understanding on the methodology used in governing and managing of stakeholders is important in designing the marine space stakeholder framework. Moreover, knowledge of the theoretical foundation is essential in designing the complete marine space stakeholder governance. Thus, this study attempts to elaborate the theoretical foundation of the methodology used and provide a model-based design of the

complete marine space stakeholder governance framework that has been developed. All these information are conveyed in **Chapter 2** and **Chapter 3**.

Documentation on the range of marine space stakeholders presented in Chapter 2 provides necessary understanding for discussion of systems analysis and design methodologies undertaken in **Chapter 4**. The focus of Chapter 3 is a review of the system methodologies in the documentation and analysis of marine space stakeholder issues. This review is undertaken to justify the systems analysis and design approach that structures much on the remainder of the thesis.

Finally, after developing several components of marine space stakeholder governance framework in previous chapters, **Chapter 5** generally demonstrates the complete development of the marine space stakeholder governance framework. This chapter discusses the analysis of the findings from GT-fg approach. The analysis was followed by benchmarking analysis and output from the activities. It continues with the experts view on how marine space stakeholder governance should be. Through face to face interview, the validation analysis on the finding is performed. A structural framework of marine space stakeholder governance in the context of Malaysian MSSSI is proposed in this chapter.

Chapter 6, Conclusion and Recommendations discuss and describe the findings of the research, its contributions, implications, recommendation for future research, and limitations. The schematic diagram of the thesis structure is shown in Figure 1.2.

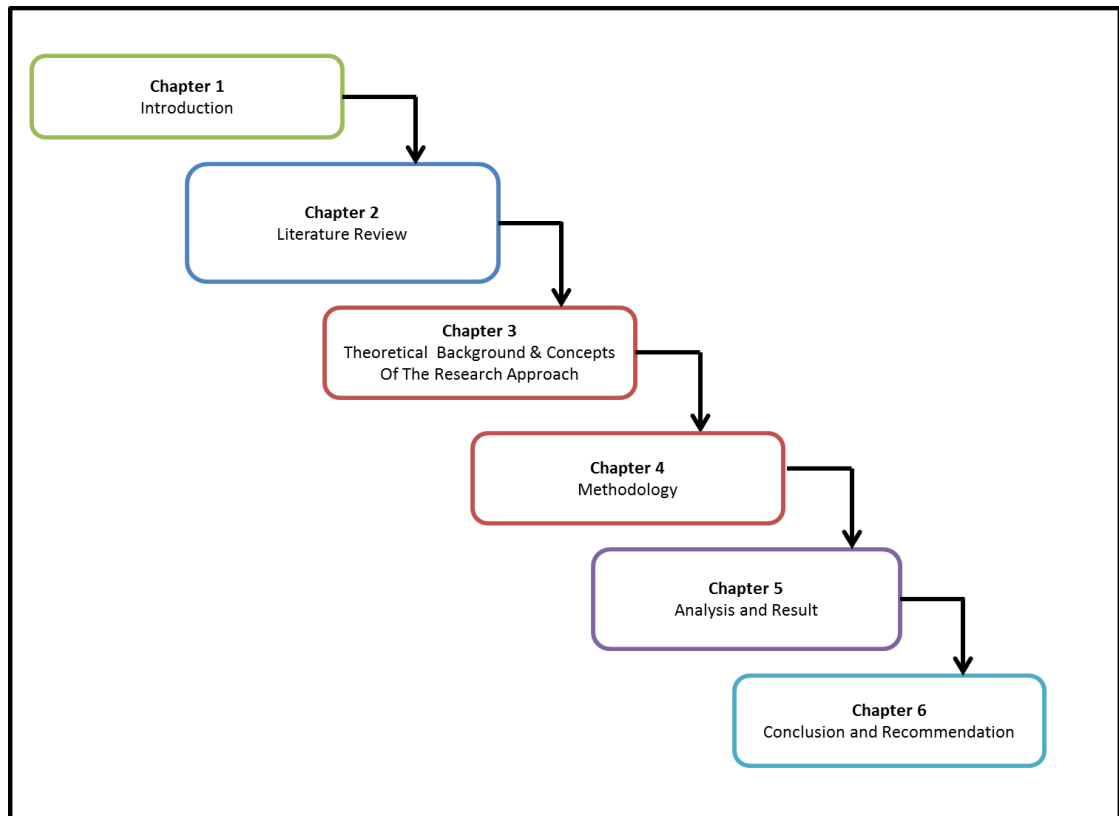


Figure 1.2 The schematic diagram of thesis structure

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