NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

DESIGNING FOR INTER-ORGANIZATIONAL COORDINATION IN INDONESIA'S MARITIME DOMAIN

by

Bagus Jatmiko
Frans Joni Tandiarrang

December 2014

Thesis Advisor: Nancy Roberts
Second Reader: Erik Jansen

Approved for public release; distribution is unlimited

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704–0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	December 2014	Master's Thesis

4. TITLE AND SUBTITLE
DESIGNING FOR INTER-ORGANIZATIONAL COORDINATION IN INDONESIA'S MARITIME DOMAIN

5. FUNDING NUMBERS

6. AUTHOR(S)
Bagus Jatmiko, Frans Joni Tandiarrang

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Naval Postgraduate School
Monterey, CA 93943-5000

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES)
N/A

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government. IRB Protocol number ____N/A____.

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (maximum 200 words)

Indonesia has major agencies in its maritime domain responsible for law enforcement at sea and the management of resources and port authorities. However, there is little coordination among these maritime stakeholders. Indeed, Indonesia Maritime Security Coordinating Board (IMSCB), charged with coordinating policy and operations, is facing major challenges.

The goal of this study is to identify alternative structural designs for the maritime domain and to recommend a design that has the potential to improve coordination and integration of all governmental and non-governmental bodies within this domain.

14. SUBJECT TERMS
Inter-organizational network, Indonesian maritime security, Indonesian maritime domain, social network analysis, information-sharing, geospatial analysis, temporal analysis, link analysis, armed robbery at sea, hotspot area, Malacca Strait

15. NUMBER OF PAGES
137

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UU

NSN 7540–01-280-5500

Standard Form 298 (Rev. 2–89)
Prescribed by ANSI Std. 239–18

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release;distribution is unlimited

DESIGNING FOR INTER-ORGANIZATIONAL COORDINATION IN INDONESIA'S MARITIME DOMAIN

Bagus Jatmiko
Lieutenant Commander, Indonesian Navy
S.H. Hang Tuah University, 2008

Frans Joni Tandiarrang
Lieutenant Commander, Indonesian Navy
S.T. Indonesian Naval College of Science and Technology, 2008

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN DEFENSE ANALYSIS

from the

NAVAL POSTGRADUATE SCHOOL
December 2014

Authors: Bagus Jatmiko
Frans Joni Tandiarrang

Approved by: Nancy Roberts, Ph.D.
Thesis Advisor

Erik Jansen, Ph.D.
Second Reader

John Arquilla, Ph.D.
Chair, Department of Defense Analysis

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

Indonesia has major agencies in its maritime domain responsible for law enforcement at sea and the management of resources and port authorities. However, there is little coordination among these maritime stakeholders. Indeed, Indonesia Maritime Security Coordinating Board (IMSCB), charged with coordinating policy and operations, is facing major challenges.

The goal of this study is to identify alternative structural designs for the maritime domain and to recommend a design that has the potential to improve coordination and integration of all governmental and non-governmental bodies within this domain.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

I. INTRODUCTION....1
A. BACKGROUND....1
B. IMSCB'S CURRENT INTER-ORGANIZATIONAL NETWORK....4
C. PROBLEM STATEMENT....7
D. RESEARCH QUESTION....7
E. THESIS STRUCTURE....8

II. LITERATURE REVIEW: INTER-ORGANIZATIONAL NETWORKS....9
A. GENERAL NETWORK TERMS....9
1. Network Types....10
2. Network Structure....10
3. Network Evolution....13
B. INTER-ORGANIZATIONAL NETWORKS....14
C. INTER-ORGANIZATIONAL NETWORK INTERACTIONS....18
1. Coordination, Cooperation, Collaboration, and Integration....18
D. CASES OF INTER-ORGANIZATIONAL NETWORKS....20
1. Inter-organizational (States) Networks in Peace Operations....20
2. Inter-organizational Health and Public Services Networks....21
3. Inter-organizational Networks in the Maritime Domain....22
E. SUMMARY....24

III. RESEARCH METHODOLOGY....25
A. DATA COLLECTION AND STRUCTURING....25
B. LIMITATIONS OF DATA....26
C. LINK ANALYSIS....26
D. HOTSPOT AND GEOSPATIAL ANALYSIS....26
E. TEMPORAL ANALYSIS....27
F. SOCIAL NETWORK ANALYSIS....27
G. SUMMARY....29

IV. DATA ANALYSIS AND RESULTS....30
A. LINK ANALYSIS....31
B. GEOSPATIAL ANALYSIS....32
1. Accidents at Sea....33
2. Violations at Sea....33
a. Armed Robbery....34
b. Asylum Seeker....35
c. Boundary Violation....37
d. Environmental Pollution....38
e. Human Trafficking....40
f. Illegal Fishing....42
g. Illegal Logging....46
h. Inadequate Documents....47
i. Smuggling....49

j. Illicit Sea Treasure Exploration 52
C. TEMPORAL ANALYSIS 53
1. Accidents at Sea 53
2. Violations at Sea 55
a. Armed Robbery 56
b. Asylum Seeker 57
c. Illegal Fishing 58
d. Illegal Logging 60
e. Inadequate Documents 61
f. Smuggling 62
D. SOCIAL NETWORK ANALYSIS 63
1. Basic Topographical Metrics 64
2. Centralization 66
3. Centrality 66

V. DISCUSSION 73
A. REGIONALLY CLUSTERED NETWORK 73
B. SEA-LANE CLUSTERED NETWORK 79
C. COMPARISON OF THE THREE NETWORK STRUCTURES 84
D. RESOURCES ALLOCATION IN A REGIONALLY CLUSTERED NETWORK STRUCTURE 89
1. Link Analysis 89
2. Geospatial Analysis 91
3. Temporal Analysis 94

VI. SUMMARY AND RECOMMENDATIONS 97
A. SUMMARY 97

APPENDIX. LIST OF INDONESIAN MARITIME AGENCIES 101
A. IMSCB 101
B. NAVY 101
C. MARINE POLICE 108
D. CUSTOM 109
E. PSDKP 110

LIST OF REFERENCES 113

INITIAL DISTRIBUTION LIST 119

LIST OF FIGURES

Figure 1. IMSCB's government network diagram. 5
Figure 2. Centralized structure. 11
Figure 3. Mesh structure. 11
Figure 4. Hub-and-spoke structure. 12
Figure 5. Cluster structure 12
Figure 6. Core/Periphery structure (Sherman, 2008). 13
Figure 7. Growth model of a network (Anklam, 2007, p.133). 13
Figure 8. Modes of network governance (Provan & Kenis, 2005). 15
Figure 9. Relationship between effectiveness at different levels of network analysis and influence by key stakeholders (Milward & Provan, 2001). 18
Figure 10. Working Together Continuum (Kloth and Applegate, 2004, p. 2). 19
Figure 11. Link chart of the Indonesian Maritime Agencies with their authorities. 32
Figure 12. Accident-at-sea hotspots from 2008 to 2013. 33
Figure 13. Armed robbery hotspots with authorized maritime agencies mapping. 34
Figure 14. Asylum-seeker hotspots with authorized maritime agencies mapping. 36
Figure 15. Boundary violation hotspots with authorized maritime agencies mapping. 38
Figure 16. Environmental pollution hotspots with authorized maritime agencies mapping. 40
Figure 17. Human trafficking hotspots with authorized maritime agencies mapping. 42
Figure 18. Illegal Fishing hotspots with authorized maritime agencies mapping. 46
Figure 19. Illegal logging hotspots with authorized maritime agencies mapping. 47
Figure 20. Inadequate documents hotspots with authorized maritime agencies mapping. 49
Figure 21. Smuggling hotspots with authorized maritime agencies mapping. 52
Figure 22. Illicit sea treasure exploration with authorized maritime agencies mapping. ...53
Figure 23. Percentages of accidents on each month of the year from 2008 to 2013 (based on 1,892 accidents; percentages do not add up to 100 because of rounding). 54
Figure 24. Percentages of accidents on each day of the week from 2008 to 2013 (based on 1,892 accidents; percentages do not add up to 100 because of rounding). 54
Figure 25. Armed robbery month-of-year distribution. 56
Figure 26. Armed robbery day-of-week distribution. 57
Figure 27. Asylum seeker month-of-the-year distribution. 57
Figure 28. Asylum seeker day-of-the-week distribution. 58
Figure 29. Illegal fishing month-of-the-year distribution. 59
Figure 30. Illegal fishing day-of-the-week distribution. 59
Figure 31. Illegal logging month-of-the-year distribution. 60
Figure 32. Illegal logging day-of-the-week distribution. 61
Figure 33. Inadequate documents month-of-the-year distribution. 61
Figure 34. Inadequate document day-of-the-week distribution. 62
Figure 35. Smuggling month-of-the-year distribution. 62

Figure 36. Smuggling day-of-the-week distribution. 63
Figure 37. Indonesian formal authority network structure. 64
Figure 38. Formal authority network degree centrality. 69
Figure 39. Formal authority network betweenness centrality. 70
Figure 40. Formal authority network closeness centrality. 71
Figure 41. Indonesian maritime regionally clustered network. 74
Figure 42. Regionally clustered network degree centrality. 77
Figure 43. Regionally clustered network betweenness centrality. 78
Figure 44. Regionally clustered network closeness centrality. 78
Figure 45. Indonesia maritime sea-lane clustered network. 79
Figure 46. Sea-lane clustered network degree centrality. 82
Figure 47. Sea-lane clustered network betweenness centrality. 83
Figure 48. Sea-lane clustered network closeness centrality. 83
Figure 49. Indonesian maritime agencies dispersion map. 90
Figure 50. Accidents at sea time wheel (Data from 2008–2013). 94
Figure 51. Violations at sea time wheel (Data from 2008–2013). 95

LIST OF TABLES

Table 1. List of maritime agencies in the armed robbery hotspots. 35
Table 2. List of maritime agencies in the asylum-seeker hotspots. 36
Table 3. List of maritime agencies in the boundary violation hotspots. 37
Table 4. List of maritime agencies in the environmental pollution hotspots. 39
Table 5. List of maritime agencies in the human trafficking hotspots. 41
Table 6. List of maritime agencies in the illegal fishing hotspots. 43
Table 7. List of maritime agencies in illegal logging hotspots. 47
Table 8. List of maritime agencies in the inadequate document hotspots. 48
Table 9. List of maritime agencies in the smuggling hotspots. 50
Table 10. The list of the agencies in the illicit sea treasure exploration hotspots. 52
Table 11. Number of incidents for each violation type in two categories. 56
Table 12. The basic topographical metrics scores for the formal authority network. 65
Table 13. The centralization scores for the formal authority network. 66
Table 14. Top 15 actors in terms of degree, betweenness, and closeness centrality scores in formal authority network (Results were calculated using ORA SNA software). 68
Table 15. The basic topographic metrics for regionally clustered network. 75
Table 16. The centralization scores for regionally clustered network. 75
Table 17. Top 15 actors in terms of degree, betweenness, and closeness centrality scores in regionally clustered network (Results were calculated using ORA SNA software). 76
Table 18. The basic topographic metrics scores for sea-lane clustered network. 80
Table 19. 80
Table 20. The centralization scores sea-lane clustered network. 80
Table 21. Top 15 actors in terms of degree, betweenness, and closeness centrality scores in sea-lane clustered network (Results were calculated using ORA SNA software). 81
Table 22. The basic topographic metrics scores comparison for three networks. 84
Table 23. The centralization scores comparison for three networks. 85
Table 24. Comparison of top 15 actors in terms of degree, betweenness, and closeness centrality scores comparison for three networks (Results were calculated using ORA SNA software). 86
Table 25. The authorities of maritime agencies for several types of violations. 91

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF ACRONYMS AND ABBREVIATIONS

BASARNAS	Badan SAR Nasional (National Search and Rescue Agency)
BIIS	Bakorkamla Integrated Information System
BPC	Border Protection Command
DJBC	Direktorat Jenderal Bea dan Cukai (Directorat General of Customs)
HQ	Headquarters
ICC	Inter-organizational Collaborative Capacity
ICG	Indonesian Coast Guard
ICHs	Inter-organizational Coordination Hubs
ICT	Information and Communication Technologies
IMSCB	Indonesian Maritime Security Coordinating Board
IO	International Organization
ISCG	Indonesian Sea and Coast Guard
Jakgung RI	Jaksa Agung Republik Indonesia (attorney General of Republic of Indonesia)
Ka BIN	Kepala Badan Intelijen Negara (Chief of State Intelligence Agency)
KPLP	Kesatuan Penjaga Laut dan Pantai (Coastal Guard and Security Unit)
MDA	Maritime Domain Awareness
MMEA	Malaysian Maritime Enforcement Agency
MRCC	Maritime Regional Control Center
MSP	Malacca Sea Patrol
NAO	Network Administrative Organization
Pang TNI	Indonesian Armed Forces Commander in Chief
Pol Air	Kepolisian Perairan (Marine Police Directorate)
Puskodal	Pusat Komando dan Pengendalian (Control Command Center)
PSDKP	Pengawasan Sumber Daya Kelautan dan Perikanan (Maritime and Fisheries Resources Supervision Directorate)
RCC	Regional Control Center
SNA	Social Network Analysis
SLOC	Sea Lines of Communication
TNI	Tentara Nasional Indonesia (Indonesian Armed Forces)

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGMENTS

We would like to thank our advisors, Dr. Nancy Roberts and Dr. Erik Jansen, for their extraordinary support and guidance throughout our academic pursuit at the Naval Postgraduate School, especially during the thesis writing process. Dr. Roberts' expertise and critical analysis for organizational networking, along with Dr. Jansen's expertise in organizational management, were fundamental in making our capstone project a good product.

We would like also to recognize our fellow NPS Indonesian students, fellow NPS international students, and many others who have given their support in so many ways and made our stay in Monterey an unforgettable moment of our lives. There are so many of you that we cannot mention all of you here.

Finally, we were truly blessed with the opportunity to have insights from a remarkable institution such as NPS with its dedicated professors and faculty along with the international office programs that care for the students in their effort of chasing their dreams.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

Indonesia is the world's largest archipelagic country, with more than 13,466 islands spread from west to east (Bakohumas, 2012). It consists of several important sea lines of communication (SLOC) (Koh, 2008) that connect the Indian and the Pacific oceans, which are vital for global maritime navigation. These SLOCs are the shipping routes for a large portion of world trade. In addition, the abundant natural resources of the maritime domain and the country's strategic position have given Indonesia great economic and strategic benefits.

This geographical position, while putting Indonesia in a highly strategic location, also exposes the nation to maritime threats, such as illegal logging and fishing, smuggling, human trafficking, drug trafficking, and territorial breaches that affect its security policies. With three quarters of Indonesia's territory maritime-based, the Indonesian government is searching for better ways to address these menaces in order to protect the country's national security. However, the presence of the waters between and around the islands within the archipelago creates enormous practical difficulties in terms of maritime governance (Cribb & Ford, 2009).

A. BACKGROUND

The maritime domain is, by definition, a multidimensional environment, made more complex in Indonesia's case due to the wide expanse of its territory and the multitude of inter-island waterways that must be monitored and controlled to provide security for the domain. One does not have the privilege to separate the governance based on region as one would on the land. In contrast with land governance that can mark a clear border and build an installation to assist with the governance, the physical fluidity of the sea contributes to the complexity of maritime governance. Maritime governance must take into account the presence of a multi-layered region of the sea—the air column, surface, water column, seabed, and subsoil—all at once in a single maritime location (Cribb & Ford, 2009, p. 13). The complexity of the maritime domain in Indonesia also involves numerous cultural groupings along with local wisdom that are spread throughout the Indonesian archipelago. These differences affect the maritime governance process as an integrated maritime security system.

The Indonesian government's response to these problems initially was organizational—to establish many different maritime agencies to govern the maritime territory

and provide maritime security and defense. When coordination among these agencies became difficult, the government reestablished the Maritime Security Coordinating Board in 2005, a board that had been dormant since 1972. The government realized that Indonesia needed a fully functioning body to coordinate the governance of maritime security. The Presidential Decree No.81/2005 on December 29, 2005 (Perpres, 2005) reestablished the body with the name of Indonesian Maritime Security Coordinating Board (IMSCB) (Sumaryono, 2009, p. 135). The main task of this body was to set up a comprehensive and integrated maritime security system to perform maritime governance. IMSCB has five specific tasks (Sumaryono, 2009, p. 138):

1. Formulate a general policy on maritime security;
2. Coordinate maritime security operations in Indonesian waters;
3. Provide technical and administrative support for maritime security;
4. Provide assistance in maritime security institutional capacity building; and
5. Encourage stakeholder engagement in ensuring maritime security.

The Presidential Decree No.81/2005 (Perpres, 2005) acts as the legislative basis for the operation that is carried out by IMSCB along with other government agencies that have field resources in the maritime domain. The coordination effort is under the supervision of IMSCB.

The Indonesian Maritime Security Coordinating Board (IMSCB) has 12 actively participating agencies, although only six of them have resources in the field in the form of office branches, ships, surveillance equipment, and personnel. These agencies are: the Indonesian Navy, KPLP ("Kesatuan Penjaga Laut dan Pantai" – Coastal Guard and Security Unit); the Customs; the Fisheries Department; and the Marine Police. These agencies have authorities that span the spectrum from law enforcement at sea to the maritime management of resources and port authority. They also handle tasks in accordance with their specific mandates in different sectors within the maritime domain.

Despite these efforts, progress on the integration of the domain appears to have stalled. Contradictory mandates among agencies in the maritime domain and the overlapping jurisdictions in the practical application of law enforcement at sea still exist. For example, KPLP and IMSCB are competing for acknowledgement by the government and other maritime authorities as the 'genuine' Coast Guard. Each agency continues to look for more authority,

resources, and privileges from the government (Supriyanto, 2013). The Ministry of Transportation with its KPLP (Kesatuan Penjaga Laut dan Pantai – Coastal Guard and Security Unit) interprets the Governmental Decree No.17/2008 (Undang-undang, 2008) as being in favor of the Indonesian Sea and Coast Guard (ISCG) under the authority of Ministry of Transportation. Meanwhile, the Ministry for Politics, Law, and Security (Kemkopolhukam) has rebuffed that notion by holding that the Presidential Decree No.81/2005 means that the IMSCB is the sole institution to hold the ISCG's mandates.

This self-defeating competition is due in large part to contradictory legislation and authority that cross jurisdictional lines in the field. A case in point is the question of jurisdiction in investigating the violation of fisheries regulation based on the governmental Decree No.31/2004 (Undang-undang, 2004). It gives investigative jurisdiction to three agencies – the navy, the marine police, and the fisheries investigator. These overlapping authorities weaken coordinated maritime governance in Indonesia and cause confusion for the maritime users due to competing bureaucracy. Without clear and definitive legislative guidance, each agency has its "own" legislation to back its respective authorities and each continues to resist coordination for fear of giving away its authorities and privileges. Maritime agencies end up being reluctant to share their information and instead retain it for internal consumption, further hindering inter-agency coordination. This lack of information-sharing ends up creating different interpretations of the same maritime security problem. So, for example, the navy, marine police, and IMSCB all have their own information gathering centers with the ability to collect data on crime and robbery occurrences at sea. However, information among them is not shared, making data synchronization impossible. Unsynchronized data then produce different analyses about crime and robbery in the maritime domain and eventually create confusion for decision-making authorities when developing maritime policies.

The inter-agency competition and battle for preeminence overshadows the goal of coordination and the recognition of shared purpose among the maritime stakeholders. It is difficult for them to see what is at stake for the whole domain. They have no common ground on which to work together in an integrated system, which further complicates the IMSCB's charge. Instead, the current condition of the Indonesian Maritime Domain can be likened to anarchy—a state of disorder characterized by the absence of overarching authority to provide communication, coordination, and mutual support among countless autonomous actors who

operate without formal connections or fixed boundaries (Gordon, 2008, p. 14). The efforts of each agency remain parochial. Attempts to resolve mutual problems and issues are not occurring because each agency only works to solve problems included within its own mandates and responsibilities.

Even if the Indonesian government were able to eliminate the conflicting legislation and bestow more authority on the IMSCB, given the vastness of the archipelago and the limited funding and insufficient resources, a single agency, even with proper authority to govern the vast domain, is unlikely to effectively and efficiently cover the whole maritime area. We believe a plausible option is the redesign the inter-organizational network to address and mitigate the anarchic conditions in the maritime domain. Before exploring the design options, we offer a brief description of the current inter-organizational network. The remaining chapters of this thesis will explore some design options for the inter-organizational network with the goal of providing better governance and unity of effort for Indonesia's maritime domain.

B. IMSCB'S CURRENT INTER-ORGANIZATIONAL NETWORK

The Indonesian government is attempting to govern its maritime domain in the vast archipelago. Indonesian Presidential Decree No.81/2005 established IMSCB's roles in the maritime domain and established a network of agencies and organizations to work together to reach their common goal. Despite the lack of recognition on the common purpose for the stakeholders and the difficulties in information sharing within the network, this is an initial effort by the IMSCB to coordinate the effort of all of the agencies in the Indonesian maritime domain.

Figure 1 is the network diagram of IMSCB within the government in accordance with the Presidential Decree No.81/2005. It illustrates the existing complex network of governmental maritime agencies responsible for administering control over the archipelago's vast maritime domain.

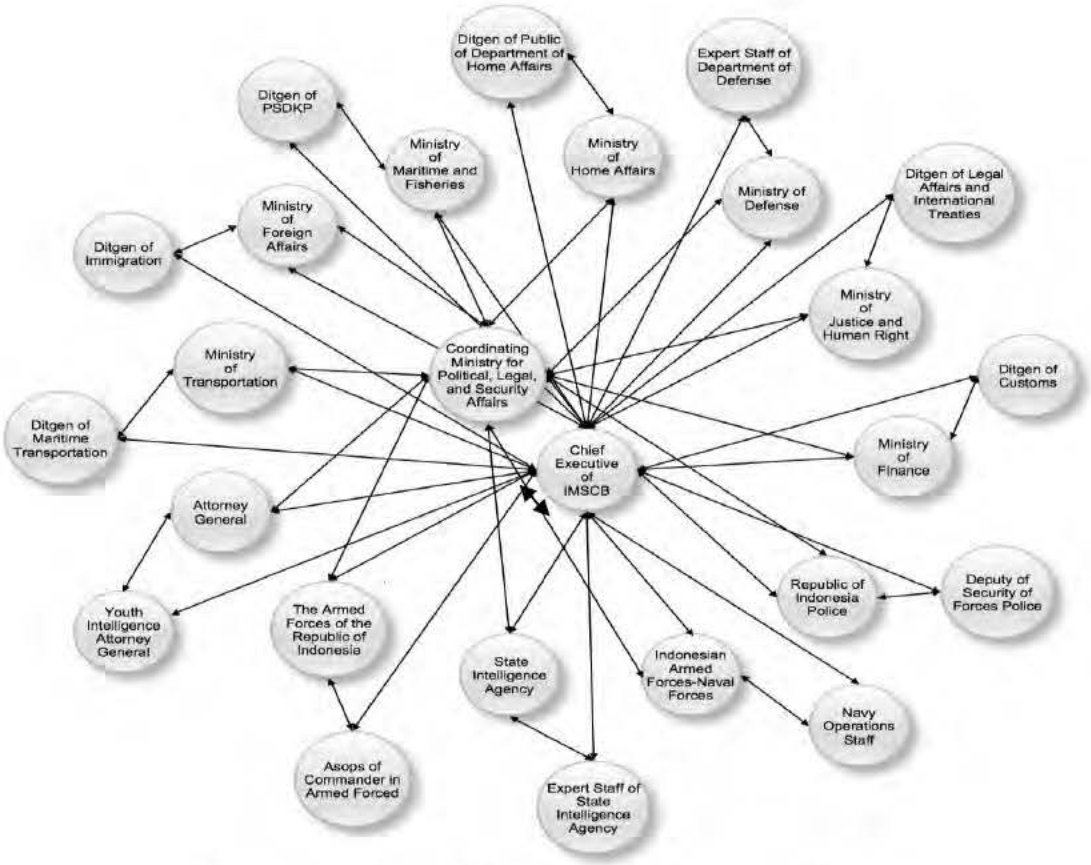


Figure 1. IMSCB's government network diagram.

The IMSB, in the center of the network diagram, is the sole institution with the legitimate authority to coordinate and endorse coordination among all maritime resources. The head of IMSCB is the Coordinating Ministry for Politics, Law, and Security (Kemkopolhukam), while there are 12 members of the IMSCB as the government stakeholders:

1. Ministry of Foreign Affairs (Kemlu)
2. Ministry of Home Affairs (Kemdagri)
3. Ministry of Defense (Kemhan)
4. Ministry of Justice and Human Rights (Kemkumham)
5. Ministry of Finance (Kemkeu)
6. Ministry of Transportation (Kemhub)

7. Ministry of Sea and Fisheries

8. Attorney General of Republic of Indonesia (Kejakgung RI)

9. Indonesian Armed Forces (TNI)

10. Republic of Indonesia Police (Polri)

11. State Intelligence Agency (BIN)

12. Indonesian Navy (TNI-AL)

Besides these 12 members of IMSCB, there is also the secretary of IMSCB who serves as the Chief Executive of IMSCB and is responsible for the implementation of IMSCB's tasks, administration, and technical functions on a daily basis. The chief directly reports to the Coordinating Minister for Politics, Law, and Security.

In order to perform daily functions, the chief executive is assisted by the Sea Security Coordination Team. This team consists of the first-echelon representatives from each of the institutions being represented as members of IMSCB. They are:

1. Director General of Law and International Agreement, Ministry of Foreign Affairs.

2. Director General of General Government, Ministry of Home Affairs.

3. Expert Staff of the Minister of Defense on Security Affairs.

4. Director General of Immigration, Ministry of Justice and Human Rights

5. Director General of Customs, Ministry of Finance.

6. Director General of Sea Transportation, Ministry of Transportation.

7. Director General Sea and Fisheries Resources Supervision, Ministry of Sea and Fisheries.

8. Junior Attorney General for Intelligence.

9. Chief of Operational Staff of Chief of General Staff Indonesian Armed Forces.

10. Deputy Head of Police Security Agency.

11. Expert Staff on Law for the State Intelligence Agency.

12. Chief of Operational Staff of Navy Chief of Staff.

This team prepares the planning of general policy on the subject of maritime security and also to plan, monitor, and evaluate the coordination execution of the maritime security operation (Perpres, 2005).

The purpose of the current network depicted in Figure 1 is to govern the Indonesian maritime domain by involving all government stakeholders. The network itself is a closed system that consists only of the government institutions that have the authority over the maritime issues. It does not include other stakeholders, such a private companies, in the maritime domain.

In principle, the IMSCB is the administrator of the overall network activities and is central to its coordination. The pattern of interactions of the inter-organizational network is similar to a "Hub and Spoke" structure (Anklam, 2007). The central hub is IMSCB which connects all the government stakeholders within the maritime domain, and all stakeholders must go through IMSB in order to link with other stakeholders. **In practice**, however, the inter-organizational network overseen by the IMSCB appears to operating more like anarchy with its attendant challenges and limitations.

C. PROBLEM STATEMENT

The Indonesian government attempted to address the maritime domain's coordination challenges with the reestablishment of IMSCB as a coordinating body. Yet, the IMSCB's subsequent coordination efforts among maritime agencies have not been successful. Although on paper it has an overarching authority, in practice the IMSCB lacks authority to establish common purpose, coordinate activities, and develop operational processes, such as communication and information, to integrate the network as a whole. The current inter-organizational network arrangement produces conditions that are closer to anarchy rather than a system of integrated, collaborative governance.

D. RESEARCH QUESTION

The research question of this thesis is how to improve inter-organization coordination in Indonesia's maritime domain especially as it pertains to network governance and operational deployment patterns to ensure maritime security?

E. THESIS STRUCTURE

This thesis consists of six chapters. Chapter I presents the background for the capstone project by explaining the background and current situation and conditions that are present in the Indonesian maritime domain. The chapter offers alternative inter-organizational network designs that attempt to correct for the deficiencies in the current design. A review of all the relevant network theories and literature is presented in Chapter II, while Chapter III describes the research methodologies employed in this project: geospatial analysis; social network analysis; and temporal analysis. The results from these analyses are presented in Chapter IV.

Following this analysis, Chapter V presents an alternative network design to address the problems inherent in the current inter-organizational design of Indonesia's maritime domain. Finally, Chapter VI reviews the results of the research. It concludes the thesis and offers what we believe is a reasonable and plausible solution to current problems in administering a geographically dispersed domain in a politically and governmentally diverse environment.

II. LITERATURE REVIEW: INTER-ORGANIZATIONAL NETWORKS

This chapter addresses basic questions about networks. What are they? How are they created and designed? What purposes do they serve? How can we evaluate their performance and effectiveness? And, how can we facilitate inter-organizational network coordination to improve their performance? Furthermore, this chapter recognizes the implementation of inter-organizational networks in many fields that could be the source of ideas for the Indonesian maritime network improvement.

A. GENERAL NETWORK TERMS

Networks are formed from the relationships among actors, be they individuals, organizations, or even nations. O'Toole (1997) defines networks as the structure of interdependence involving multiple organizations that are bonded by ties of authority bonds, exchange relations, and form coalitions based on common interest in a single structure. Expanding on this definition, McGuire (2003) considers networks as structures that involve multiple nodes of agencies or organizations with multiple linkages. The structures could be formal or informal, and are typically intersectoral or intergovernmental. Furthermore, Agranoff (2004) describes networks in public organizations as a structure composed of governmental and nongovernmental agencies working together to exchange information and formulate and implement policies.

Networks can be formed out of numerous types of relationships. Borgatti et al. (2013) explain that there can be multiple relationships in a single network. Each of relationship type determines the corresponding network. For example, measuring friendship ties will result in a friendship network. Likewise, measuring family ties will present in a family network. Furthermore, analysis of a network can combine the ties in various ways depending on the requirement. Borgatti argues that networks can be grouped into two categories (pp. 3–5). They are personal ties signifying inter-personal relationships and acquaintanceship ties that refer to the relations among organizations on a large scale.

1. Network Types

Milward and Provan (2006) explain the types of networks as fundamental to the understanding of network management. They describe four types of public networks that consist of service implementation networks, information diffusion networks, problem-solving networks, and community capacity building networks.

Service implementation networks normally provide services as the result of the collaboration of two or more organizations that provide joint services. This type of network utilizes horizontal management of service providers in the forms of firms, nonprofits, or government agencies.

Information diffusion networks primarily focus on information sharing across the departmental boundaries with horizontal and vertical ties among interdependent governmental agencies.

Problem-solving networks have the primary purpose of solving existing complex problems, such as the one addressed in this thesis. This type of network often builds on the temporary information diffusion networks that become dormant after the problem is resolved.

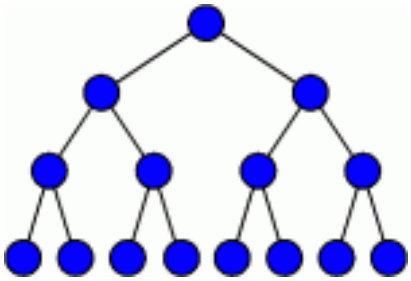
Community capacity building networks have the goal of building social capital in community-based settings. These networks, which are present and future oriented, normally involve a wide range of agencies to address any problem that may arise in a community.

Literature on networks commonly describes three central functions: information diffusion and knowledge exchange, network learning, and innovation (Popp et al. 2013, p. 8). However, a network that has a primary function, such as service-provider network, also will develop multiple functions in information sharing and knowledge exchange, learning, and capacity-building.

2. Network Structure

Anklam (2007) describes network structure as the most tangible property of a network. Anklam explains that network structures have some distinctive patterns although variation in structure is infinite. The basic patterns are: centralized structure; mesh; hub-and spoke; clusters; and core/periphery.

Centralized structure is a pattern that disseminates authority from a single person on the top or center of the network structure through a structured series of subgroups (Anklam, 2007, p. 53). In this pattern, the nodes are connected by a relationship that a node in the top/center of the structure leads (see Figure 2). Both of the network structure in Figure 2 are the same and depict the same network structure.



or

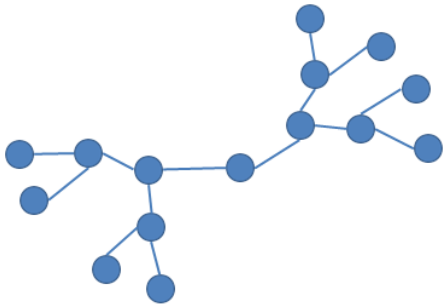


Figure 2. Centralized structure.

Mesh is a network structure in which the connection among nodes is equal to every other node (see Figure 3). This pattern signifies a close-knit entity (Anklam, 2007, p. 54).

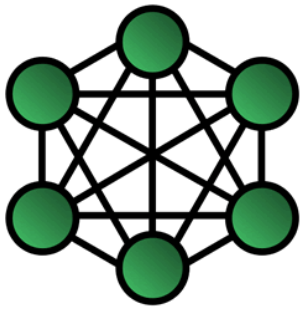


Figure 3. Mesh structure.

Hub-and-Spoke has a star or starburst structure (see Figure 4). The hub is the central connector node among spokes within a network.

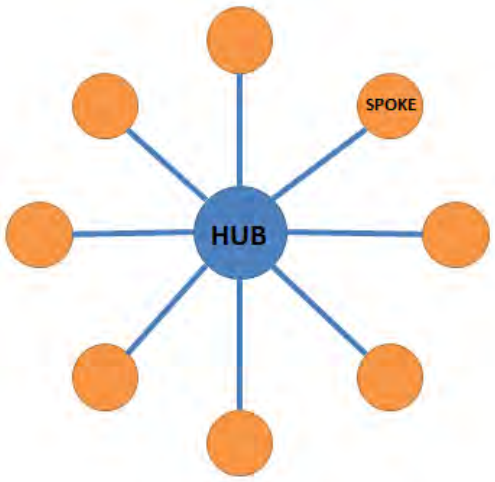


Figure 4. Hub-and-spoke structure.

Clusters are connected or isolated groups of nodes within a network structure. The presence of clusters could indicate the emergence of small groups within a network (see Figure 5).

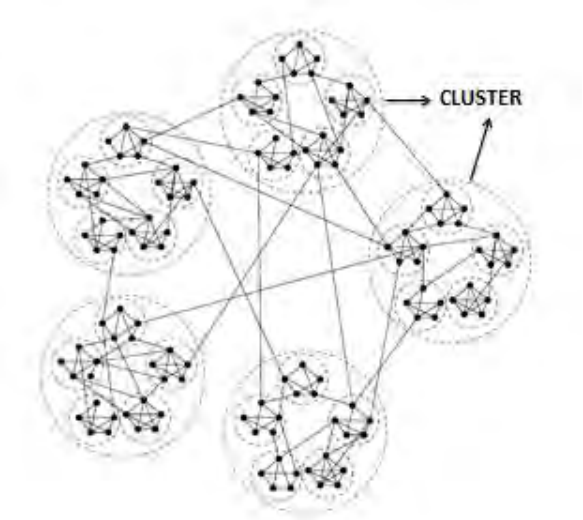


Figure 5. Cluster structure

Core/Periphery structure is a group of highly connected nodes in the middle of the structure that are connected to other nodes in the periphery of the network. The blue nodes in Figure 6 represent the core structure and the green nodes are the periphery.

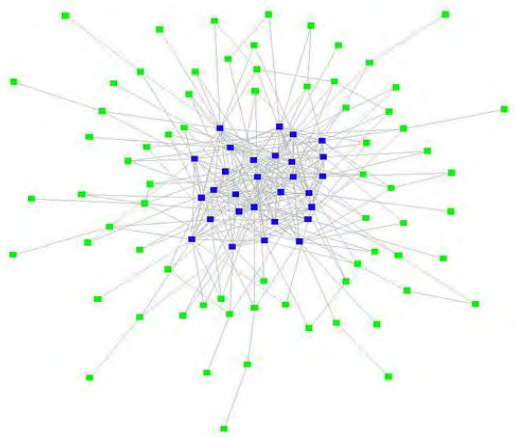


Figure 6. Core/Periphery structure (Sherman, 2008).

Social network analysis metrics are the measurement tools used to describe network structures that are difficult to discern with the naked eye. These metrics, and others drawn from social network analysis, are powerful tools to analyze network structures and their relational ties.

3. Network Evolution

Anklam (2007) describes a network's evolution over time. In Figure 7, she divides the growth model for a network's five phases: initiation, purpose, organize, grow, and perform.

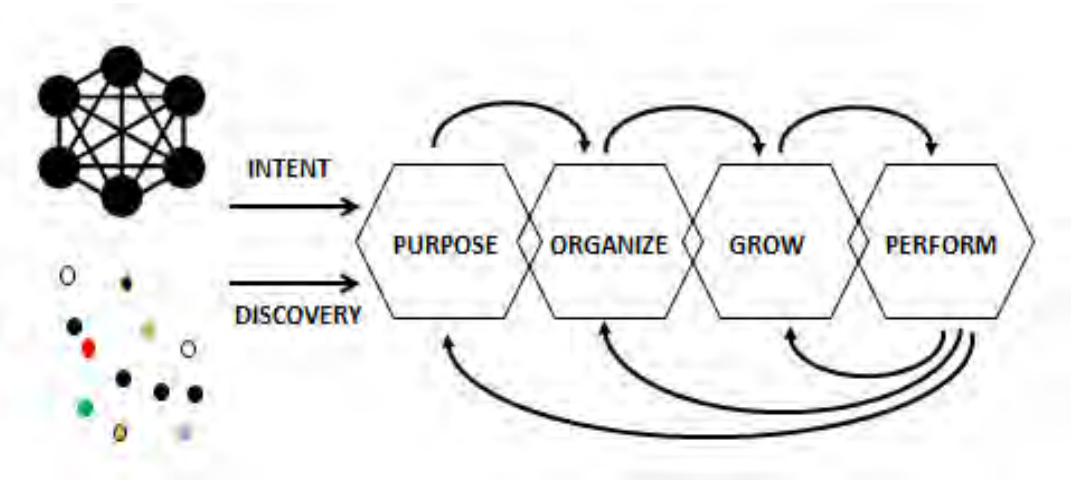


Figure 7. Growth model of a network (Anklam, 2007, p.133).

1. Social actors initiate or begin networks either through intent or discovery. Intent means that the network was initiated through the intention of one or more entities that already have a clear purpose for the network's establishment. On the other hand, discovery means that the network was discovered through the process of interaction among entities that then surfaced similar ideas and purposes that led to network formation.

2. Network purpose is what the network hopes to achieve. It is the foundation of a network. The purpose then drives more specific details of a network's design.

3. Networks organize by identifying members and strengthening their relationships. The network also organizes by finding and evolving suitable structures and governance models (see Section B), establishing norms of participation, and setting up the network's pace and routines to get work done.

4. During the growth phase, the network builds additional capabilities to develop and support tasks necessary to achieve its goals. Particular attention is paid to how members are working together to reinforce core values and network purpose.

5. In the performance phase, networks monitor their outputs and outcomes to determine how effective and efficient they are in achieving their purpose. Monitoring key relationships in the external environment is essential to this effort. As the environment changes, the network must adapt. However, as Anklam notes, network growth does not follow a steady progression through all five phases. Setbacks and disturbances are expected as illustrated by the arrows heading leftward from the perform phase in Figure 7. Although movement is considered to be natural for long-lived networks, not all networks are able to make dynamic changes needed to sustain their activities over time.

B. INTER-ORGANIZATIONAL NETWORKS

Provan, Fish, and Sydow (2007) consider the inter-organizational network to be the "whole network" that consists of multiple organizations linked through multifaceted ties. The term 'whole' refers to a network consisting of three or more organizations connected to support the whole network's goals. Based on their 20 years studying inter-organizational networks, the authors focus on three key elements: n*etwork governance, network leadership and management, and network performance.*

Network governance is the coordination mechanism of a network that focuses on the network as the unit of analysis in order to guide the network in a steady state (Kenis & Provan,

2005). Kenis and Provan (2005) introduce the typology illustrated in Figure 8 to distinguish among the three modes of network governance: self-governance, lead organization governance, and network administrative organization (NAO) governance. Self-governance, or "shared governance," is the most common and involves all network members in active network management and decision making. It is characterized by small numbers of members in a decentralized network structure. Its advantages lie in the ease of its formation and high levels of commitment. Its disadvantages lie in frequent meetings, the lack of clear goals, and the challenges of reaching consensus on network issues.

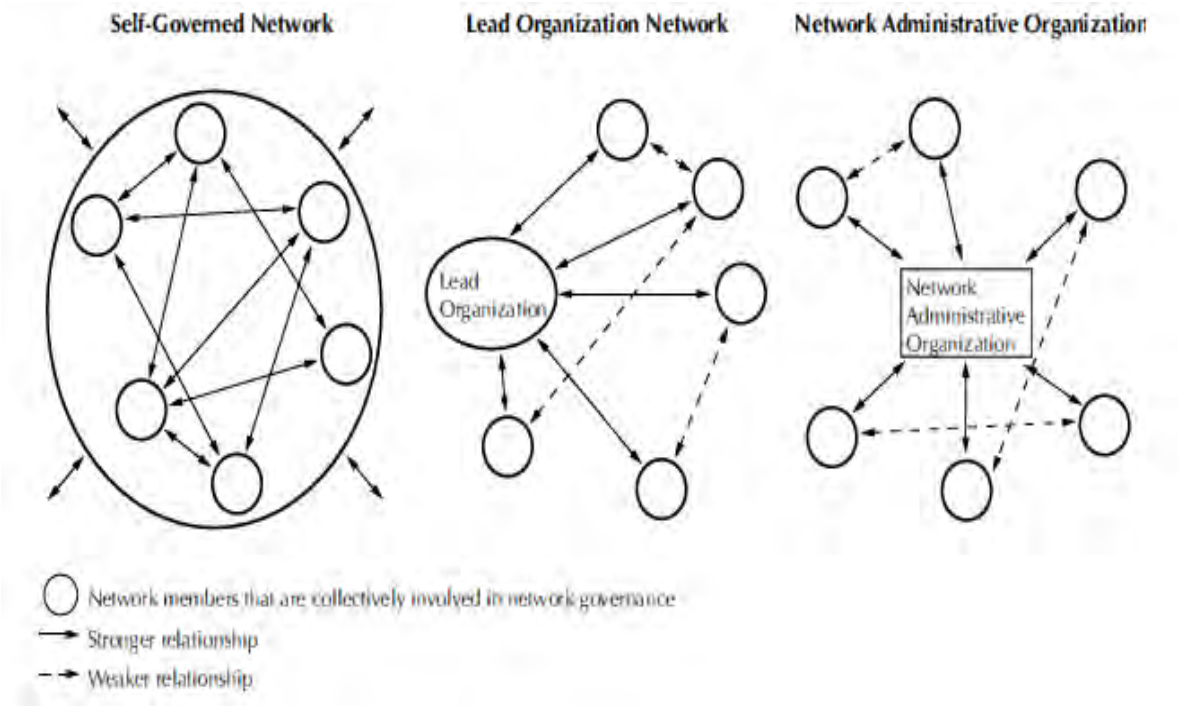


Figure 8. Modes of network governance (Provan & Kenis, 2005).

As networks increase in size and complexity, they move toward the other two governance modes: the lead organization or the NAO mode. The lead organization identifies one of the more powerful organizations with sufficient resources and legitimacy to assume the administrative burden for the inter-organizational network. The advantage of this mode is the efficiency of clear network direction and management. The disadvantages are the potential for lead organization domination and the low participation from the members.

The third governance mode is NAO. It is similar to the lead organization but with one exception. In the NAO, an organizational entity is created to oversee and manage the whole network. It attends only to administration functions and network management. It does not get involved in the provision of services as other network members do. However, the NAO form also has the disadvantages of higher operation costs, a more complex administration process, and a potential loss of control and decision authority for some network members.

Network leadership and management is described by Milward and Provan (2006) as providing a task framework to guide inter-organization network leaders and managers in inter-organizational networks no matter what governance mode they choose. The five tasks within this framework are:

- *Management of Accountability*. This task identifies who is responsible for what to ensure everyone in the network is doing their tasks accordingly. Moreover, the task is also to avoid any free riders within the network. At the individual organization level, the managers are to ensure the contribution of their respective organizations to the network through activities and resources.

- *Management of Legitimacy*. This task convinces the stakeholders that the network is functioning as intended and is adding value from their perspectives. The legitimacy of network performance is intended to attract positive publicity, resources, and new members. At the organization level, the manager in the network is to demonstrate the value of participation and legitimize the role of organization among the members.

- *Management of Conflict*. The task identifies tensions in the network and search for ways to address and solve them. In order to reduce tensions within the network, the manager of the network should act as the "good faith" broker. In individual organizations, the task resolves problems with individual network members and acts as a link in order to balance between organization and network.

- *Management of Governance*. This task sets up decision making for the network and ensures that interests of network members are represented. It determines the proper structure for the network governance and then implements and manages the structure. At the individual organization level, the task is to work effectively based on the network structure.

- *Management of Commitment*. The task builds network loyalty and support and sustains them over time by informing network participants of all the activities and distributing network resources equitably. At the organization

level, the task is to build commitment from within the organization to support network's goals.

Network performance is the achievement of the positive level of network outcomes that cannot be attained by one member working alone (Popp et al. 2013, p. 10). It only can be attained with unity of effort among all network members. Despite claims to the contrary, networks do not always produce positive outcomes and some even fail. Their sustainability and outcomes, as Human and Provan (2000) have found, depend on external and internal legitimacy and support, especially during a network's early stages of evolution. Thus, Provan and Milward (2001) underscore the importance of evaluating the effectiveness of inter-organizational networks. All network members, especially those who are allocated scarce public funding, need to demonstrate they are utilizing resources efficiently and effectively to meet the needs of the public and the network.

According to Milward and Provan (2001), network evaluations must include three levels of analysis: community, network, and organization/participant levels. The network can achieve effectiveness by minimally satisfying the needs of each group—principals, agents, and clients—instead of focusing only on one particular level of analysis. Principals monitor and fund the network; agents work as network administrators and service-level professionals; and clients receive the products or services from the network. The effectiveness of one level, however, does not ensure the effectiveness of the other two. As illustrated in Figure 9, the goals between network-level with community-level and organization-level, as shown by the two-way arrow between the organization level and the network level depict a reciprocal relationship, as does the two-way arrow between the network level and the community level. However, the interrelationship between the community-level and organization-level, as depicted by the one-way arrow between the organization and community level suggests that particular relationship is not mutually supportive.

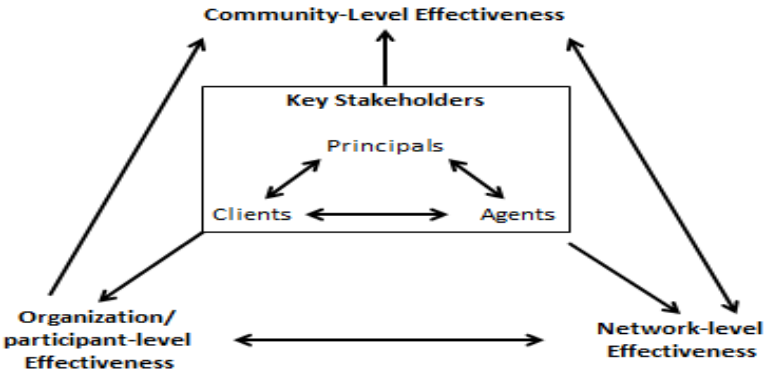


Figure 9. Relationship between effectiveness at different levels of network analysis and influence by key stakeholders (Milward & Provan, 2001).

In addition, the criteria needed to measure network effectiveness vary across the levels. At the *community level*, the criteria are the aggregate outcomes for the population of clients being served by the network and the overall costs of service for the client within the network community. At the *network level*, the criteria are the growth of network membership, range of services provided, absence of service duplication, relationship strength, creation and sustainability of the NAO, integration of services, cost of network maintenance, and the member's commitment to network goals. The criteria for the last level, the *organization level*, are agency survival, enhanced legitimacy, resource acquisition, cost of services, service access, client outcomes, and minimum conflict among multi-program agencies across the network.

C. INTER-ORGANIZATIONAL NETWORK INTERACTIONS

Organizations have numerous ways to interact with other organizations. Their level of involvement depends on their purposes and how they view the constraints and opportunities in their environments.

1. Coordination, Cooperation, Collaboration, and Integration

Kloth and Applegate (2004) identify four ways organizations can interact in their *Working Together Continuum* (Figure 10). The continuum begins with independent organizations at the top right and moves clockwise to continuum, coordination, cooperation, and collaboration, and ultimately to integration.

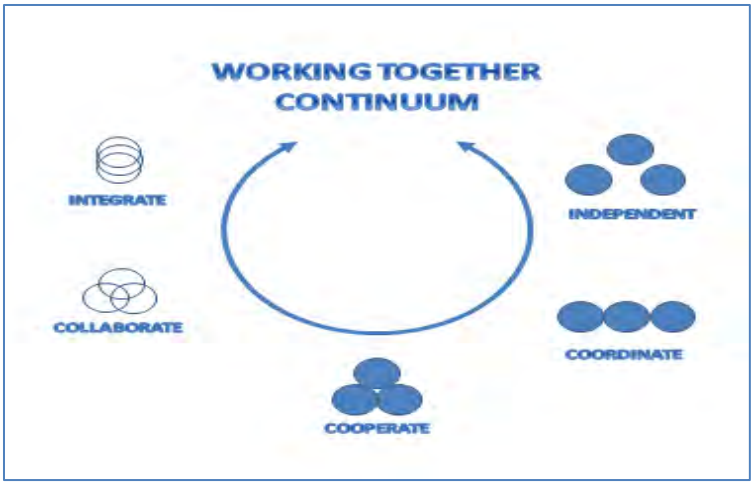


Figure 10. Working Together Continuum (Kloth and Applegate, 2004, p. 2).

Independent. Independent organizations pursue their self-interests without concern for or connections with other organizations even though they are in the same sector.

Coordination. When organizations find value in working with other organizations, they identify specific ways they can interact while maintaining and protecting their interests and boundaries. An example of coordination is the inter-service coordination between the federal and state government in a distinct case. They may have a joint operation, but the boundaries remain clear.

Cooperation. When organizations find value in working with other organizations, they share information and technical capabilities. Cooperation can be illustrated by a military joint exercise in which the participants implement information sharing and provide technical capabilities among them.

Collaboration. When organizations find value in working with other organizations, they pursue a common purpose, share information and financial benefits, and align internal policies and practices. An example of collaboration is the relation of the multinational military operation in which all of the militaries involved within the collaboration conduct information sharing, as well as alignment in policies and practices, in order to attain the mission goals.

Integration. When organizations find value in working with other organizations, they conjoin their purposes, operations, and policies. A fine example of integration is the business

merger between two companies that combines all of their assets, operations, and policies for the same purpose.

In a similar vein, Roberts describes a continuum of inter-organizational arrangements. Coordination is positioned at the lowest level because the participants have a low degree of involvement with other network members (N. Roberts, personal communication, November 10, 2014). Cooperation, in the mid-range of the continuum, requires a higher degree of organizational involvement and interaction, although some resources remain exclusively at the disposal of the respective organizations. The next level of inter-organizational arrangements is collaboration, in which participants begin to share their resources and operational patterns.

Kloth and Applegate note that it is possible for organizations to return to former arrangements, so the continuum should not be interpreted to mean that one form of interaction is inherently better than the others. Selection depends on what is the best fit with the environment and the organizations' purposes. In the case of the Indonesian maritime domain, it would appear that the IMSCB is attempting to introduce coordination mechanisms to govern the domain, although as described in Chapter I, it faces a number of challenges to move the organizations from independence to coordination.

D. CASES OF INTER-ORGANIZATIONAL NETWORKS

How have other organizations dealt with challenges in their respective inter-organizational domains? We turn to cases in three domains—peace operations, health service networks, and other maritime domain networks—to identify ideas for improving inter-organizational coordination.

1. Inter-organizational (States) Networks in Peace Operations

Inter-organization coordination has become one of the most important factors in peace operations within the United Nations. Indeed some experts see coordination as a key factor that determines operational success (Nitsova, 2012, p. 10). However, challenges in this domain are great. Different views about organizational missions, end results, and operations make coordination difficult (Paris, 2009, p. 53). One study of inter-organizational coordination in hostile environments recommends a centralized governance network (Nitsova, 2012, p. 48).

Obstructions to coordination are typically found in national authorities, so strong authority in the inter-organizational network is advised.

Balas (2011) examines the motivation for joining inter-organizational networks. *Resource-based* motivation occurs when international organizations (IOs) need others' resources to support their operations. *Complementarity-based* motivation occurs when each IO pursues its comparative advantages (e.g. conflict resolution skills), and joins with other organizations to complement its skill sets. The *complexity-based motivation* occurs when IOs recognize that they lack the knowledge, skills, and competencies in complex peace operations so they seek partners to learn from their experiences.

These cases suggest that giving attention to the inter-organizational network structure and governance, as well as to reward systems, might be worth considering in improving coordination in Indonesia's maritime domain.

2. Inter-organizational Health and Public Services Networks

Provan and Milward (1995) conducted a comparative study of effectiveness in U.S. inter-organizational mental health networks. Their multi-constituency participants included clients, families, service professionals, state-level policy makers, funders, agency staff, administrators, and taxpayers among the most prominent ones (Provan & Milward, 1995, p. 9). They found more effective networks focused on client outcomes, operated in states that provided incentives and monitoring mechanisms, and were run locally within a larger system that was centrally coordinated through a single core agency (Provan & Milward, 1995, p. 31). Despite this, integration among provider organizations did not automatically ensure the effectiveness of the overall system. The outcomes were realized only by those networks that had centralized network integration, direct, non-fragmented external controls, stability, and sufficient resources (p. 28).

Gibbons' (2007) research demonstrates the link between the inter-organizational network structure and the network's ability to diffuse information system wide in a health system. The results of her research confirm that certain network structures support information diffusion, knowledge sharing, collaboration, and access to resources. Gibbons came up with five network structures that consist of *unconstrained network*, *fully connected*, *chain structure*,

hierarchy, and *connected clusters*. From those structures, unconstrained networks (unconstrained and fully connected) always outperformed the more constrained structures in information diffusion. Among the three constrained structures, the chain structure is the worst for diffusing information while the other two structures hold merely the same scores for information diffusion. The links building that connects sub-groups within the poorly performing networks, however, can facilitate the information dissemination throughout the network without increasing the network density. Her research recommends small interventions by creating additional connections among members in the network structure in order to increase its effectivity in diffusing information to the whole system.

These cases point out the importance of a centralized network system with the inclusion of incentives to improve network effectiveness. Furthermore, these examples suggest creating small numbers of additional connections can actually increase the capability of information diffusion within the network structure. The results from these cases could become useful inputs in creating alternative structures in the Indonesian maritime network. Moreover, the five structures' impact on the information diffusion could be taken as models in finding the most suitable structure for the Indonesian maritime environment.

3. Inter-organizational Networks in the Maritime Domain

Idrobo (1997) searched for alternative designs for Colombia's inter-organizational networks in the maritime domain. Colombia had many competing organizations without an overarching authority, similar to Indonesia. Indeed, Colombian authorities hesitated in accepting a newly formed Coast Guard as their lead agency. Idrobo concluded that a single organization with ultimate authority would be required to ensure coordination of the Colombian maritime domain. This is also the case with Indonesian maritime domain. The similarity of the challenges and the problem could be the exemplary case for the improvement of Indonesian maritime network.

The Australian government formed the Border Protection Command (BPC) in 2006 as a joint agency between the Ministry of Defense and the Ministry of Immigration and Border Protection due to increasing multi-dimensional threats. The BPC has primary responsibility and operational control over assets of both Australian Defense Forces and Customs and Border Protection (Border Protection Command, 2014). Moreover, the BPC has several maritime

agency partners who coordinate their tasks especially in border areas. The success of BPC's inter-organizational network suggests how Indonesia's inter-organization network might be configured to improve its coordination. The network structure that involves many inter-departmental maritime agencies could be a subject of study to improve the Indonesian maritime network.

Similar to the BPC, the Malaysian government established the Malaysian Maritime Enforcement Agency (MMEA) in 2006. It found serious problems in Malaysia's maritime enforcement due to numerous agencies with overlapping functions, jurisdictions, and an inefficient use of resources (MMEA, 2013). The MMEA's new mission is to enforce laws at sea and to protect the security of Malaysian water territory. It acts as the principal agency for the maritime security issues and reports directly to the office of the Malaysian prime minister. Under direct order from the prime minister, MMEA subsumed several specific authorities from other maritime agencies in the maritime domain. The situation of MMEA formation is similar to Indonesia's IMSCB current condition with several agencies that dwell in the same domain with overlapping authorities and jurisdictions. The MMEA' governance structure also may be studied as one alternative for Indonesia's maritime network.

Tumin (2007) presented a case study about the importance of information sharing in inter-organizational networks in the United States Navy, Coast Guard, and Department of Transportation to build maritime domain awareness. The creation of the Maritime Domain Awareness (MDA) system played a vital role in maritime security by permitting information sharing and dissemination that enhanced situational awareness. Information sharing in the Indonesian maritime domain also plays a pivotal role. The creation of an information sharing center and improvements in information connectivity among the maritime agencies might be a good way to mitigate some of the coordination problems. The implementation of an MDA system similar to the one in this case could improve the information sharing system in the Indonesian maritime network and could enhance the inter-agencies coordination process.

Hocevar (2012) describes the formation of the Malacca Sea Patrol (MSP) in 2004, a multi-national network combating piracy that consists of several littoral states adjacent to the Malacca Strait region, including Indonesia. In addition to MSP, the Regional Cooperation Agreement on Combating Piracy and Armed Robbery against Ships in Asia (ReCAAP), initiated by Japan, was established at the strategic level in 2006. Both of these inter-

organizational and multinational formations utilize an information-sharing center to coordinate their operation as well as to disseminate the information among them. These inter-organizational networks signify the importance of having inter-organizational collaboration to improve maritime security in the region by utilizing the information sharing, data collection, and analysis technologies. Furthermore, Hocevar (2010) also explains the network innovations in port security. The Joint Harbor Operations Center and Maritime Unified Command in San Diego area set up integrated operation centers for inter-organizational coordination among maritime agencies in San Diego port security. These two centers provided resources and data to decrease response time and increase common situational awareness among the participant agencies. Utilizing an information-sharing system, the centers were able to increase each agency's awareness of the other's assets and improve the efficiency of operational deployments.

E. SUMMARY

This chapter summarizes numerous studies that describe networks and their basic features which enable them to coordinate activities in a common environment. Several of the methods reviewed in this chapter are used to analyze the Indonesian maritime domain in Chapter III.

III. RESEARCH METHODOLOGY

Our search for ways to improve Indonesian maritime domain network coordination begins with data collection and data structuring. Our data primarily come from the IMSCB, in particular events that involve resource allocations and the incidents occurring within the maritime domain. Once we explain how our data are collected and structured, we briefly describe our analysis using four different methodologies: link analysis; geospatial analysis; temporal analysis; and social network analysis. The goal of our analysis is to find a better structure for the maritime network. Ideally, the new structure will ensure better communication and information exchange among the agencies and more efficient operational deployments for limited stakeholder resources.

A. DATA COLLECTION AND STRUCTURING

We were unable to collect data from all the Indonesian maritime stakeholders due to limited data availability and resources. Instead, we drew data from 6 maritime agencies that have field resources and conduct operations at sea under the coordination of IMSCB. The data for these six agencies primarily came from open sources on the Internet accessed through their official websites. The six maritime agencies are: the IMSCB;[1] the Navy;[2] the maritime police;[3] the fisheries department/PSDKP;[4] the coastal unit/KPLP;[5] and the customs.[6]

From the six official websites, we identified 413 organizations that interact within the Indonesian maritime domain. These organizations, henceforth known as nodes, represent the all organizations that participate in field operations under the coordination of IMSCB, Taken as a whole, they create the formal authority network of the Indonesian maritime domain.

---

[1] http://www.bakorkamla.go.id/index.php/profil/visi-misi-3

[2] http://www.tnial mil.id/Home.aspx

[3] http://www.polri.go.id/polda/

[4] http://akp.kepegawaianpsdkp.com/daftar-upt-pengawasan.html

[5] http://kemhubri.dephub.go.id/hubla/

[6] http://www.beacukai.go.id/index.html?page=kantor-bc/pangkalan-sarana-operasi.html

B. LIMITATIONS OF DATA

In addition to the limitations noted above, this study uses the data taken from the IMSCB data source on the Indonesian maritime domain. The data taken from IMSCB and other open sources are not fully reliable since they are collected without going through distinct processes to ensure the data reliability. Without proper handling, the data collected will affect the presentation in this study. Considering these limitations of analysis, the results of this study should be considered tentative and exploratory rather than definitive. Our methodological approach (see below) could be the basis for future study when data collection and processing have been improved. .

C. LINK ANALYSIS

We began our study using software Palantir to conduct link analysis among the 413 nodes. Our analysis reveals how the nodes are interconnected with one another in the formal authority network. Link analysis is a method to evaluate the process of building up networks of interconnected objects in order to explore pattern and trends (Berry & Linoff, 2004, pp. 321–322). Link analysis is often confused with social network analysis because both examine the pattern of relations among various objects. However, there is one basic difference between these two methods. SNA includes only similar types of objects while link analysis examines relations between different object types (Everton, 2012, p. 6).

D. HOTSPOT AND GEOSPATIAL ANALYSIS

Hotspot spatial analysis, a subset of geospatial analysis, enables us to detect the patterns of occurrence of maritime incidents within certain vulnerable areas and to identify areas that need more attention due to illicit activities such as robbery at sea, illegal logging, smuggling, drug trafficking, and many more criminal activities.

Geospatial analysis provides a specific perspective on a distinct location in viewing events, patterns, and processes that operate on or near the surface of the earth (Smith et al. 2012). The mapping of maritime incidents in Indonesia uses geospatial analysis to determine the gravity of the maritime issues. These incidents then can be grouped into clusters to identify the types of the incident that take place in certain geographical locations. Ultimately, Smith explains the focus of geospatial analysis on the occurrences' locations and their linkage to the geographic information. In order to analyze the geospatial aspect, *ArcGIS* software is employed

to map the occurrences and relate them to specific attributes in order to predict plausible actions (Eris, 2014). *ArcGIS* is utilized to process the data, so they can be used to find the hotspots and outliers and natural clusters of data in finding the best way to employ resources.

We also employ hotspot visualization to anticipate the proper deployment of necessary resources to those areas most in need. Using data from the maritime network resources mapping (see below) and the hotspot mapping, a network's overall mapping picture illustrates the location of the network's resources and the incidents that take place in a single operational visualization. This operational picture then is able to identify the network facility closest to the hotspot. The analysis can also calculate the feasible distance from the resources location to the target area in order to find out whether the distances are within the reach of the network's assets. Thus, our integrated geospatial mapping method enables us to locate resources across the domain and to suggest ways to distribute those resources based on the closest facility in order to reduce transaction costs.

E. TEMPORAL ANALYSIS

Within the Indonesian maritime domain network, temporal analysis reveals information about the time patterns of incident occurrences in the sea. Most importantly, it also enables us to recognize dynamic changes in the pattern of incidents over time (Peuquet, 1994). Our temporal analysis utilizes Palantir software which allows us to isolate certain interesting patterns such as the spikes or low-points of an activity over time. Palantir, a software application for integrating, visualizing, and analyzing information (Palantir, 2004), offers is other advantages as well. It enables us to do timeline analysis and create graphic representations and event histograms and integrate all types of analyses such as statistic, regional, temporal, geospatial, and SNA (see below) into one platform (Payne et al. 2008).

F. SOCIAL NETWORK ANALYSIS

Social network analysis (SNA) is a methodology used to analyze the structure of networks with quantitative measures (Everton, 2012, p.5). Moreover, SNA determines the interaction and ties among actors within the networks in which they are embedded (Everton, 2012).

This study begins with an examination of the formal authority network structure under IMSCB's coordination. It then explores two additional network structures—the regionally-

clustered network and sea-lane clustered network—as alternatives to improve network coordination.

As mentioned in the data collection above, each structure of these networks within the Indonesian maritime network consists of six maritime agencies with 413 nodes that comprise a series of matrices. The matrix construction is then used for processing the data using the ORA software program. ORA software has many features. It is an analysis tool to examine network change over time and space with a variety of geo-spatial network metrics and change detection techniques. It also can identify model network changes over time and perform Course of Action analysis. ORA software also is used to describe a network's topography and centrality and detect risks or vulnerabilities of network design structure. Moreover, it can assist the analyst in evaluating one or more networks by assessing the nature of, features of, change in, and determinants of complex networks (Carley et al. 2013).

Our SNA analysis focuses on six parameters to assess the network's formal structure. Those parameters are *diameter*, *average distance*, *density*, *betweenness centrality*, *betweenness centralization,* and *closeness centrality*. *Network diameter* refers to "a network's longest geodesic line and could indicate how dispersed the network is. Everton explains that a network with large diameters may be more decentralized than a small one (Everton, 2012, p. 137). Moreover, he argues that decentralized networks are suitable for solving non-routine, complex, and/or rapidly changing problems or challenges (Everton, 2012, p. 137). According to Everton (2012), "*Average distance* refers to the average length of all the shortest paths between all actors in a network." (p. 137). He argues, "Information should diffuse faster through networks with lower average distance than those with higher average distance" (p. 137). Good information diffusion within a network may ensure effective and efficient coordination process in the formal structure among agencies within a network.

The next parameter considered is *density* of the network, which Scott et al. (2005), defined as "the number of actual connections between members divided by the number of possible connections" (pp. 445–446). The more connections that occur among the actors within a network, the denser the network will become. The density of the network may impact the network's ability to coordinate its activities. The high score of density may ease the coordination process among the actors in a network. *Betweenness centrality,* the most used measurement according to Freeman (1979), identifies an actor's role in a network by measuring

its ownership on information and resources control (Corteville, 2009, p. 13). This measure computes the extent of each actor's shortest paths that connect all actors in the network (Everton, 2012, p. 210). An organization with a high level of betweenness centrality has control of the information flow and resources in a network. Moreover, this organization has the capability for maintaining the network communication (Shimbel, 1953) and also for coordinating group processes (Cohn & Marriott, 1958). Therefore, an organization with high scores of betweenness centrality would coordinate a network better.

Meanwhile, *betweenness centralization* is a variation of the actor's betweenness centrality scores within a network. The bigger a network's centralization index, the more likely an actor in a network will have a high betweenness centrality score in comparison with other actors. Betweenness centralization measures the extent to which actors located between other actors in the network. *Closeness centrality* calculates the average geodesic distance of an actor to all actors within a network (Everton, 2012, p. 209). For example, a score of 1.00 indicates that an actor is one step away from other actors in the network. Meanwhile, a score that is close to 0.00 designates the maximum distance of an actor within a network. Hakimi (1965) and Sabidussi (1966) argue that a central actor of a network would communicate with other points with minimum time and cost, and the actor would have advantages in making coordination around the network structures.

Applying these measures to network structures will generate more effective coordination processes of the formal structure among the maritime agencies in the domain. Moreover, an effective structure would distribute information faster for the network. This effectiveness is crucial for ensuring an equal level of coordination process, timely information distribution and proper understanding of the maritime issues.

G. SUMMARY

This study provides an overview of the four methodologies (link analysis, hot-spot and geospatial analysis, temporal analysis, and social network analysis) that are used to describe and explore the IMSCB's current formal inter-organizational network structure. The results of these analyses follow in the next chapter and the implications in Chapter V.

THIS PAGE INTENTIONALLY LEFT BLANK

IV. DATA ANALYSIS AND RESULTS

This chapter employs four methodologies (link analysis, geospatial analysis, temporal analysis, and social network analysis) to analyze the event and incident data drawn from the Indonesian maritime domain. The objective of this chapter is to describe the domain's activities and operations and the formal network structure that coordinates it.

A. LINK ANALYSIS

Link analysis helps to visualize the connections between maritime agencies authorities in regard to the incidents in the Indonesian water territory. Accidents at sea are under the authority of all agencies. Meanwhile, violations of the law are processed according to the mandates of the respective agency, based on the government regulation. IMSCB has the authority to address all incidents at sea since it involves all stakeholders under its authority for maritime operations. The Navy is authorized for most of the incidents except for asylum seekers and illegal logging. Similarly, the Marine Police Force is authorized for most incidents with the exception of illegal fishing. Coastal units are only authorized to investigate ships' sea-worthiness documents, while customs has the mandate to oversee the flow of goods coming in or out of the country. The last agency is the Fisheries Department that has the mandate to investigate illegal fishing. These organizations and their authorities are illustrated in the Figure 11 link chart.

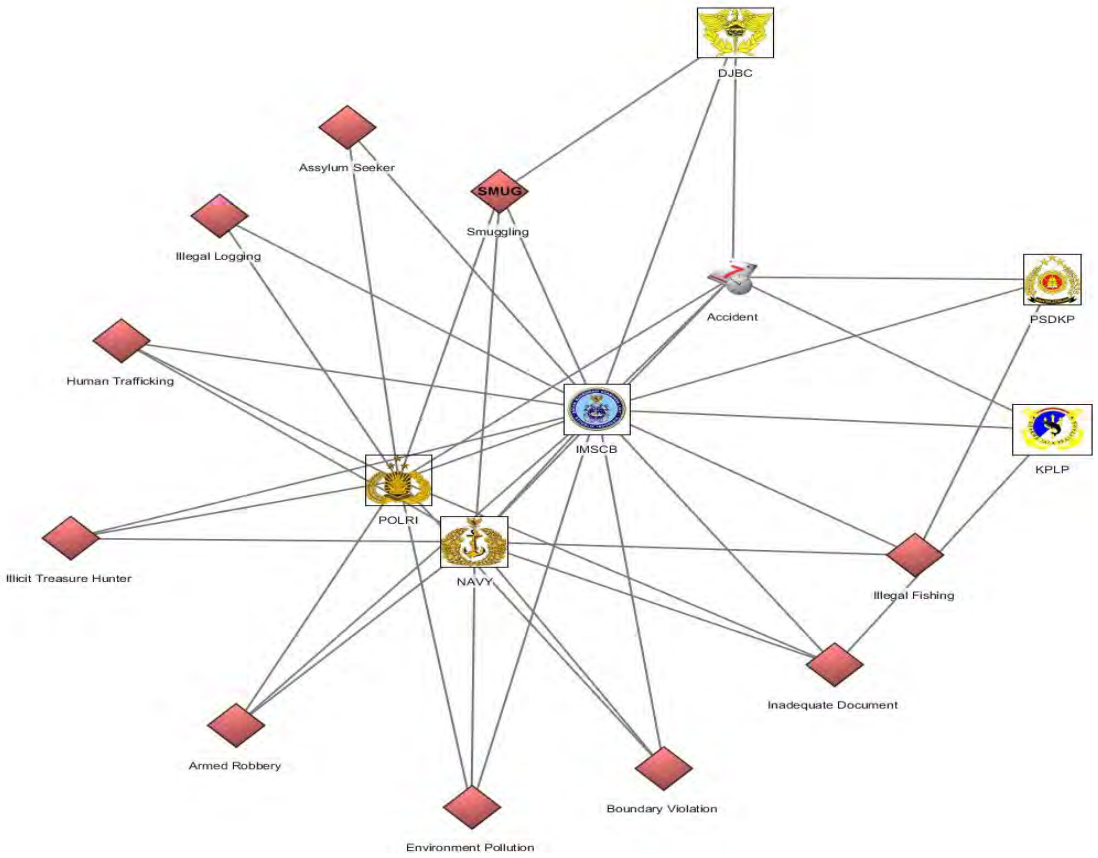


Figure 11. Link chart of the Indonesian Maritime Agencies with their authorities.

As shown in Figure 11, the IMSCB coordinates the other maritime agencies in the network and oversees its authorities to ensure unity of effort.

We turn to the geospatial analysis below to identify the hotspots where incidents and crimes are committed at sea. A key question is whether agencies are located close to the hotspots where incidents are occurring.

B. GEOSPATIAL ANALYSIS

The geospatial analysis method can pinpoint the hotspots where incidents and crimes are committed at sea. Overlaying the agencies on the hotspot map then enables the analyst to identify which agencies are co-located in the regions where the incidents occur.

1. Accidents at Sea

The accidents-at-sea data used in this analysis were gathered from the IMSCB database from 2008 to 2013. The region with the highest accident density is concentrated in the Riau Islands, Batam water area, the Gulf of Jakarta, and Sunda Strait. Meanwhile, a moderate number of accidents takes place in the harbor area in Belawan Harbor, the Gulf of Bayur, Banjarmasin water area, Bangka-Belitung water area, Makassar water area, and Kupang water Area (Figure 12).

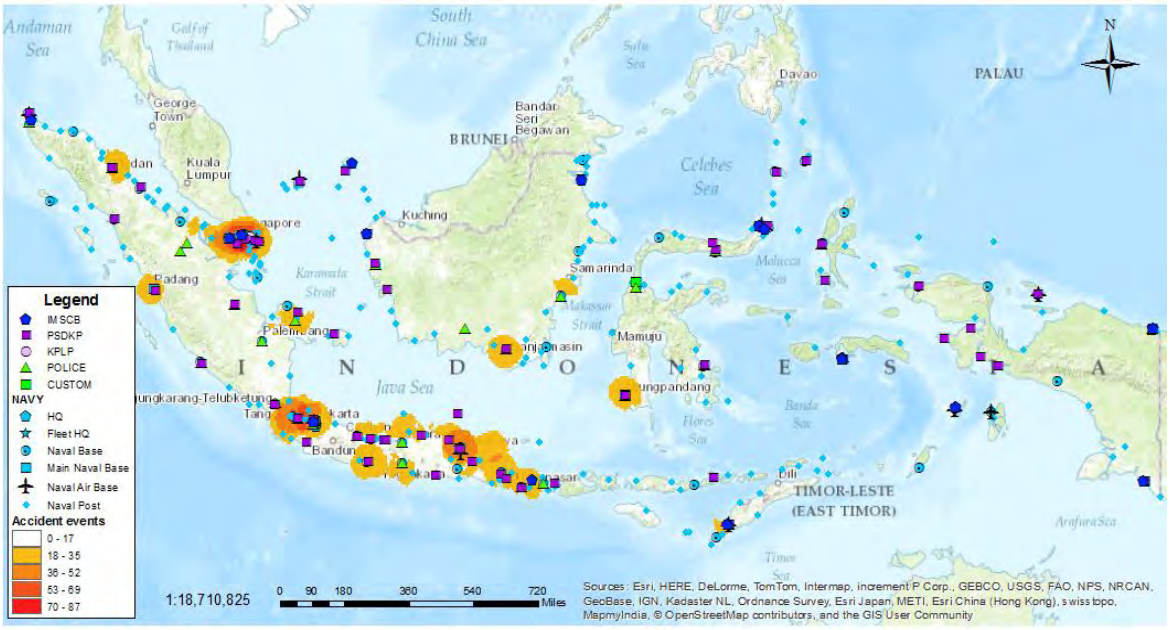


Figure 12. Accident-at-sea hotspots from 2008 to 2013.

2. Violations at Sea

The data for the violations at sea ranges from 2011 to September 2013. The various data then were sorted into ten categories: armed robbery, asylum seeker, boundary violation, environment pollution, human trafficking, illegal fishing, inadequate document, smuggling, and illicit sea treasure exploration.

a. Armed Robbery

The Batam water at the end of Malacca Strait is the hottest spot for armed robbery. The next places are the Dumai water area, Belawan water area, Malacca Strait, and Balikpapan water area (Figure 13).

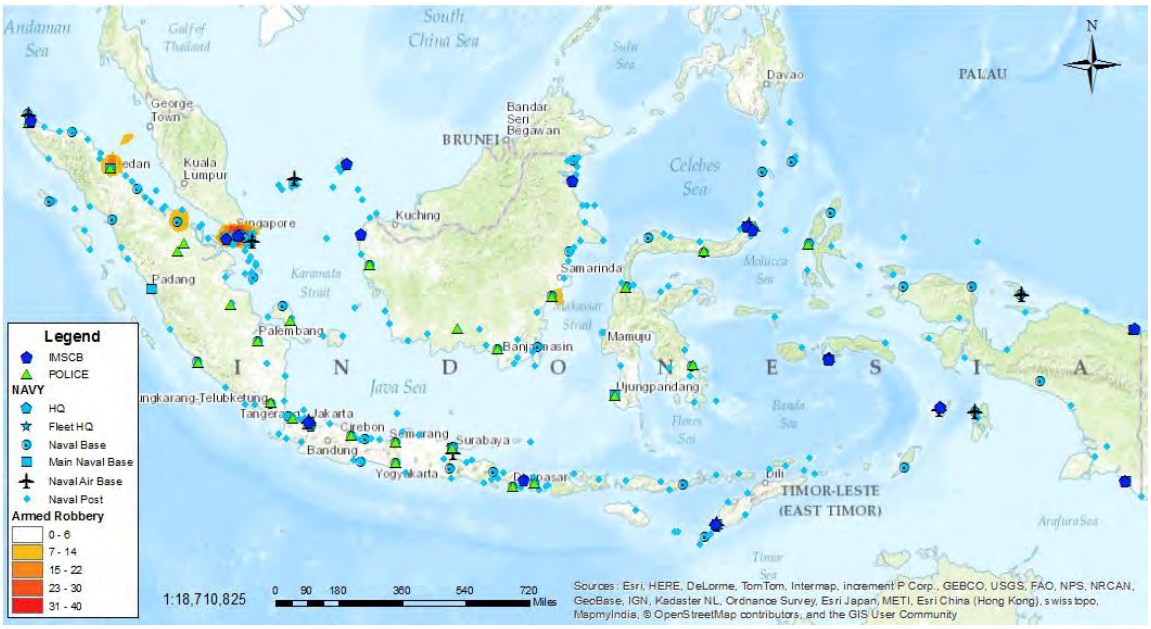


Figure 13. Armed robbery hotspots with authorized maritime agencies mapping.

The next step is to identify whether the agencies with the required authorities to investigate and process armed robbery are adjacent to the hotspot area. Table 1 presents the maritime law enforcement agencies that are located in the vicinity of the hotspot areas. The analysis shows that the numbers of agencies are sufficient to cover the hotspot areas.

Table 1. List of maritime agencies in the armed robbery hotspots.

Hot Spot	Field Office
Belawan water and Malacca Strait	Main Naval Base I Belawan Naval Post Pangkalan Susu Naval Post Seruway Regional Marine Police North Sumatra
Dumai water	Naval Base Dumai Naval Post Tanjung Medang
Batam water and Riau Islands	Task Force I Batam MRCC Batam RCC Tg Balai Karimun Main Naval Base IV Tg. Pinang Naval Post Lagoi Naval Post Berakit Naval Base Batam Naval Post Tanjung Sangkuang Naval Post Tolop Naval Post Sambu Naval Post Nipa Island Naval Post Abang Island Naval Post Sugi Naval Post Galang Island Naval Post Telaga Punggur Naval Post Tanjung Datuk Naval Post Tanjung. Balai Karimun Naval Post Takong Hiu Naval Post Leho Naval Post Moro Naval Post Mentigi Naval Air Base Tanjung Pinang Regional Marine Police Riau Islands
Balikpapan water	Naval Base Balikpapan Naval Post Kampung Baru Regional Marine Police East Borneo

b. Asylum Seeker

Asylum-seeking is a form of boundary violation that requires careful handling. The Indonesian waters normally are used as a transit for asylum seekers before reaching their final destination, primarily Australia. The hotspot areas for this type of violation are in the Gulf of Jakarta, Banten water area, Sunda Strait, Garut water area, Cilacap water, Wonogiri water,

Surabaya water, Madura water, and Kupang water area (Figure 14). The regions of Jakarta, Banten, Sunda Strait, and Garut are the highest hotspots for the asylum seeker category.

The agencies that have the authorities to address the asylum-seeker category are listed in Table 2. Although some of the agencies do not have the authority to process the asylum seekers, they can conduct the initial investigation prior to further processing by the authorized agencies.

Table 2. List of maritime agencies in the asylum-seeker hotspots.

Hot Spot	Field Office
Banten water	Regional Marine Police Banten
Kupang water	Regional Marine Police Nusa Tenggara Timur RCC Kupang
Surabaya and Madura waters	Regional Marine Police East Java
Gulf of Jakarta	Regional Marine Police Metro Jaya, IMSCB HQ
Sunda Strait	Regional Marine Police Lampung

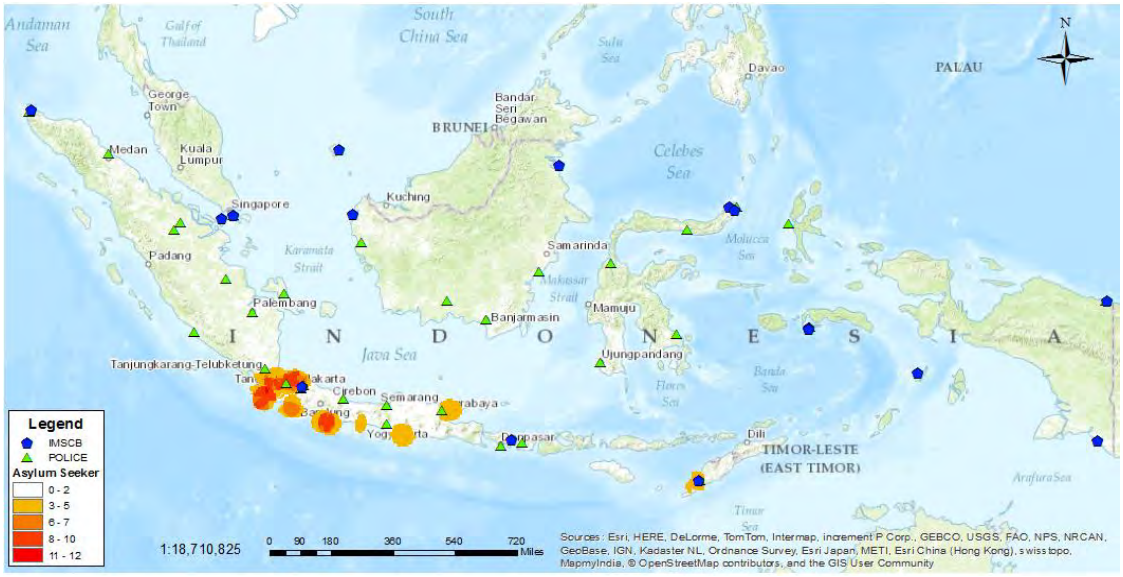


Figure 14. Asylum-seeker hotspots with authorized maritime agencies mapping.

c. Boundary Violation

Boundary violations are committed by foreign ships that do not have a legal basis to enter the Indonesian water, and their activities in the area present security violations as well as territorial breaches. The hotspot areas for this type of violation are to be found in Belawan Water and the Malacca Strait, Nias Island water, Juwana water, Pacitan water, Eastern Madura water, Northeastern Bali water, Berau water, Halmahera water, and Arafuru water areas (Figure 15).

Different from other hotspot areas, the hotspot areas in Eastern Madura, Northeastern Bali, Halmahera, and Arafuru waters do not have available maritime agencies in the vicinity. The closest agency to the Northeastern Bali hotspot is the RCC Karang Asem that is located 32 nm away; the closest agency to the Eastern Madura hotspot is the Paiton naval post that is located 54 nm away; the closest agency to the Halmahera hotspot is the Feni Island naval post located 74 nm away; and the closest agency to the Arafuru hotspot is the Wanam naval post as far as 106 nm away (Table 3).

Table 3. List of maritime agencies in the boundary violation hotspots.

Hot Spot	Field Office
Belawan water and Malacca Strait	Main Naval Base I Belawan Naval Post Tanjung Tiram Naval Post Bandar Khalifah Regional Marine Police North Sumatera
Nias Island water	Naval Post Gunung Sitoli Naval Post Teluk Dalam
Rembang water	Naval Post Rembang Naval Post Jepara
Pacitan water	Naval Post Sadeng
Eastern Madura water	Eastern Fleet Command Main Naval Base V Surabaya Naval Post Logending Naval Post Paiton Naval Base Batuporon Naval Post Sadeng Naval Air Base Juanda Regional Marine Police East java
Northeastern Bali water	Naval Post Celukan Bawang Naval Post Gili Air

Hot Spot	Field Office
	RCC Karang Asem
Berau water East Borneo	Naval Post Pulau Derawan Naval Post Pulau Maratua Naval Post Tanjung Batu
Halmahera water	Naval Base Morotai Naval Post Gebe Island Naval Post Feni Island
Arafuru water	Main Naval Base XI Merauke Naval Post Wanam Naval Post Bade RCC Merauke

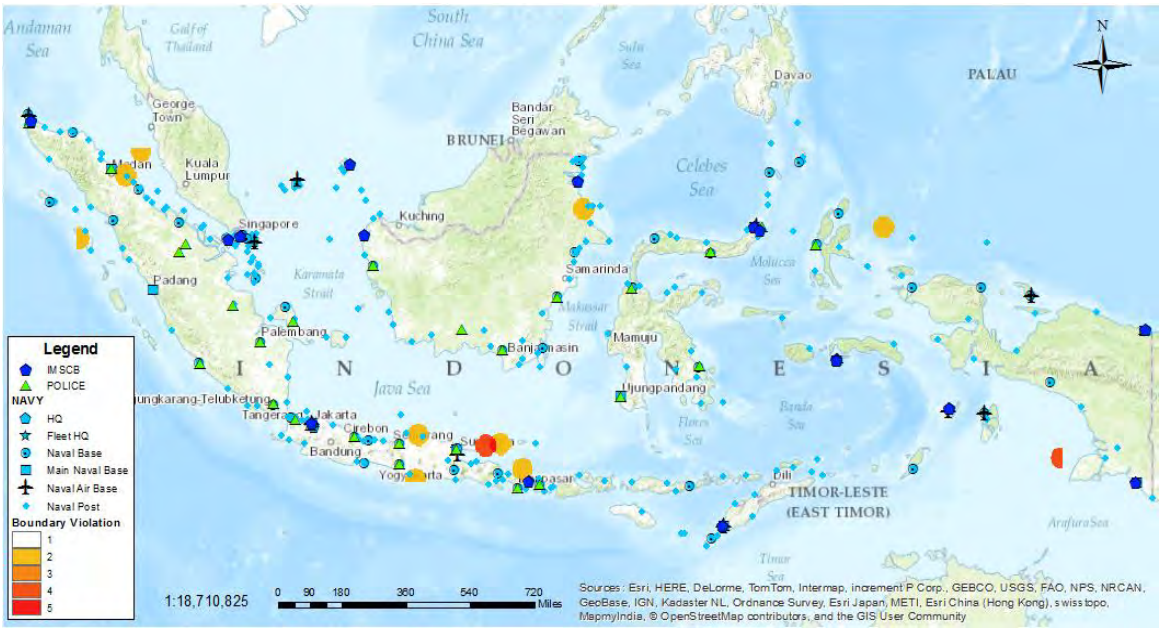


Figure 15. Boundary violation hotspots with authorized maritime agencies mapping.

d. Environmental Pollution

Environmental pollution includes all activities that affect and degrade the environment's physical functions. Toxic waste-dumping into the sea would be one examples. The hotspot areas for such activity are in the Deli Serdang, Dumai, Padang, Batam, Riau Islands waters, Northern water of Pangkal Pinang, Northern waters of Banten, Southern Coast

of East Java, Bau-bau water, and Jayapura water (Figure 16). Table 4 shows the agencies in the vicinity of the hotspot areas.

Table 4. List of maritime agencies in the environmental pollution hotspots.

Hot Spot	Field Office
Deli Serdang water	Regional Marine Police North Sumatra Main Naval Base I Belawan Naval Post Tanjung Tiram
Dumai water	Naval base Dumai Naval Post Tanjung Medang
Batam and Riau Islands waters	Naval Post Selat Panjang Main Naval Base IV Tg. Pinang Naval Post Lagoi Naval Post Berakit Naval Base Batam Naval Post Tanjung Sangkuang Naval Post Tolop Naval Post Sambu Naval Post Nipa Island Naval Post Abang Island Naval Post Sugi Naval Post Galang Island Naval Post Telaga Punggur Naval Post Tanjung Datuk Naval Base Tanjung Balai Karimun Naval Post Takong Hiu Naval Post Leho Naval Post Moro Naval Base Mentigi Naval Air Base Tanjung Pinang Regional Marine PoliceRiau Islands Task Force I Batam MRCC Batam RCC Tanjung Balai Karimun
Padang water	Main Naval Base II Padang Naval Post Enggano Island Naval Post Simaubuk
Northern waters of Pangkal Pinang	Naval Base Bangka Belitung Naval Post Pangkal Balam

Hot Spot	Field Office
Northern waters of Banten	Naval Base Banten Naval Post Kronjo Naval Post Pulau Panjang Naval Post Pulau Sangiang Naval Post Pulau Tempurung Regional Marine Police Banten
Southern Coast of East Java	Naval Post Sendang Biru
Bau-bau water	Naval Post Bau-bau
Papua water	Main Naval Base X Jayapura Naval Post Skow Sae Regional Marine Police Papua RCC Jayapura

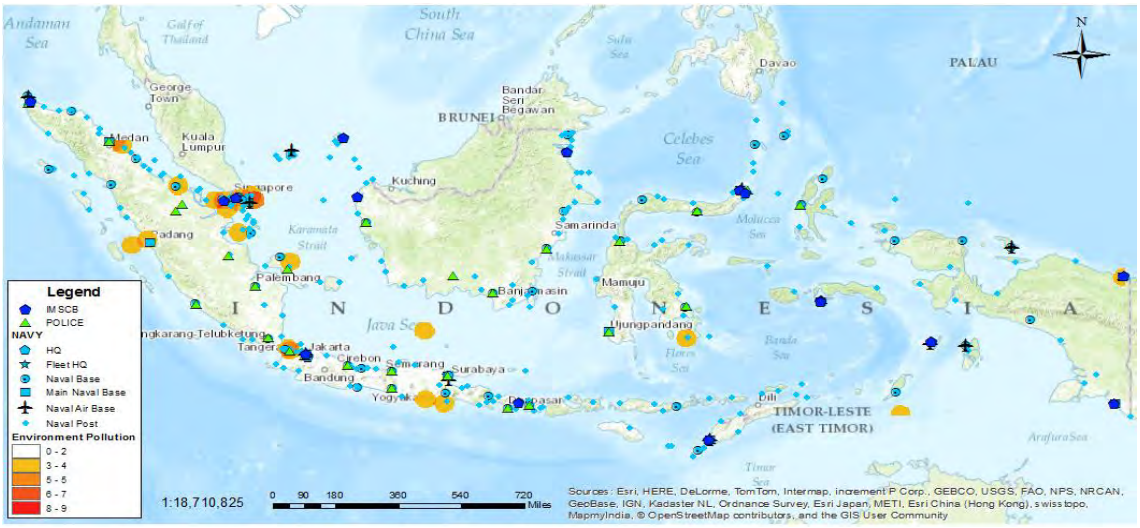


Figure 16. Environmental pollution hotspots with authorized maritime agencies mapping.

e. Human Trafficking

Human trafficking is an illicit activity in which a human being is the object of commodities by coercion for the purpose of human exploitation. The highest hotspot areas for this type of activity are in the Kupang and Surabaya waters. The lower-density hotspots are in Batam, Ujung Kulon, Southern Yogyakarta water, and Pare-pare water (Figure 17). Agencies in these areas are shown in Table 5.

Table 5. List of maritime agencies in the human trafficking hotspots.

Hotspot	Field Office
Tanjung Balai Asahan water	Naval Base Tanjung Balai Asahan Naval Post Bagan Asahan Naval Post Sei Berombang
Batam water	Task Force I Batam MRCC Batam Marine Police Riau Islands Main Naval Base IV Tg. Pinang Naval Post Lagoi Naval Post Berakit Naval Base Batam Naval Post Tanjung Sangkuang Naval Post Tolop Naval Post Sambu Naval Post Pulau Nipa Naval Post Telaga Punggur Naval Post Takong Hiu Naval Base Mentigi
Ujung Kulon water	Naval Post Binuangen Naval Post Sumur
Southern Yogyakarta water	Naval Base Yogyakarta Naval Post Sadeng Marine Police Yogyakarta
Surabaya water	Eastern Fleet HQ Naval Base Batuporon Main Naval Base V Surabaya Naval Air Base Juanda Marine Police East Java
Pare-pare water	Naval Post Pinrang

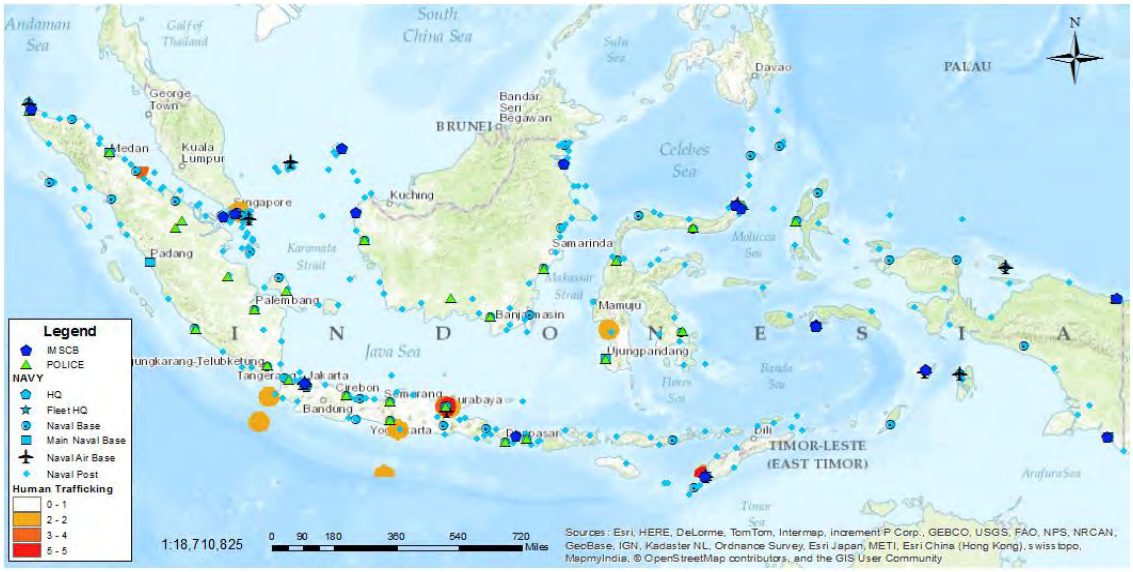


Figure 17. Human trafficking hotspots with authorized maritime agencies mapping.

f. Illegal Fishing

Fishing activities in the sea are deemed illegal when they do not abide by the fisheries regulations that include license requirements, taxes, and approved locations and times for fishing. The hotspots of these illegal activities are spread widely in the archipelago (Figure 18). The concentration of such activities is in the Belawan to Tanjung Balai Asahan waters, Western Aceh water, Batam and Riau Islands water, Tarempa Island water, Bangka-Belitung water, the Gulf of Jakarta water, Northern Banten water, Sunda Strait, Cirebon and Tegal water, Makassar, Tarakan Water, Celebes Sea from Manado to Tahuna water, and Southern Ambon water. Table 6 shows the agencies in the vicinity of these hotspots.

Table 6. List of maritime agencies in the illegal fishing hotspots.

Hotspot	Field Office
Belawan-Tanjung Balai Asahan waters	Main Naval Base I Belawan Naval Post Pangkalan Susu Naval Post Seruway Naval Base T.B. Asahan Naval Post Tanjung Tiram Naval Post Sei Berombang Naval Post Bagan Asahan Naval Post Bandar Khalifah Naval Post Pulau Jemur Work Unit PSDKP Tanjung Balai Karimun Work Unit PSDKP Belawan
Western Aceh water	Naval Post Lampulo Naval Post Lhoknga Regional Marine Police Aceh RCC Aceh
Batam and Kepri waters	Main Naval Base IV Tg. Pinang Naval Post Lagoi Naval Post Berakit Naval Base Batam Naval Post Tanjung Sangkuang Naval Post Tolop Naval Post Sambu Naval Post Pulau Nipa Naval Post Sugi Naval Post Pulau Galang Naval Post Telaga Punggur Naval Post Tanjung Datuk Naval Base Tanjung Balai Karimun Naval Post Takong Hiu Naval Post Leho Naval Post Moro Naval Base Mentigi Naval Air Base Tanjung Pinang Work Unit PSDKP Batam Work Unit PSDKP Moro Work Unit PSDKP Tanjung Pinang Work Unit PSDKP Pulau Kijang Work Unit PSDKP Moro Work Unit PSDKP Tanjung Balai Karimun

Hotspot	Field Office
Tarempa water	Naval Base Tarempa Naval Air Base Matak Naval Post Jemaja Naval Post Memperuk Naval Post Mengkait Naval Post Pulau Mangkai Work Unit PSDKP Tarempa
Natuna water	Naval Base Ranai Naval Post Penangi Naval Post Pulau Laut Naval Post Sebang Mawang Naval Post Sedanau Work Unit PSDKP Natuna RCC Natuna
Bangka Belitung water	Work Unit PSDKP Sungai Liat Work Unit PSDKP Tanjung Pandan Naval Post Pangkal Balam Naval Post Pulau Mendanau
Jakarta Gulf, Northern Banten water and Sunda Strait	NAVY HQ FLEET HQBAR Main Naval Base III Jakarta Naval Post Pulau Karya Naval Post Tanjung Pasir Naval Base Banten Naval Post Pulau Sangiang Naval Post Pulau Tempurung Naval Post Pulau Panjang Naval Post Sumur Naval Post Kronjo Naval Base Lampung Naval Post Kota Agung Naval Post Labuan Maringgai Naval Air Base Jakarta Base PSDKP Jakarta Work Unit PSDKP Muara Angke Work Unit PSDKP Lempasing Work Unit PSDKP Karangantu IMSCB HQ

Hotspot	Field Office
Cirebon and Tegal waters	Naval Base Cirebon Naval Base Tegal Naval Post Gebang Naval Post Kluwut Naval Post Sigandu Naval Post Tanjung Sari Work Unit PSDKP Batang Work Unit PSDKP Kejawan Work Unit PSDKP Pekalongan Work Unit PSDKP Tegalsari
Makassar water	Main Naval Base VI Makassar Work Unit PSDKP Makassar
Tarakan water	Naval Base Tarakan Naval Post Bunyu Naval Post Pantai Amal Naval Post Tanjung Ahus Work Unit PSDKP Tarakan RCC Tarakan
Manado and Tahuna waters	MRCC Manado RCC Kema Task Force II Manado Main Naval Base VIII Manado Naval Base Tahuna Naval Air Base Manado Work Unit PSDKP Dagho Work Unit PSDKP Bitung
Southern Ambon waters	MRCC Ambon Task Force III Ambon Work Unit Ambon Main Naval Base IX Ambon

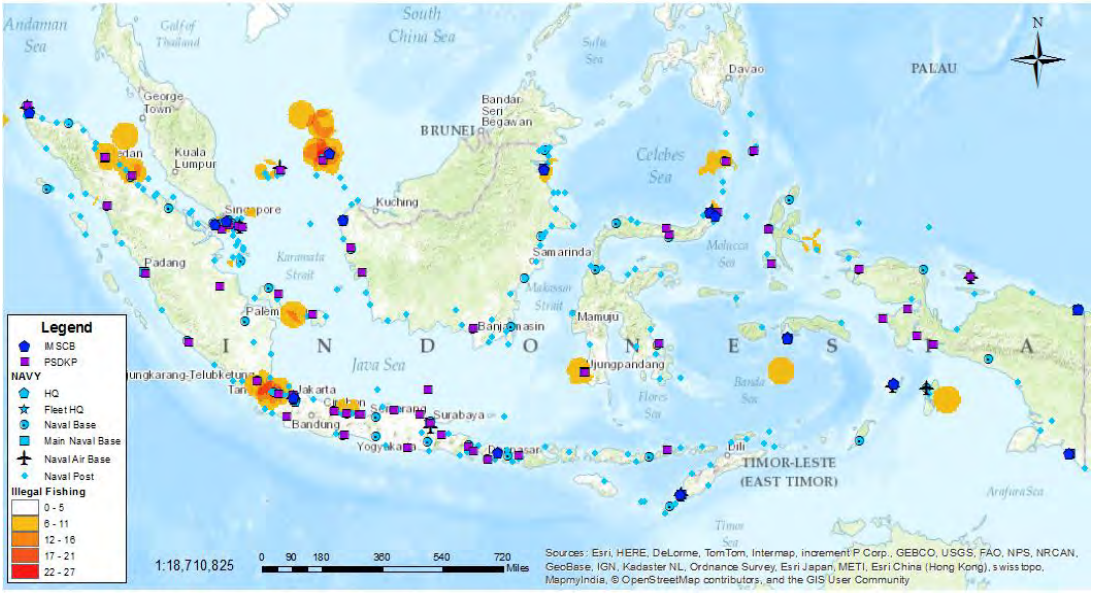


Figure 18. Illegal Fishing hotspots with authorized maritime agencies mapping.

g. Illegal Logging

Illegal logging is the violation of laws that regulate the harvest, use, transport, and the sale of timber as products from the forest. These activities are conducted without legitimate rights of timber management. The hotspots of this illicit activity are concentrated in the Tanjung Balai Asahan water, Dumai and Bengkalis waters, Batam and Riau Islands water, Indragiri Hilir water, Kapuas River, Natuna Islands water, the Gulf of Sibolga, Tarakan and Nunukan waters, Balikpapan water, and Makassar Strait and water (Figure 19). The agencies in these areas are shown in Table 7.

Table 7. List of maritime agencies in illegal logging hotspots.

Hotspot	Field Office
Dumai and Bengkalis waters	Marine Police Riau
Batam and Kepri Islands water	MRCC Batam RCC TBK Task Force I Batam Marine Police Riau Islands
Natuna water	RCC Natuna
Kapuas River	Marine Police West Kalimantan
Balikpapan water and Makassar strait Makassar water	Marine Police East Kalimantan Marine Police South Sulawesi

As reflected in Table 7, some hotspots do not have agencies with the authorities to deal with illegal logging, such as Tanjung Balai Asahan water, Indragiri Hilir water, and the Gulf of Sibolga.

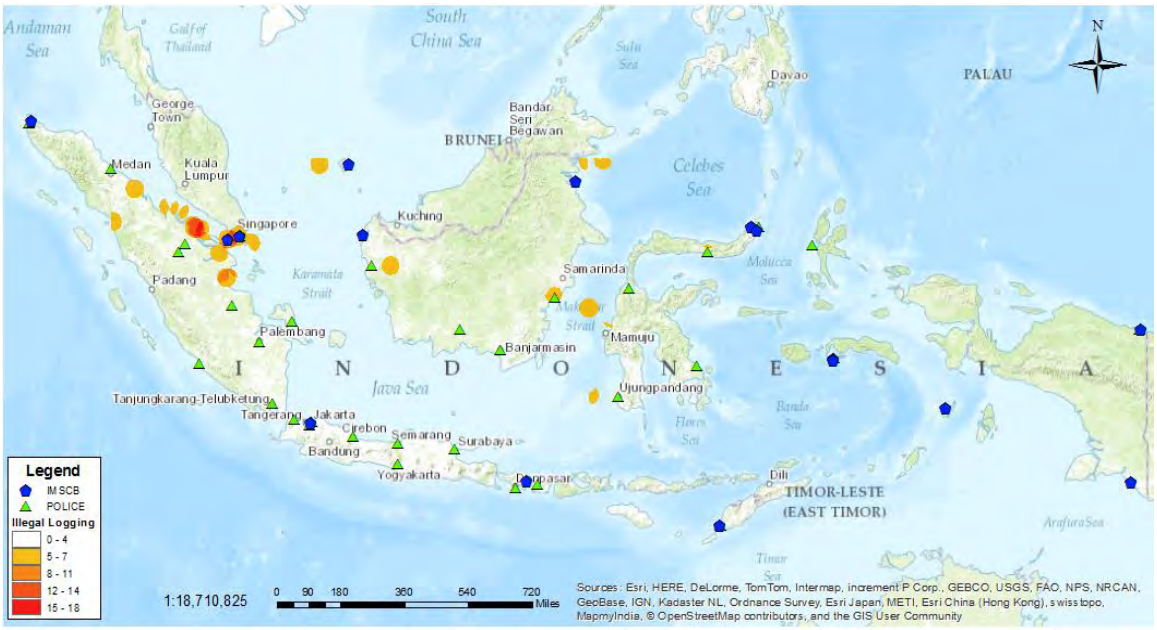


Figure 19. Illegal logging hotspots with authorized maritime agencies mapping.

h. Inadequate Documents

The laws of navigation oblige the ships that sail in Indonesian territorial water to have complete documents that confirm their seaworthiness. Neglect in completing these documents results in violation of the law. This type of violation is concentrated in Dumai and Bengkalis

waters, Batam and Riau Islands water, Natuna water, Jambi water, Northern Central Java water, Sangihe Islands water, Kolaka water, Northern Ambon water, and Sorong water (Figure 20). The agencies located in or near these hotspots are shown in Table 8.

Table 8. List of maritime agencies in the inadequate document hotspots.

Hotspot	Field Office
Dumai and Bengkalis waters	Naval base Dumai Naval Post Bengkalis Naval Post Muntai Naval Post Tanjung Medang Marine Police Sumbar
Batam and Kepri waters	Main Naval Base IV Tg. Pinang Naval Post Lagoi Naval Post Berakit Naval base Batam Naval Post Tanjung Sangkuang Naval Post Tolop Naval Post Sambu Naval Post Pulau Nipa Naval Post Pulau Abang Naval Post Sugi Naval Post Pulau Galang Naval Post Telaga Punggur Naval Post Tanjung Datuk Naval base Tanjung Balai Karimun Naval Post Takong Hiu Naval Post Leho Naval Post Moro Naval base Mentigi Naval Air Base Tanjung Pinang MRCC Batam RCC TBK Task Force I Batam Marine Police Kepri
Jambi water	Marine Police Jambi Naval Post Jambi
Northern Centre Java water	Naval base Semarang Naval Post Jepara Naval Post Sigandu Naval Post Tanjung Sari Marine Police Central Java
Sangihe Island water	Naval base Tahuna

Hotspot	Field Office
Manado water	Main Naval Base VIII Manado Naval Air Base Manado Naval Post Arakan Naval Post Atep Oki MRCC Manado RCC Kema Task Force II Manado Marine Police Sulut
Kolaka water	Naval Post Kolaka
Northern Ambon water	Main Naval Base IX Ambon Naval Post Bula Naval Post Pulau Buru MRCC Ambon Task Force III Ambon Marine Police Maluku
Sorong water	Naval base Sorong Naval Post Waisai

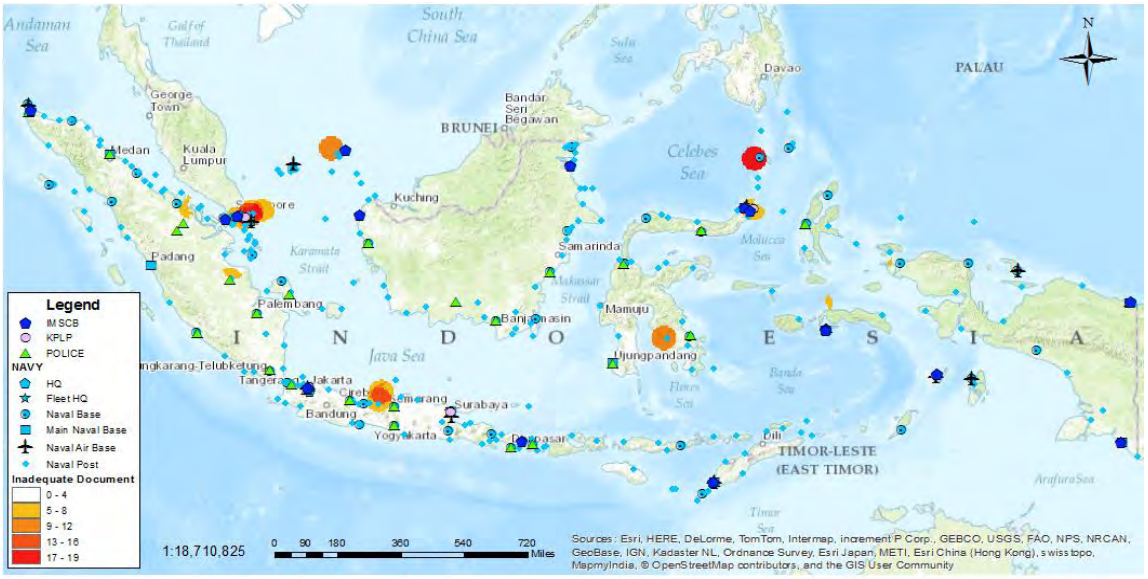


Figure 20. Inadequate documents hotspots with authorized maritime agencies mapping.

i. Smuggling

Smuggling includes all unlawful transportation of goods and commodities, sometimes dangerous and illegal commodities such as weapon and drugs, coming in or out of countries without any legitimate documentation. Smuggling is concentrated in Medan water, Tanjung

Balai Asahan water, Dumai water, Batam and Riau Islands waters, Jakarta and Tangerang waters, Surabaya water, Balikpapan to Smarinda waters, and Manado water (Figure 21). The agencies in these areas are shown in Table 9.

Table 9. List of maritime agencies in the smuggling hotspots.

Hotspot	Field Office
Medan water	Marine Police North Sumatra Main Naval Base I Belawan
Tanjung Balai Asahan water	Naval Base Tanjung Balai Asahan Naval Post Bagan Asahan Naval Post Sei Berombang Naval Post Tanjung Tiram
Dumai water	Naval Base Dumai Naval Post Bengkalis Naval Post Tanjung Medang Naval Post Muntai
Batam and Kepri waters	Main Naval Base IV Tg. Pinang Naval Post Lagoi Naval Post Berakit Naval base Batam Naval Post Tanjung Sangkuang Naval Post Tolop Naval Post Sambu Naval Post Pulau Nipa Naval Post Pulau Abang Naval Post Sugi Naval Post Pulau Galang Naval Post Telaga Punggur Naval Post Tanjung Datuk Naval Base Tanjung Balai Karimun Naval Post Takong Hiu Naval Post Leho Naval Post Moro Naval Base Mentigi Naval Air Base Tanjung Pinang MRCC Batam RCC TBK Task Force I Batam Marine Police Riau Islands Operational Base Batam Operational Base Tanjung Balai Karimun

Hotspot	Field Office
Jakarta and Tangerang waters	Western Fleet HQ Main Naval Base III Jakarta Naval Post Kronjo Naval Post Pulau Karya Naval Post Pulau Panjang Naval Post Tanjung Pasir Marine Police Banten Marine Police Metro Jaya Operational Base Tanjung Priok IMSCB HQ
Surabaya water	Eastern Fleet HQ Naval base Batuporon Main Naval Base V Surabaya Naval Air Base Juanda Regional Marine Police East Java
Balikpapan and Samarinda waters	Naval Base Balikpapan Naval Post Anggana Naval Post Kampung Baru Marine Police East Borneo
Manado water	Main Naval Base VIII Manado Naval Air Base Manado Naval Post Arakan Naval Post Atep Oki MRCC Manado RCC Kema Task Force II Manado Marine Police North Sulawesi

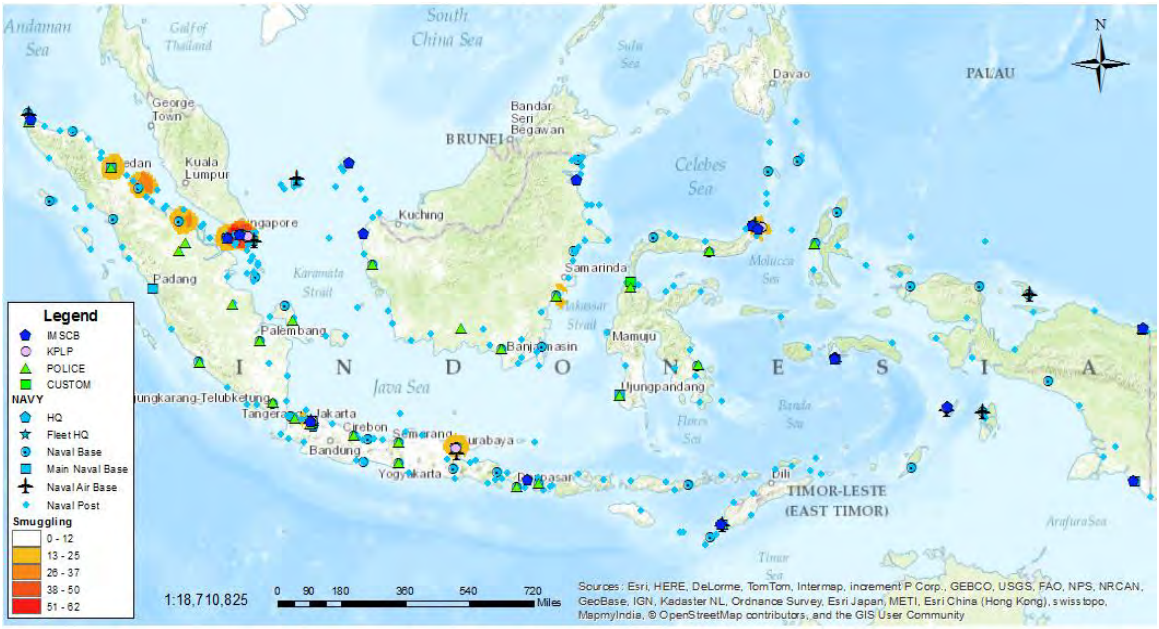


Figure 21. Smuggling hotspots with authorized maritime agencies mapping.

j. Illicit Sea Treasure Exploration

This activity entails unlawful seabed exploration without legitimate documentation in order to salvage sunken ships that may contain valuable goods. The hotspots are in Tanjung Pinang water and Konawe water (Figure 22). Table 10 shows the authorized agencies in the areas adjacent to the hotspots for illegal sea exploration.

Table 10. The list of the agencies in the illicit sea treasure exploration hotspots.

Hotspot	Field Office
Southern Bintan Island water	Main Naval Base IV Tg. Pinang Lanal Mentigi Naval Air Base Tg. Pinang Naval Post Berakit Naval Post Galang Island
Konawe water	Naval Post North Konawe

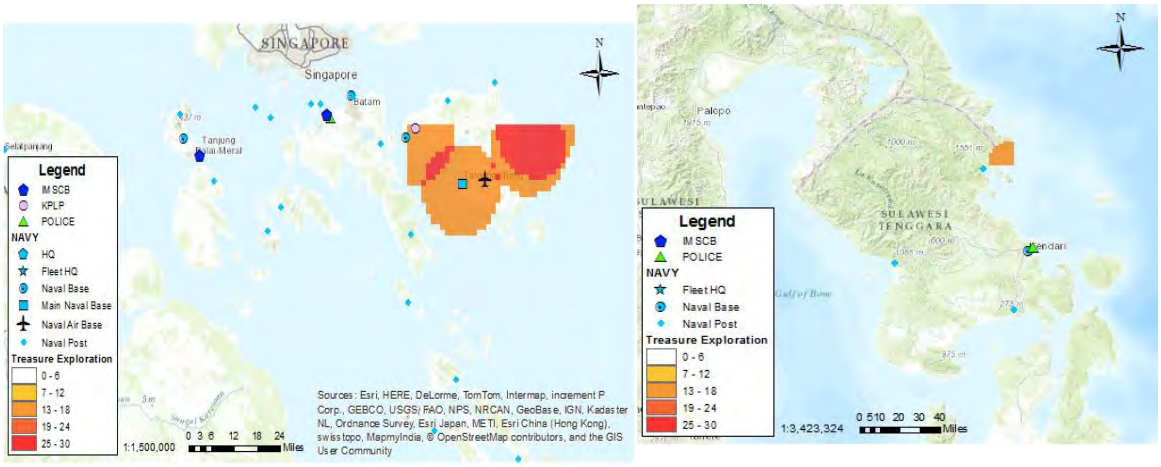


Figure 22. Illicit sea treasure exploration with authorized maritime agencies mapping.

C. TEMPORAL ANALYSIS

Temporal analysis examines the trend of incidents and crimes at sea with time as the basis of analysis. This study analyzes the incidents based on two categories. They are *month of the year* and *day of the week*. The distribution of incidents at sea is then analyzed using this method by measuring the percentage of the incidents that take place during each month in a year. Similarly, the same treatment is applied to the distribution of incidents on a *day-of-the-week* basis. This method enables the analysis of incident distribution over the entire year month by month and then compares the level of activities for each day of the week.

Similar to spatial analysis, the temporal analysis method includes two types of incidents at sea: *accidents at sea* and *violations at sea*.

1. Accidents at Sea

The accidents data included in this study are taken from IMSCB's data source ranging from the year 2008 to 2013. There is no conspicuous pattern in the *month-of-the-year* accidents distribution. However, January is the month with the highest percentage of accidents, followed by July, August, and September (Figure 23). The assumption is that January is the first month of the year and there are more ships steaming *en route* in comparison with other months and, therefore, increasing the possibilities of accidents at sea.

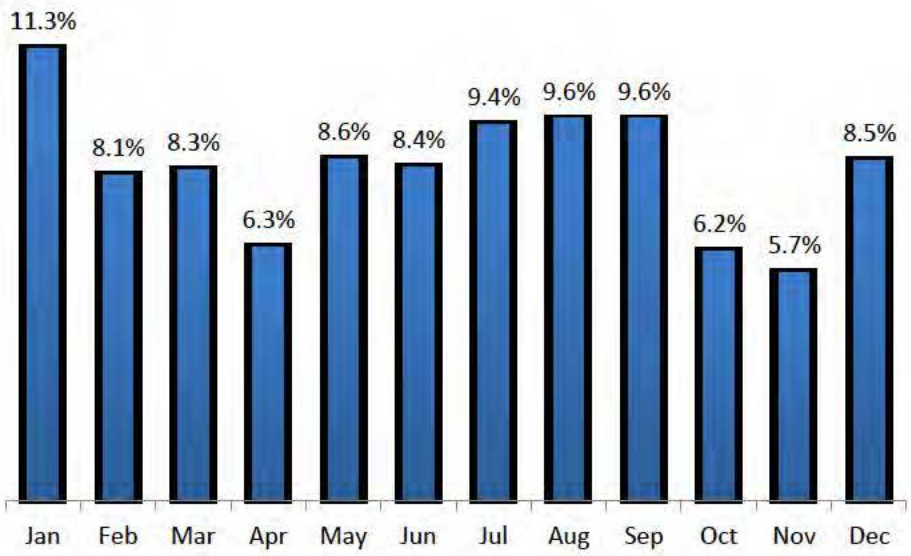


Figure 23. Percentages of accidents on each month of the year from 2008 to 2013 (based on 1,892 accidents; percentages do not add up to 100 because of rounding).

From the day-of-the-week distribution (Figure 24), the concentration of accidents appears to take place Tuesday through Saturday, with the percentage well above 13% as compared to slightly below 13% on Sundays and Mondays. This might be caused by fewer activities on Sunday and Monday.

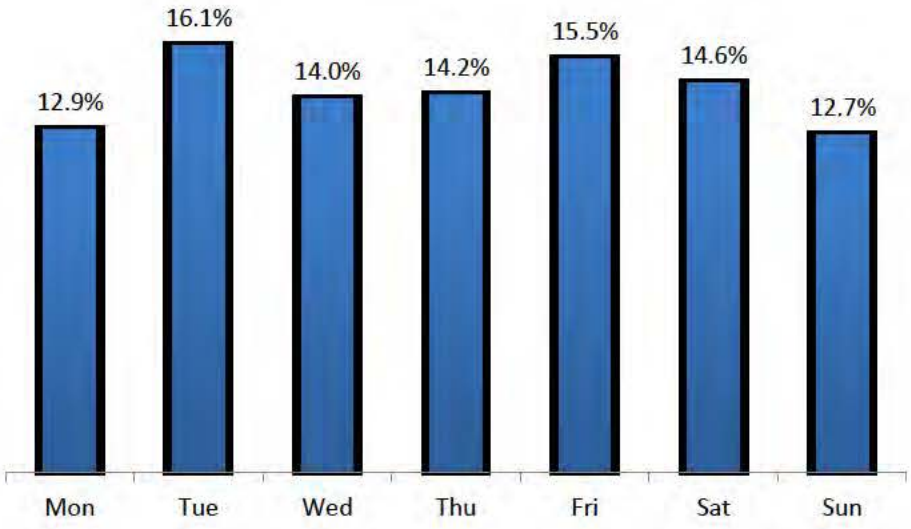


Figure 24. Percentages of accidents on each day of the week from 2008 to 2013 (based on 1,892 accidents; percentages do not add up to 100 because of rounding).

2. Violations at Sea

The data taken from IMSCB's data source ranging from January 2011 to September 2013 are categorized into ten types of violations. The data used for month-of-the-year category are from January 2011 to December 2013. Meanwhile, the day-of-the-week category includes all data from January 2011 to September 2014 to add greater accuracy to the analysis. However, one of the difficulties in the analysis is the insufficient amount of data. Some of the violation types have insufficient data for the purposes of analysis. Among these types are boundary violations, human trafficking, and illicit sea treasure exploration (Table 11). The minimum data requirement for analysis is five cases in each time variable for each type of violation (Larseen & Marx, 1981). Therefore, minimum requirements of 35 violations are required to analyze the distribution of the day-of-the-week category, and at least 60 violations are required to analyze the month-of-the-year category. Due to insufficient data, four types of violations cannot be analyzed: *boundary violations, environmental pollution, human trafficking,* and *illicit sea treasure exploration.*

Table 11. Number of incidents for each violation type in two categories.

Type of violation	Number of Incidents	
	Month-of-year	Day-of-week
Armed Robbery	97	119
Asylum Seeker	66	70
Boundary Violation	10	13
Environment Pollution	18	29
Human Trafficking	10	14
Illegal Fishing	348	388
Illegal Logging	60	70
Inadequate Document	142	164
Smuggling	268	348
Illicit Sea Treasure Exploration	4	5

a. Armed Robbery

There is no distinct pattern for month-of the-year distribution. For certain months (January, May, August, September, and October) the number for this type of violation is relatively low (Figure 25). In August through October the number of armed robberies is relatively small.

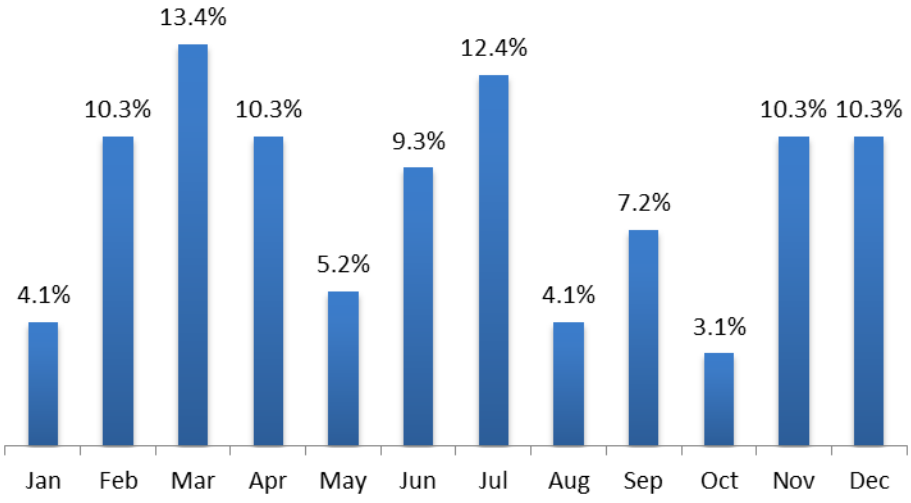


Figure 25. Armed robbery month-of-year distribution.

Similar to the previous analysis, day-of-week distribution yields a uniform pattern over the entire week. However, it seems that incidents are less likely to occur on Sunday (Figure 26).

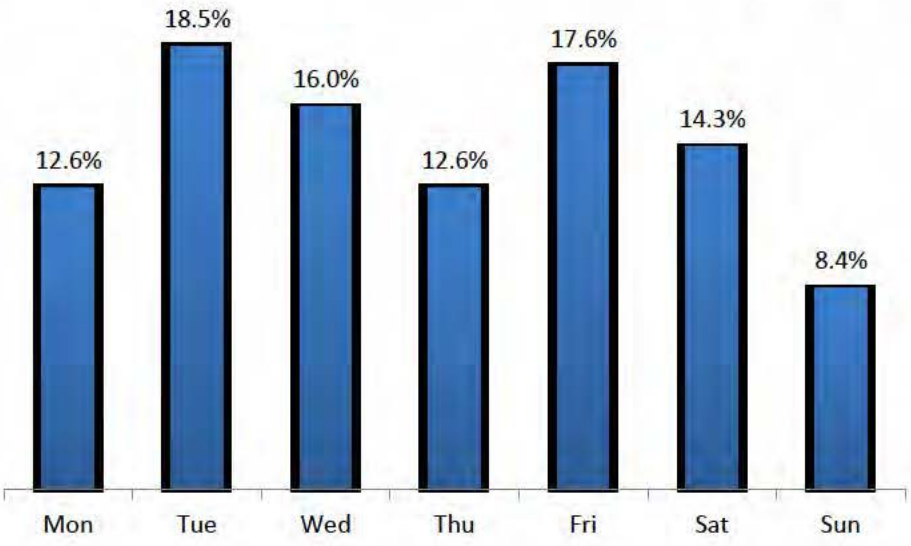


Figure 26. Armed robbery day-of-week distribution.

b. Asylum Seeker

This type of violation occurs almost uniformly the entire year except at the beginning and end of the year (Figure 27).

Figure 27. Asylum seeker month-of-the-year distribution.

The day-of-week distribution is somewhat less uniform than that for month of the year. More than 80% of incidents occurred on week days, and only 17.1% occurred on Saturday and Sunday (Figure 28).

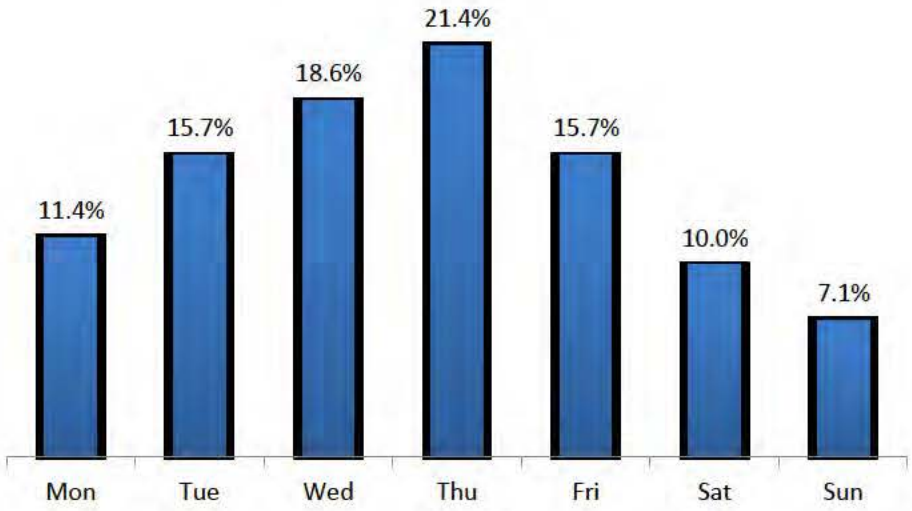


Figure 28. Asylum seeker day-of-the-week distribution.

c. Illegal Fishing

The month-of-year distribution for illegal fishing shows a clearer pattern. Although incidents occur throughout the year, there are times when there is significantly more activity than at other times. Ratcliffe (2004) labels this type of crime hotspot as "focused." The number of violations rises significantly in March, April, and May, with the total percentage in these months contributing to 48.6% of the total incidents (Figure 29).

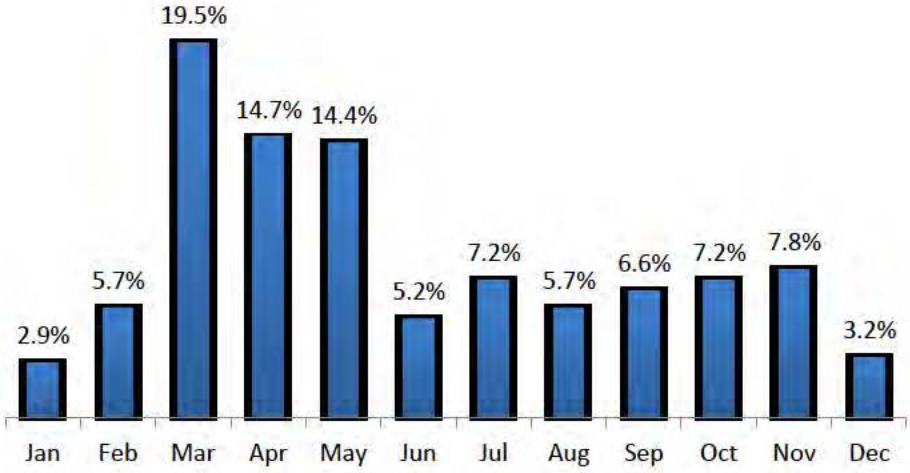


Figure 29. Illegal fishing month-of-the-year distribution.

In contrast with the month-of-the-year distribution, the day-of-the-week category does not reveal a clear pattern. The only assumption that can be gleaned is that incidents are least likely to take place on Sunday and Monday (Figure 30).

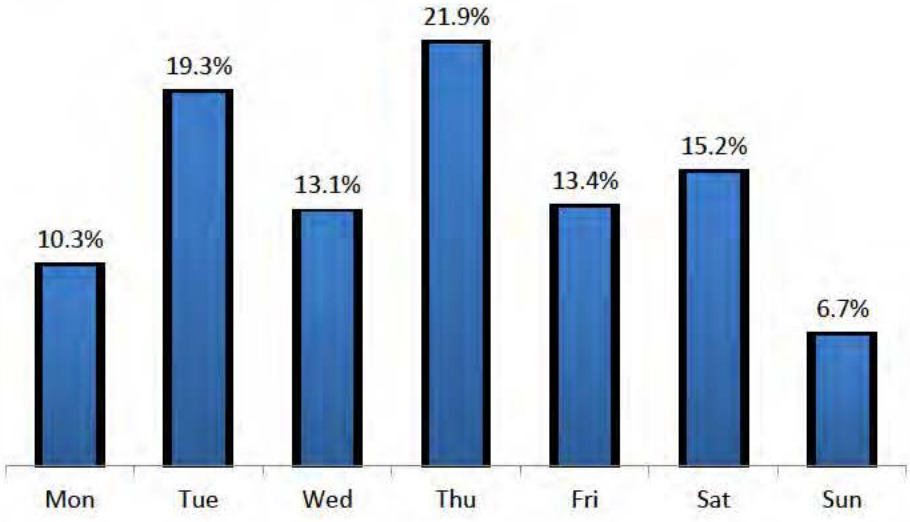


Figure 30. Illegal fishing day-of-the-week distribution.

d. Illegal Logging

The monthly pattern of illegal logging is less clear than those for illegal fishing. However, there are still some patterns that seem focused. Illegal logging activities are concentrated during March through April and also from October to November in comparison with the other months (Figure 31).

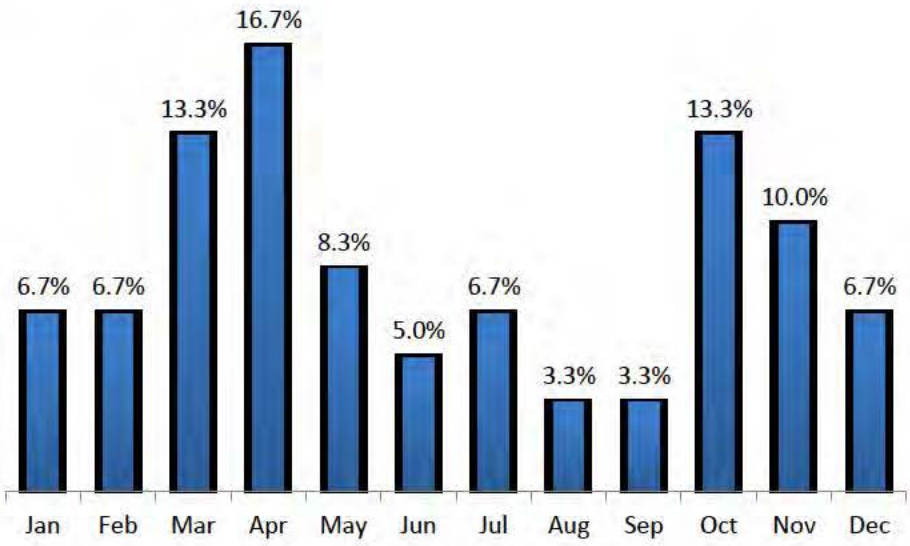


Figure 31. Illegal logging month-of-the-year distribution.

There is no obvious pattern in the day-of-the-week distribution. However, it is worth noting that a significant number of these violations takes place on Wednesday (Figure 32).

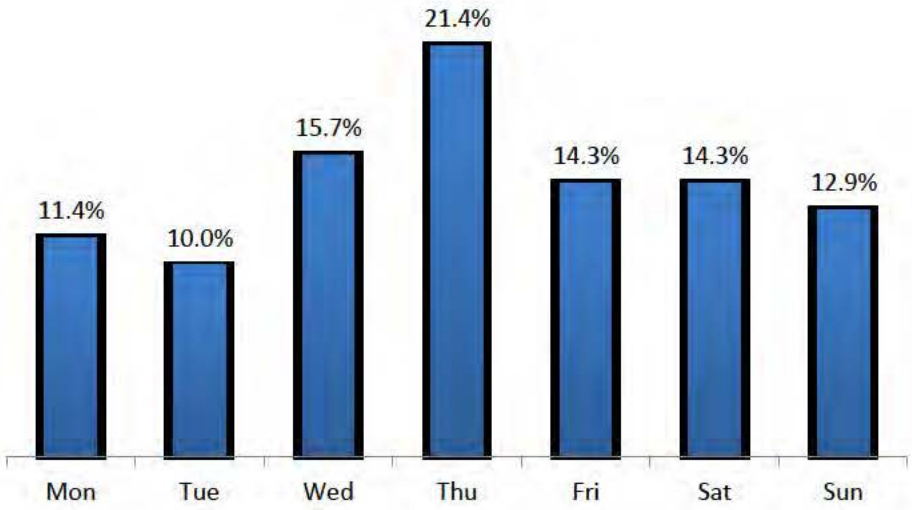


Figure 32. Illegal logging day-of-the-week distribution.

e. Inadequate Documents

There are no distinct patterns in the month-of-the-year distribution for inadequate documents. The number of violations is conspicuously high, however, in February, August, and November. The total percentage of 42.3 % is only for these three months (Figure 33). These activities are least likely to take place in January and December.

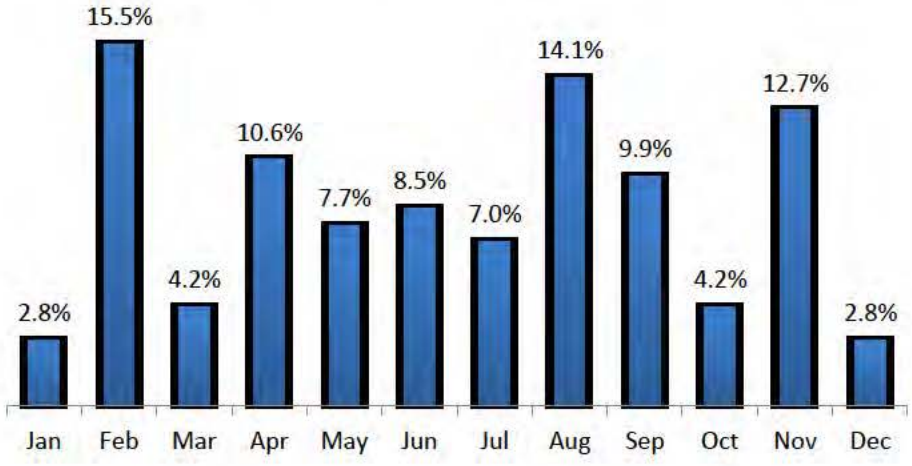


Figure 33. Inadequate documents month-of-the-year distribution.

Day-of-the-week distribution shows acute types of temporal hotspot categories (Ratcliffe, 2004, p. 12). In this case, 38.4% of the activities fall on one day only, which is on Thursday. Although incidents occur throughout the week, there are many fewer incidents happening outside the acute time (Figure 34).

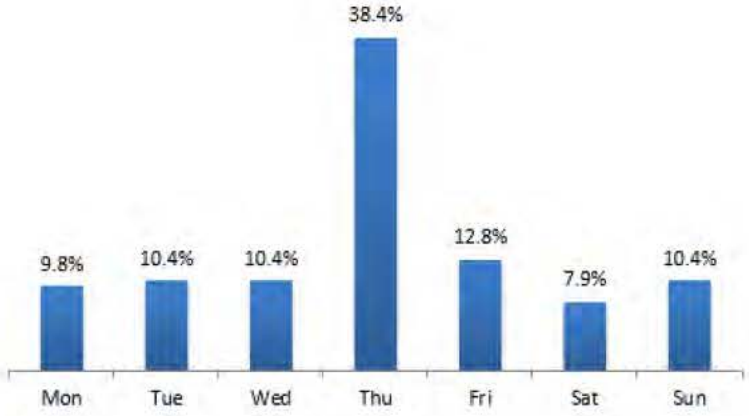


Figure 34. Inadequate document day-of-the-week distribution.

f. Smuggling

Smuggling activities that take place throughout the year do not have a clear pattern. Even so, a significant rise in activities can be spotted in May and September (Figure 35).

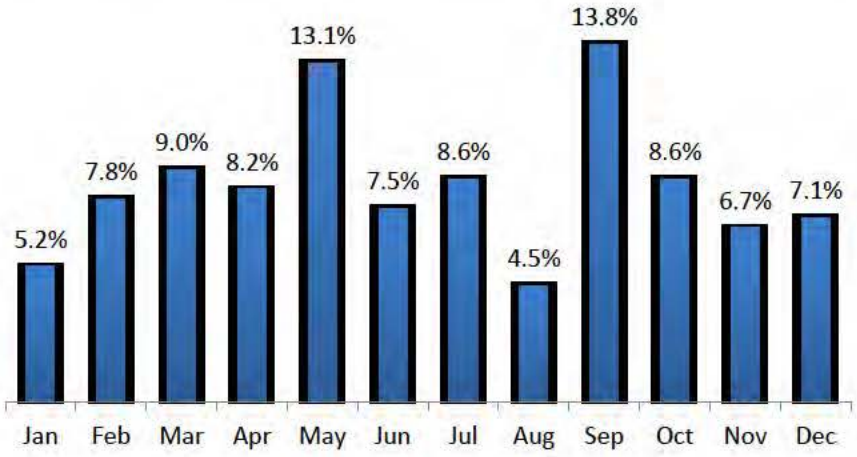


Figure 35. Smuggling month-of-the-year distribution.

The day-of-the-week pattern is less uniform in comparison to the month-of-the-year distribution. Smuggling activities mostly take place on the weekdays from Monday through Friday and drop significantly on the weekend (Figure 36).

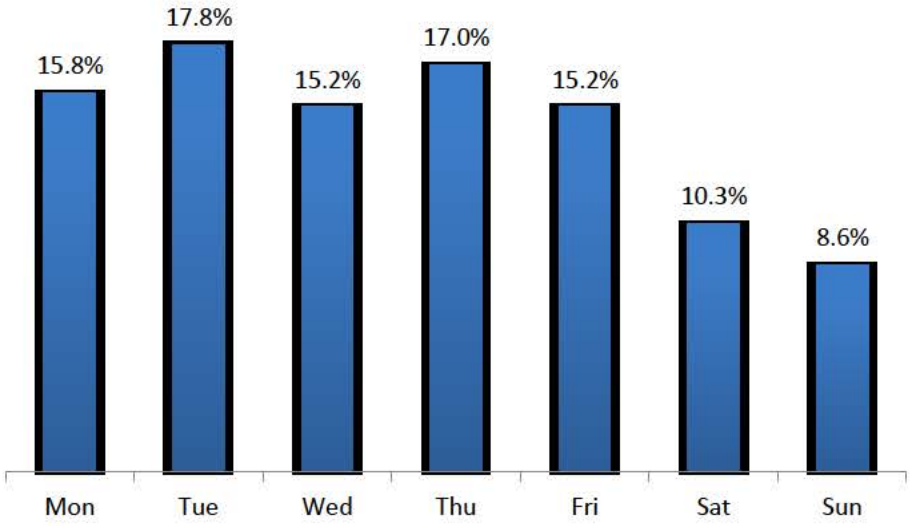


Figure 36. Smuggling day-of-the-week distribution.

D. SOCIAL NETWORK ANALYSIS

Using SNA, this study describes the current network structure. It begins by providing an overview of the network's topology in terms of its density, diameter, and average distance metrics. Centralization analysis also is employed to ascertain how centralized the network is. Finally, we run centrality analysis, using degree, betweenness and closeness centrality metrics to determine which organization/agency holds the central role within a network.

The current Indonesian maritime network shown below is the formal authority network structure. It is structured as a hierarchy, where every level reports to the one above it. The highest level is the Headquarters or the Directorate General. IMSCB as the coordinator collects all of the information from the HQ of each of the maritime agencies. The information is then distributed equally among the stakeholders of the maritime network. The structure of the hierarchy network of the current Indonesian maritime network is illustrated in Figure 37.

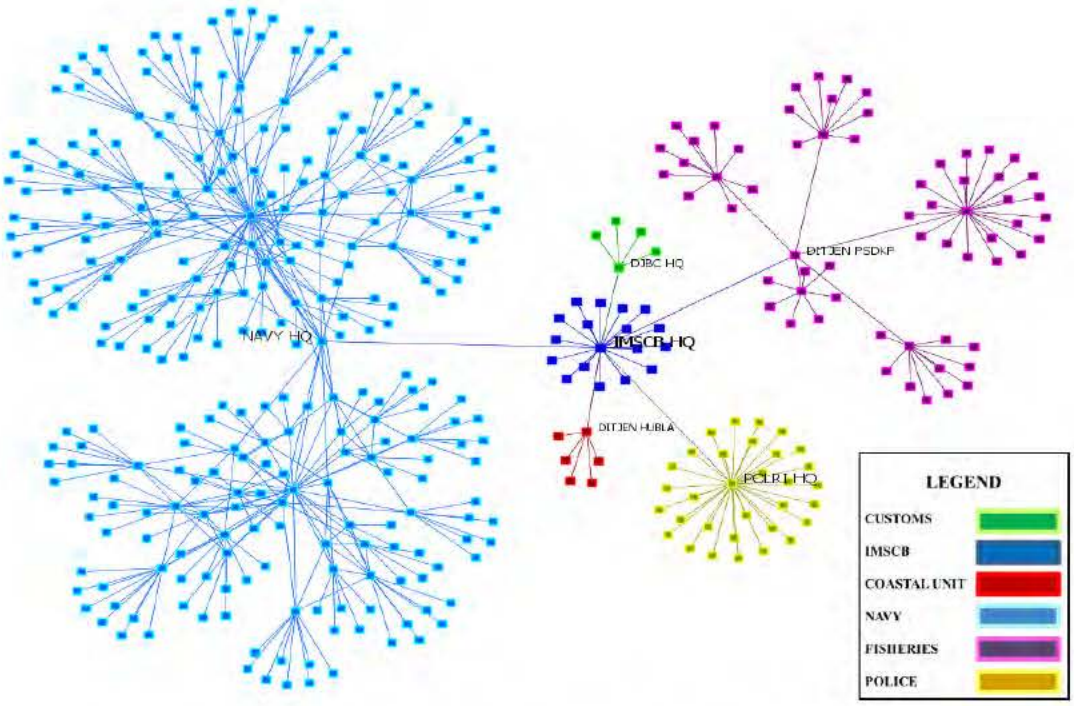


Figure 37. Indonesian formal authority network structure.

1. Basic Topographical Metrics

SNA analysis examines 413 nodes of the maritime security agencies from six Indonesian maritime network stakeholders. These stakeholders hold authorities to conduct maritime security operations on the sea. The nodes in the picture represent the IMSCB, Navy, Marine Police, KPLP, PSDKP, and customs agencies.

The basic topographical metrics of the formal authority network are shown in Table 12. The network has a density of 0.007 which means it has relatively few ties among the agencies in the network. The only connections are those in the hierarchy. (High density scores would be indicative of another type of structure which enables transfer of information among the agencies and better networking).

Table 12. The basic topographical metrics scores for the formal authority network.

Metrics	Formal authority network
Node Count	413
Density	0.007
Diameter	7
Average Distance	4.96
Compactness	0.227

The second metric is network diameter. The formal authority network has the value of 7. This score means that the longest distances between actors in the network is seven steps away, a score characteristic of centralized networks. In contrast, a less centralized network would have a lower score and would suggest faster information diffusion within the network (Samozain, 2013).

The formal authority network has a value of 4.96 for the average distance metric. It means that the average distance among the nodes within the network is relatively large. Due to the distance, it suggests a lengthy communication process to diffuse information throughout the network which is very characteristic of hierarchies.

The last metric is compactness, a variation of what is known as cohesion. Cohesion equals the proportion of all pairs of actors that can either directly (e.g. a friend) or indirectly (e.g. a friend of a friend) reach one another. This analysis uses compactness analysis which is simply one minus the respective fragmentation score (Everton, 2012, p. 138).[7] In the case of this formal authority network, the network has a cohesion score of 1.00 since there are no isolates or disconnected clusters. Compactness differs from cohesion in that it weights the cohesion score by the average (path) distance between all pairs of actors in the network. So, if there are two networks where 100 percent of the nodes are directly or indirectly connected to one another, but the average path distance is 1.5 in one and 2.0 in the other, the cohesion score for both networks will be the same, but the first network's compactness score will be greater than the second's (Everton, 2014). The scores were calculated using UCINET and the results

77 Network fragmentation refers to the degree of fragmentation that takes place within a network (Everton, 2012, p. 137).

for the formal authority network is 0.227 for compactness score. This score might indicate that the formal authority network is fairly compact in its coordination.

2. Centralization

The metrics for centralization are shown in Table 13. These metrics are measuring a network in order to determine its level of centralization. Based on the metrics, the formal authority network has the characteristics of a fairly centralized network as would be expected with the NAO form of governance, with the IMSCB as administrator, as described in Chapter II.

Table 13. The centralization scores for the formal authority network.

Metrics	Formal authority network
Degree Centralization	0.106
Degree Std. Dev.	0.011
Betweenness Centralization	0.621
Betweenness Std. Dev.	0.048
Closeness Centralization	0.287
Closeness Std. Dev.	0.029

3. Centrality

Centrality analysis looks for the central actor within a network based on the various measures of centrality. The central actor in a network has control over information resources and acts as the network's coordinator. Moreover, a coordinator of the network should be able to collect and distribute information to the whole network effectively and efficiently. In the case of Indonesian maritime domain, the government has appointed the IMSCB as the network administrator based on the decree (Perpres, 2005). For that reason, IMSCB should be the center of gravity for the network in accordance with its role as the coordinator to ensure the network is running well. However, a very different picture emerges as seen in figures 38–40 below. The formal

authority network does not pivot around the IMSCB. This suggests a serious issue given the central role of the IMSCB as the legitimate coordinator of the maritime network.

Table 14 illustrates the 15 top actors in the whole network with the highest value of degree, betweenness, and closeness centrality. The formal authority network recognizes the Eastern Fleet (Navy Eastern Fleet Command) with the highest degree centrality score and Navy HQ with the highest betweenness and closeness value. Moreover, the centrality measure puts the Navy's field offices as the central actors within the network. Table 14 provides the measurements for the Navy as the central actor of network in the formal authority network (see Figures 38–40). Despite the mandate that identifies IMSCB as the maritime network coordinator, the measurement of the network shows otherwise. In fact, the Navy holds the central role in the current maritime network.

Table 14. Top 15 actors in terms of degree, betweenness, and closeness centrality scores in formal authority network (Results were calculated using ORA SNA software).

Formal Authority Network		
Degree Centrality	Betweenness Centrality	Closeness Centrality
EASTERN FLEET	NAVY HQ	NAVY HQ
0.112	0.63	0.348
POLICE HQ	IMSCB HQ	EASTERN FLEET
0.078	0.479	0.324
WESTERN FLEET	EASTERN FLEET	WESTERN FLEET
0.068	0.352	0.306
IMSCB HQ	DITGEN PSDKP	IMSCB HQ
0.053	0.274	0.305
PSDKP BASE JKT	WESTERN FLEET	Naval Air Base Manado
0.053	0.256	0.299
Naval Air Base Juanda	POLICE HQ	Naval Air Base Juanda
0.039	0.145	0.298
Naval Base Tarempa	PSDKP BASE JKT	Naval Air Base Kupang
0.034	0.099	0.291
Naval Air Base Manado	Naval Air Base Tg. Pinang	Naval Air Base Biak
0.034	0.09	0.289
Naval Base Dabo Singkep	Naval Air Base Manado	Naval Air Base Tanjung Pinang
0.032	0.086	0.289
Naval Base Lhokseumawe	Naval Air Base Juanda	Naval Air Base Aru
0.032	0.076	0.289
NAVY HQ	Naval Air Base Jakarta	Naval Air Base Tual
0.032	0.069	0.288
Naval Base Batam	PSDKP Station Bitung	Naval Air Base Jakarta
0.029	0.048	0.288
Naval Base Dumai	PSDKP Station Pontianak	Naval Air Base Matak
0.029	0.048	0.283
Main Naval Base VII Kupang	Naval Base Dabo Singkep	Naval Air Base Sabang
0.029	0.043	0.283
Naval Base Banjarmasin	PSDKP StationTual	Naval Base Tegal
0.027	0.043	0.27

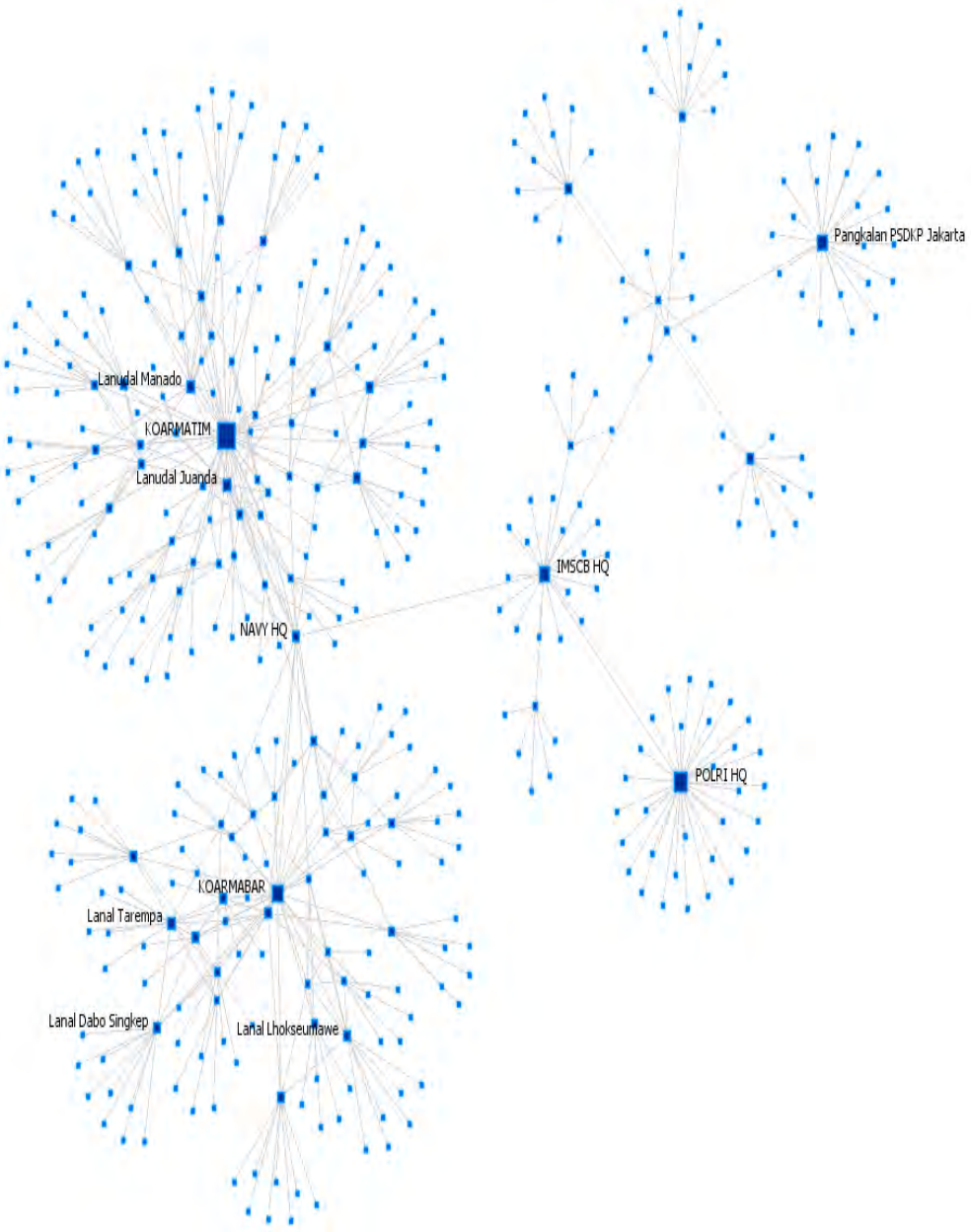


Figure 38. Formal authority network degree centrality.

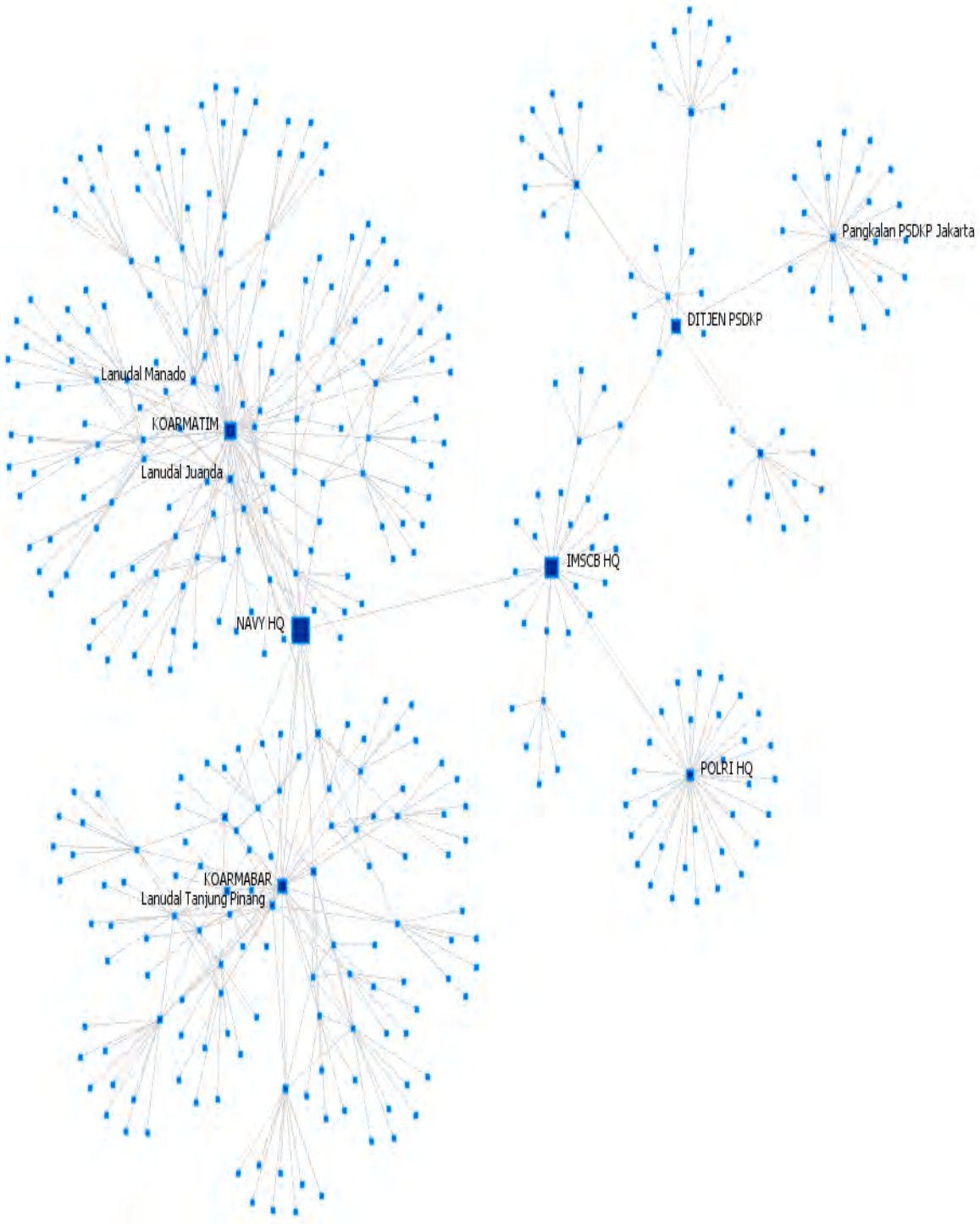


Figure 39. Formal authority network betweenness centrality.

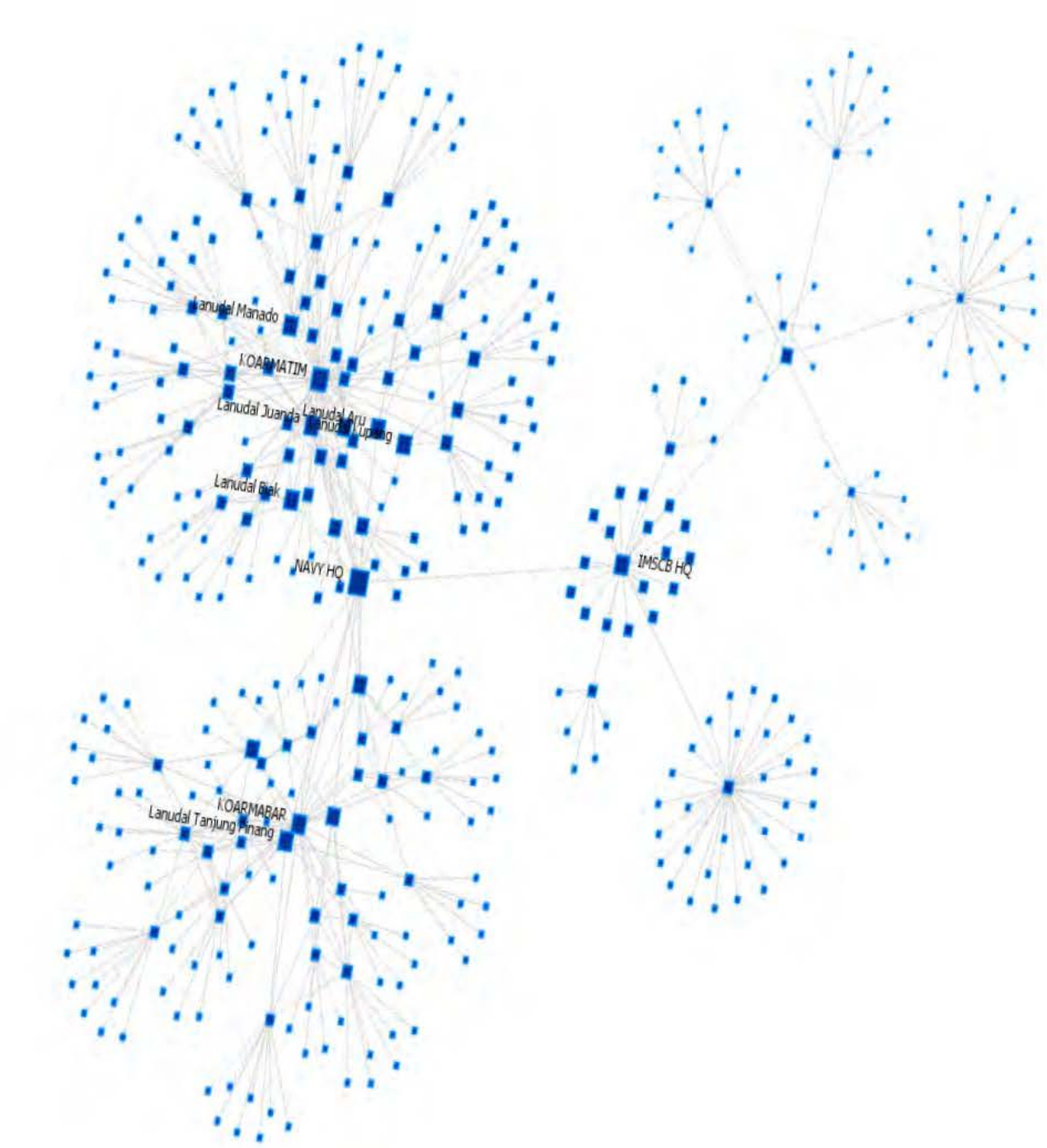


Figure 40. Formal authority network closeness centrality.

THIS PAGE INTENTIONALLY LEFT BLANK

V. DISCUSSION

The previous chapter analyzed the current Indonesian maritime network. The link analysis illustrated the connections among the maritime agencies and their authorities, noting the overlapping jurisdictions especially in the case of incident investigations and handling. The geospatial analysis located hotspots in the Indonesian maritime domain that require more attention and possibly the addition of additional branch offices. The temporal analysis identified patterns of incidents occurring at sea and social network analysis described the current network structure and some of its limitations.

Taken together, these analyses have prompted a search for alternative network structures to enhance network performance in the maritime domain. We offer two possibilities beyond the current structure: a regional network structure that forms clusters based on the geographical proximity; and a sea-lane network structure that clusters agencies based on the three Indonesian Sea Lanes of Communication (SLOC).

A. REGIONALLY CLUSTERED NETWORK

The regionally clustered network (Figure 41) is based on geographical proximity among the maritime stakeholders. They are clustered around the nearest IMSCB Information center in the HQ, Maritime Regional Control Centers (MRCCs), and the Regional Control Centers (RCCs). The IMSCB's information centers are then connected to each other to form 'chain' network. All of the MRCCs and RCCs are connected directly to the IMSCB HQ as the overall data coordinator. The picture is the whole network structure that shows the main nodes of the IMSCB's information processing centers that form a chain.

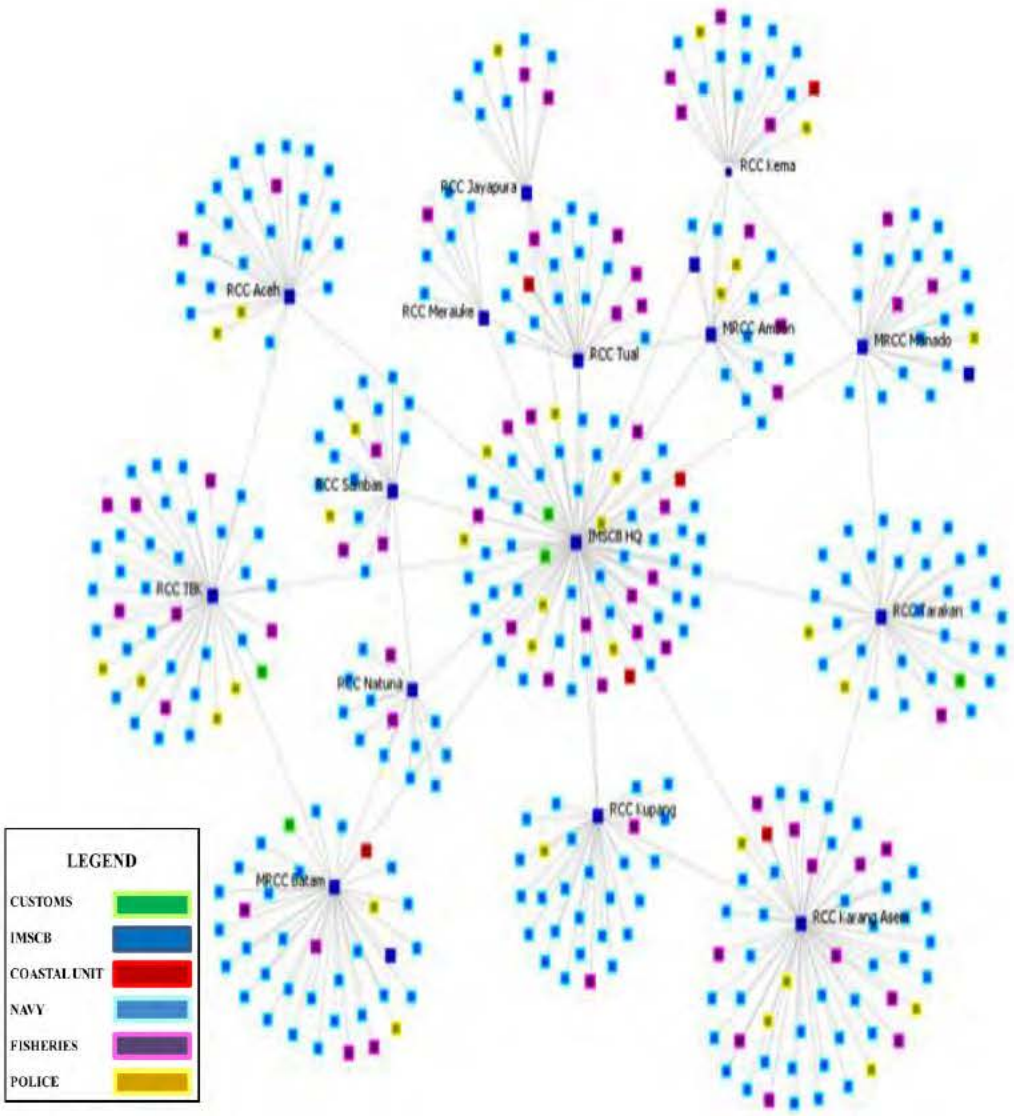


Figure 41. Indonesian maritime regionally clustered network.

Similar to the formal authority network, the regionally clustered network uses the same basic topographical metrics of centralization, and centrality. The results of these analyses are shown in tables 15 to 17 and figures 42 to 44.

Table 15. The basic topographic metrics for regionally clustered network.

Metrics	Regionally clustered network
Node Count	413
Density	0.005
Diameter	4
Average Distance	3.374
Compactness	0.313

Table 16. The centralization scores for regionally clustered network.

Metrics	Regionally clustered network
Degree Centralization	0.188
Degree Std. Dev.	0.016
Betweenness Centralization	0.775
Betweenness Std. Dev.	0.045
Closeness Centralization	0.509
Closeness Std. Dev.	0.034

Table 17. Top 15 actors in terms of degree, betweenness, and closeness centrality scores in regionally clustered network (Results were calculated using ORA SNA software).

Regionally clustered Network		
Degree Centrality	Betweenness Centrality	Closeness Centrality
IMSCB HQ	IMSCB HQ	IMSCB HQ
0.192 RCC Karang Asem	0.779 RCC Karang Asem	0.553 RCC Karang Asem
0.136 RCC TBK	0.247 RCC TBK	0.417 RCC TBK
0.104 MRCC Batam	0.191 MRCC Batam	0.407 RCC Tarakan
0.095 RCC Tarakan	0.171 RCC Tarakan	0.406 RCC Kupang
0.087 RCC Kupang	0.161 RCC Kupang	0.401 MRCC Batam
0.073 RCC Aceh	0.133 RCC Aceh	0.4 RCC Tual
0.066 MRCC Manado	0.118 MRCC Manado	0.391 MRCC Manado
0.058 RCC Tual	0.103 RCC Tual	0.388 RCC Aceh
0.058 MRCC Ambon	0.098 RCC Kema	0.387 RCC Natuna
0.049 RCC Kema	0.083 MRCC Ambon	0.383 RCC Kema
0.049 RCC Sambas	0.083 RCC Sambas	0.381 MRCC Ambon
0.046 RCC Natuna	0.081 RCC Natuna	0.38 RCC Sambas
0.039 RCC Jayapura	0.066 RCC Jayapura	0.372 RCC Jayapura
0.027 RCC Merauke	0.043 RCC Merauke	0.369 RCC Merauke
0.019	0.029	0.367

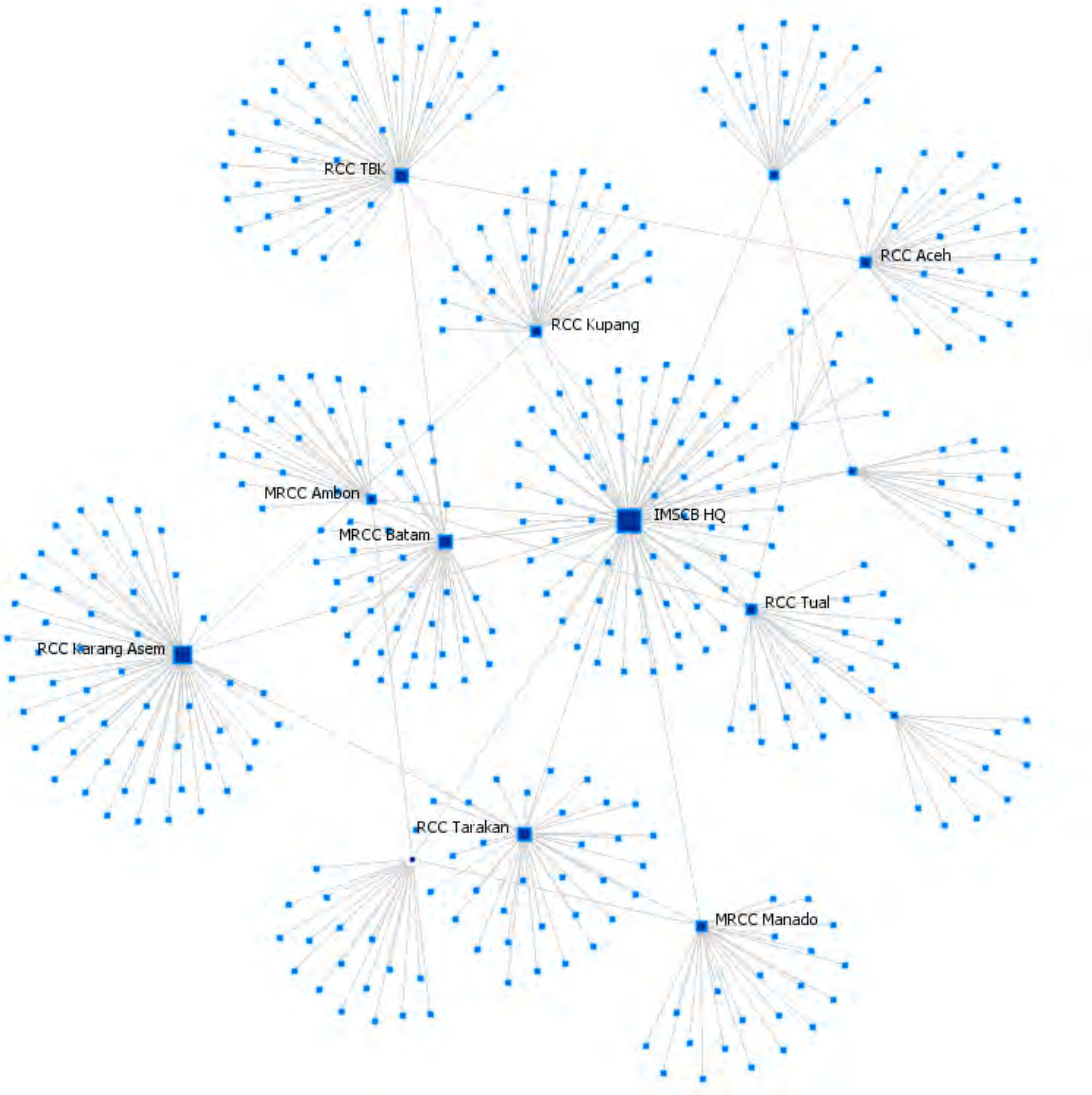


Figure 42. Regionally clustered network degree centrality.

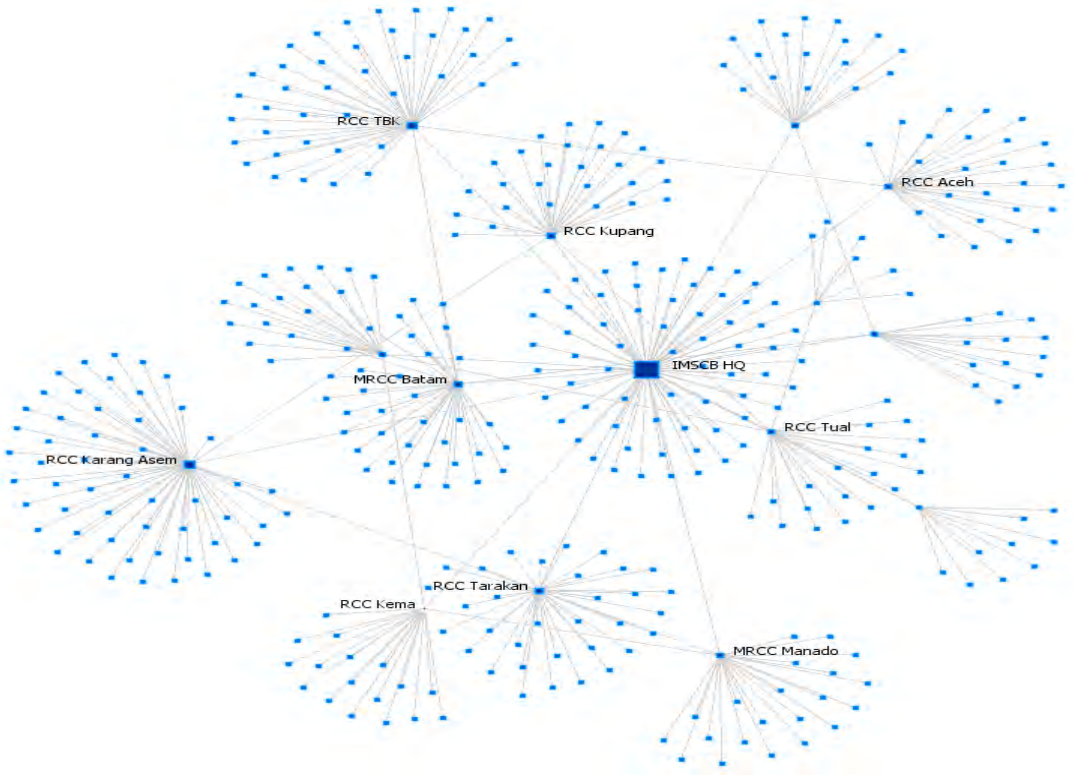


Figure 43. Regionally clustered network betweenness centrality.

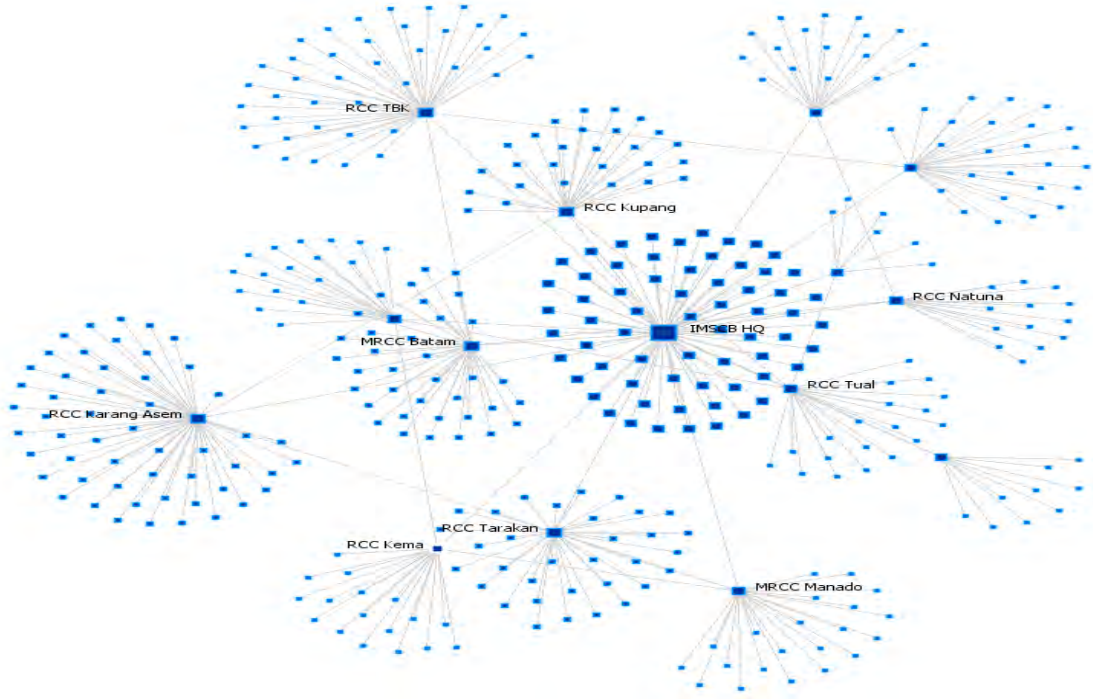


Figure 44. Regionally clustered network closeness centrality.

B. SEA-LANE CLUSTERED NETWORK

Indonesia has three SLOCs that connect the northern with the southern waters, mainly from the Pacific to the Indian Ocean. The second network structure illustrated in Figure 42 is taken from the "connected cluster" network (Gibbons, 2007). The basis of this structure is the location of Indonesian main SLOC. For that reason, the network is named the sea-lane clustered network. This structure is similar to the regional network structure in which the IMSCB's information centers are the hubs of the organizational clusters. But in this case, the IMSCB positions its resources along the three main Indonesian SLOCs. The stakeholders' branches are connected to the closest IMSCB's centers. All of the MRCCs and RCCs that create clusters in each SLOC then connect to each other—creating a mesh connection. Finally, every MRCC at the core of each cluster is coordinating with the IMSCB HQ Control Command Center (Puskodal). Figure 42 illustrates the structure.

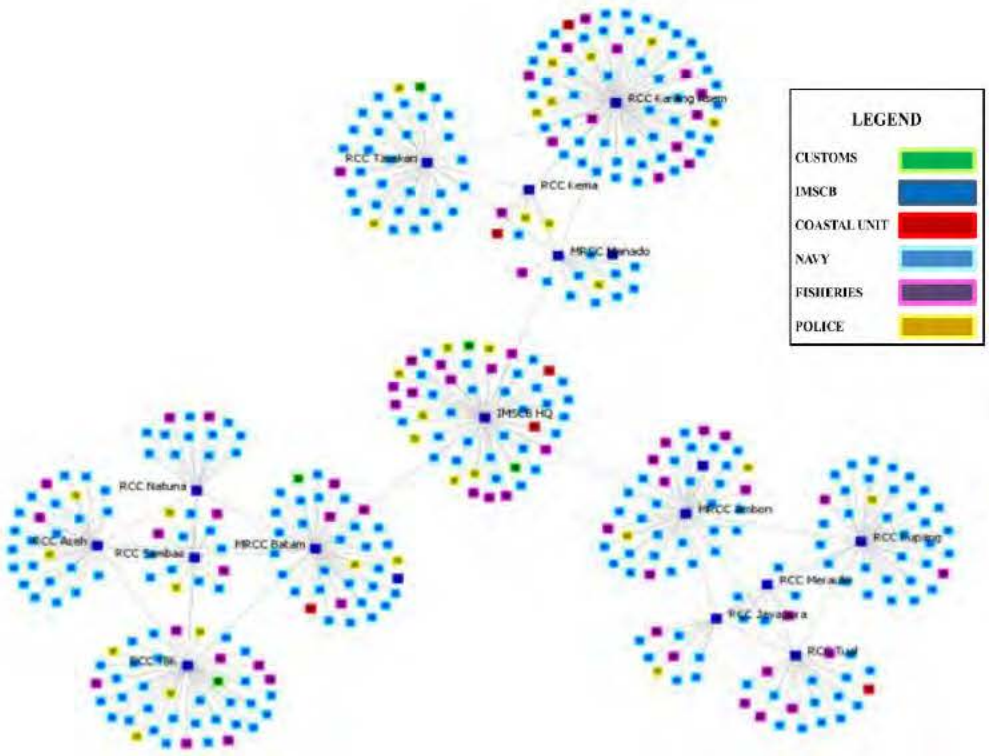


Figure 45. Indonesia maritime sea-lane clustered network.

With the similar analysis tools these are the results for the sea lanes based network structure.

Table 18. The basic topographic metrics scores for sea-lane clustered network.

Metrics	Sea-lane clustered network
Node Count	413
Density	0.005
Diameter	6
Average Distance	4.285
Compactness	0.266

Table 19.

Table 20. The centralization scores sea-lane clustered network.

Metrics	Sea-lane clustered network
Degree Centralization	0.158
Degree Std. Dev.	0.015
Betweenness Centralization	0.736
Betweenness Std. Dev.	0.057
Closeness Centralization	0.326
Closeness Std. Dev.	0.028

Table 21. Top 15 actors in terms of degree, betweenness, and closeness centrality scores in sea-lane clustered network (Results were calculated using ORA SNA software).

Sea-lane clustered Network		
Degree Centrality	Betweenness Centrality	Closeness Centrality
RCC Karang Asem	IMSCB HQ	IMSCB HQ
0.163	0.743	0.399
IMSCB HQ	MRCC Batam	MRCC Batam
0.129	0.485	0.349
RCC TBK	MRCC Ambon	MRCC Manado
0.107	0.433	0.34
MRCC Ambon	MRCC Manado	MRCC Ambon
0.104	0.423	0.337
MRCC Batam	RCC Karang Asem	DITGEN SEA Transport
0.1	0.287	0.285
RCC Kupang	RCC TBK	DITGEN PSDKP
0.092	0.185	0.285
RCC Tarakan	RCC Kupang	Custom HQ
0.087	0.158	0.285
RCC Aceh	RCC Tarakan	Regional Marine Police Banten
0.07	0.154	0.285
RCC Tual	RCC Aceh	Regional Marine Police Jabar
0.056	0.118	0.285
RCC Sambas	RCC Tual	Regional Marine Police Jateng
0.044	0.09	0.285
RCC Natuna	RCC Sambas	Regional Marine Police Lampung
0.041	0.067	0.285
MRCC Manado	RCC Natuna	Regional Marine Police Metro Jaya
0.039	0.062	0.285
RCC Jayapura	RCC Jayapura	Regional Marine Police South
0.032	0.043	0.285
RCC Merauke	RCC Merauke	WESTERN FLEET
0.024	0.029	0.285
RCC Kema	RCC Kema	Naval Base Banten
0.019	0.024	0.285

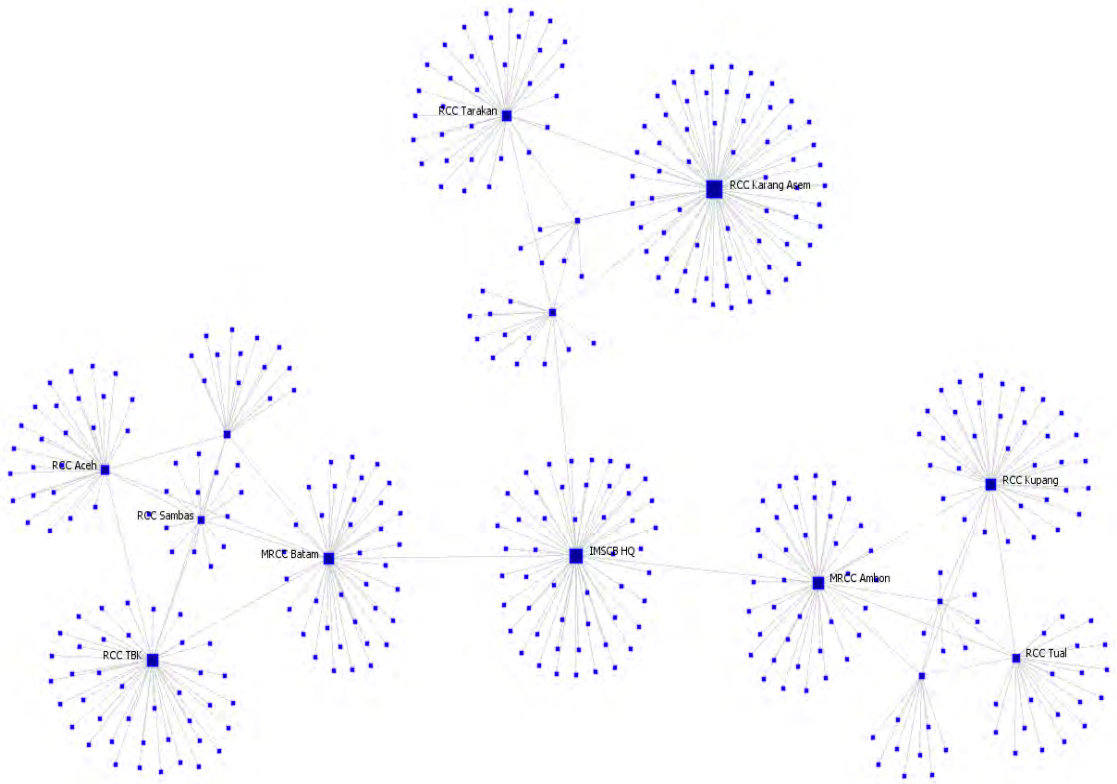


Figure 46. Sea-lane clustered network degree centrality.

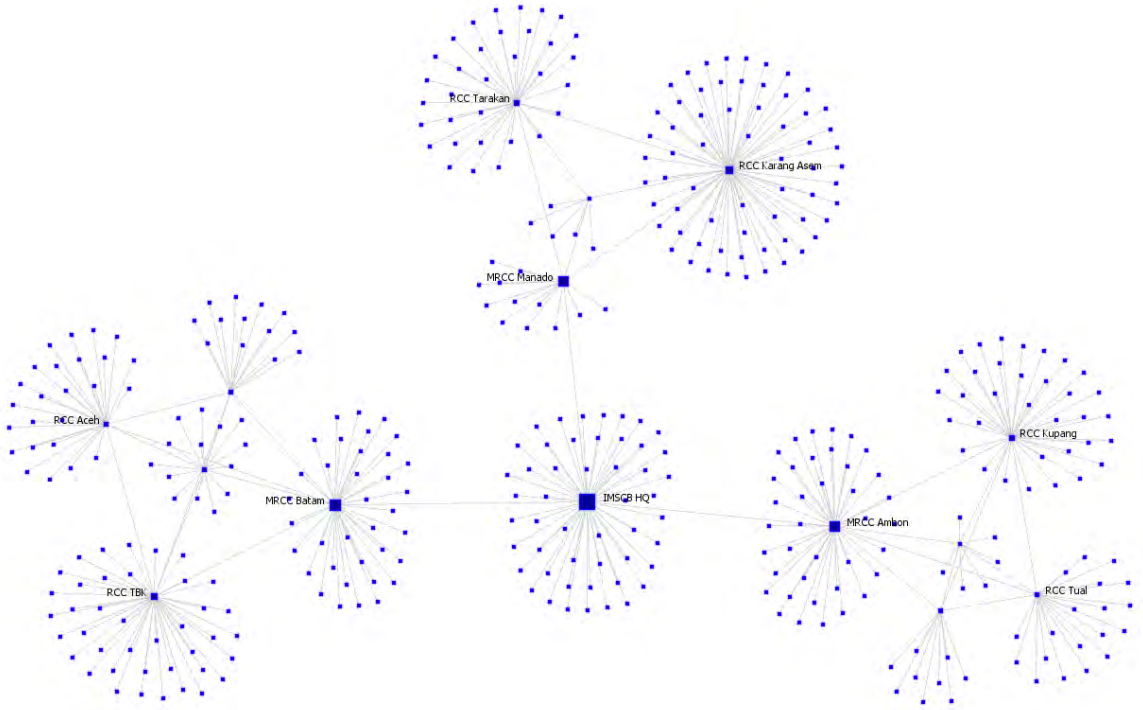


Figure 47. Sea-lane clustered network betweenness centrality.

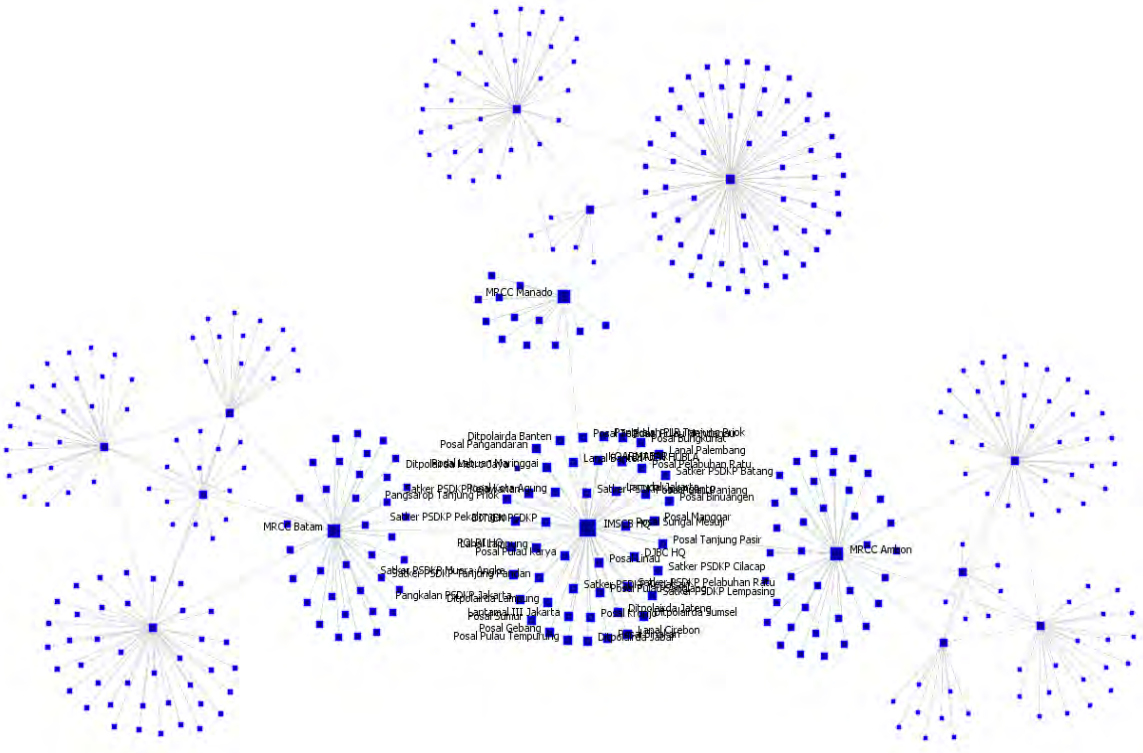


Figure 48. Sea-lane clustered network closeness centrality.

C. COMPARISON OF THE THREE NETWORK STRUCTURES

The current Indonesian formal authority network is compared with the two alternative network structures in Table 21 below using the basic topographical metrics.

Table 22. The basic topographic metrics scores comparison for three networks.

Metrics	Networks		
	Formal authority	Regionally clustered	Sea-lanes clustered
Node Count	413	413	413
Density	0.007	0.005	0.005
Diameter	7	4	6
Average Distance	4.96	3.374	4.285
Compactness	0.227	0.313	0.266

The formal authority network has a 0.007 density score. Meanwhile the other two have the same score of 0.005 for regional and sea-lane networks. The values of the second and third suggest the connections of these two alternatives would create fewer connections reducing the information sharing.

On the diameter metric comparison, the regionally clustered network has the shortest diameter with the value of (4) in comparison with the formal network that has the value of (7) and the sea-lane network with the value of (6). With the diameter value that is almost half of the formal authority network, the regionally clustered network is the least centralized network among these forms because the longest distance between actors in the network is only four steps away, ensuring that information would travel faster among the agencies.

The scores of the average distance of these networks are 4.96, 3.374, and 4.285, respectively, for the formal authority network, regionally clustered network, and sea-lane clustered network. The regionally clustered network has the shortest average geodesic distance. Therefore, the information distribution and coordination process in the regionally clustered network is likely to be faster, more efficient, and more effective.

The calculation of the three previous metrics has shown that the regionally clustered network is the most condensed network. Using the compactness analysis, the scores are 0.227,

0.313, and 0.266 for formal, regionally clustered, and sea-lane clustered network, respectively. The regionally clustered network has the highest compactness score which suggests this structure would be the most cohesive of the three structures.

The table below illustrates the comparison of the centralization metrics of the three networks (see Table 22). From the comparison scores, the betweenness centralization scores (0.621, 0.775, and 0.736 for formal, regionally clustered, and sea-lane clustered network respectively) reveal a mixed pattern. For example, in terms of degree centralization, the regionally clustered network is more decentralized. However, in terms of betweenness centralization, it is more centralized. Meanwhile, in terms of closeness centralization, regionally clustered network has the highest value.

Table 23. The centralization scores comparison for three networks.

Metrics	Networks		
	Formal authority	Regionally clustered	Sea-lane clustered
Degree Centralization	0.106	0.188	0.158
Degree Std. Dev.	0.011	0.016	0.015
Betweenness Centralization	0.621	0.775	0.736
Betweenness Std. Dev.	0.048	0.045	0.057
Closeness Centralization	0.287	0.509	0.326
Closeness Std. Dev.	0.029	0.034	0.028

From the comparison of these networks, the average score of the regionally clustered network is higher than the other networks (see Table 22). In five out of six measures the regionally clustered network has the higher scores for all metrics (except for betweenness standard deviation with 0.048, 0.045, and 0.057 for formal authority, regionally clustered, and sea-lane clustered networks, respectively). This result suggests that the regionally clustered network is the most centralized among these networks and, furthermore, has the potential to reinforce the IMSCB's vital role in maritime coordination.

To explore this potential, we compare the centrality metrics among the three network structures in the Table 23 below. As previously stated in chapter IV, the formal authority network points out the Navy is the central player in the maritime domain based

on centrality analysis. However, the regionally clustered network identifies IMSCB HQ as the actor with the highest score on all centrality measures, and all of the 15 top ranked actors on all metrics are the IMSCB's branch offices. For the sea- lane clustered network, IMSCB has the highest score for betweenness and closeness, and the RCC Karang Asem is the actor with the highest degree centrality. Additionally, on the degree and betweenness centrality metrics the IMSCB's branch offices all rank as the top 15 actors, while on closeness centrality, it is all maritime agencies.

The scores in Table 23 show the IMSCB as the central actor in the regionally clustered network structure. The sea-lane clustered network identifies IMSCB's betweenness (0.743) and closeness value (0.399) as relatively high, but IMSCB's centrality score on the regionally clustered network structure is higher (0.779 for betweenness and 0.553 for closeness) than the sea-lane clustered network. In short, IMSCB is more central in the regionally clustered network than in the sea-lane clustered network.

Table 24. Comparison of top 15 actors in terms of degree, betweenness, and closeness centrality scores comparison for three networks (Results were calculated using ORA SNA software).

Degree Centrality			Betweenness Centrality			Closeness Centrality		
Formal authority	Regionally clustered	Sea-lane clustered	Formal authority	Regionally clustered	Sea-lane clustered	Formal authority	Regionally clustered	Sea-lane clustered
EASTERN FLEET	IMSCB HQ	RCC Karang Asem	NAVY HQ	IMSCB HQ	IMSCB HQ	NAVY HQ	IMSCB HQ	IMSCB HQ
0.112	0.192	0.163	0.63	0.779	0.743	0.348	0.553	0.399
POLICE HQ	RCC Karang Asem	IMSCB HQ	IMSCB HQ	RCC Karang Asem	MRCC Batam	EASTERN FLEET	RCC Karang Asem	MRCC Batam
0.078	0.136	0.129	0.479	0.247	0.485	0.324	0.417	0.349
WESTERN FLEET	RCC TBK	RCC TBK	EASTERN FLEET	RCC TBK	MRCC Ambon	WESTERN FLEET	RCC TBK	MRCC Manado
0.068	0.104	0.107	0.352	0.191	0.433	0.306	0.407	0.34
IMSCB HQ	MRCC Batam	MRCC Ambon	DITGEN PSDKP	MRCC Batam	MRCC Manado	IMSCB HQ	RCC Tarakan	MRCC Ambon
0.053	0.095	0.104	0.274	0.171	0.423	0.305	0.406	0.337
PSDKP BASE JKT	RCC Tarakan	MRCC Batam	WESTERN FLEET	RCC Tarakan	RCC Karang Asem	Naval Air Base Manado	RCC Kupang	DITGEN SEA Transport
0.053	0.087	0.1	0.256	0.161	0.287	0.299	0.401	0.285
Naval Air Base Juanda	RCC Kupang	RCC Kupang	POLICE HQ	RCC Kupang	RCC TBK	Naval Air Base Juanda	MRCC Batam	DITGEN PSDKP
0.039	0.073	0.092	0.145	0.133	0.185	0.298	0.4	0.285
Naval Base Tarempa	RCC Aceh	RCC Tarakan	PSDKP BASE JKT	RCC Aceh	RCC Kupang	Naval Air Base Kupang	RCC Tual	Custom HQ
0.034	0.066	0.087	0.099	0.118	0.158	0.291	0.391	0.285
Naval Air Base Manado	MRCC Manado	RCC Aceh	Naval Air Base Tg. Pinang	MRCC Manado	RCC Tarakan	Naval Air Base Biak	MRCC Manado	Regional Marine Police Banten
0.034	0.058	0.07	0.09	0.103	0.154	0.289	0.388	0.285
Naval Base Dabo Singkep	RCC Tual	RCC Tual	Naval Air Base Manado	RCC Tual	RCC Aceh	Naval Air Base Tanjung Pinang	RCC Aceh	Regional Marine Police Jabar
0.032	0.058	0.056	0.086	0.098	0.118	0.289	0.387	0.285
Naval Base Lhokseumawe	MRCC Ambon	RCC Sambas	Naval Air Base Juanda	RCC Kema	RCC Tual	Naval Air Base Aru	RCC Natuna	Regional Marine Police Jateng
0.032	0.049	0.044	0.076	0.083	0.09	0.289	0.383	0.285
NAVY HQ	RCC Kema	RCC Natuna	Naval Air Base Jakarta	MRCC Ambon	RCC Sambas	Naval Air Base Tual	RCC Kema	Regional Marine Police Lampung
0.032	0.049	0.041	0.069	0.083	0.067	0.288	0.381	0.285
Naval Base Batam	RCC Sambas	MRCC Manado	PSDKP Station Bitung	RCC Sambas	RCC Natuna	Naval Air Base Jakarta	MRCC Ambon	Regional Marine Police Metro Jaya
0.029	0.046	0.039	0.048	0.081	0.062	0.288	0.38	0.285
Naval Base Dumai	RCC Natuna	RCC Jayapura	PSDKP Station Pontianak	RCC Natuna	RCC Jayapura	Naval Air Base Matak	RCC Sambas	Regional Marine Police South
0.029	0.039	0.032	0.048	0.066	0.043	0.283	0.372	0.285
Main Naval Base VII Kupang	RCC Jayapura	RCC Merauke	Naval Base Dabo Singkep	RCC Jayapura	RCC Merauke	Naval Air Base Sabang	RCC Jayapura	WESTERN FLEET
0.029	0.027	0.024	0.043	0.043	0.029	0.283	0.369	0.285
Naval Base Banjarmasin	RCC Merauke	RCC Kema	PSDKP StationTual	RCC Merauke	RCC Kema	Naval Base Tegal	RCC Merauke	Naval Base Banten
0.027	0.019	0.019	0.043	0.029	0.024	0.27	0.367	0.285

Based on the measurement of each network structure, the regionally clustered network structure comes up as the most favorable structure to support coordination and information-sharing process in the Indonesian maritime network. The regionally clustered network structure has several advantages that could benefit the Indonesian maritime network: the distance among agencies is shorter which could shorten the information spreading time; the less spread-out network has faster information diffusion within the network; the shortest geodesic distance is for more efficient and effective for information

distribution; the highest compactness score means the cohesiveness of the network is also high; the most centralized score suggests the network is more centralized compared to the other alternatives; and the central actor in the regionally clustered network structure is IMSCB and its branch offices that align with the IMSCB's task as the coordinator of the maritime network.

Moreover, the regionally clustered network aligned with the Maritime Domain Awareness (MDA) system developed in the United States after 9/11 (U.S. Coast Guard, 2005) and newly proposed in Indonesia through the idea of the Indonesian navy (Marsetio, 2014, pp. 54–61). The purpose of the information such as the MDA is to increase the maritime security through the diffusion of information to all maritime agencies in order to increase the awareness of the incidents that occur in the maritime domain.

The role of IMSCB also changes in a regionally clustered network. Connecting maritime agencies that are geographically adjacent to each other, the IMSCB would act as the hub within the clusters. All maritime agencies that are already divided into clusters will then forward any significant information that they gathered in the field directly to the IMSCB branch office in the vicinity. The IMSCB offices then would disseminate the information to the agencies in each cluster under them and also coordinate with the neighboring hub in other clusters. This system then would be useful for incidents that take place in areas between the two clusters. The hubs in the regionally clustered network structure will then end up in the IMSCB HQ as the main hub of the system.

For the reason that all IMSCB branch offices hold higher scores of centrality compared to the other agencies of this network, the diffusion and collection of information could reach the agencies faster in comparison to the other structural alternatives. This pattern of information dissemination would enable the agencies to respond more promptly. Furthermore, this structure allows widespread information gathering system that is not limited to particular agencies, but involves all resources in the field. This system stands to l benefit the whole network since the information gathering resources are spread along the archipelago.

D. RESOURCES ALLOCATION IN A REGIONALLY CLUSTERED NETWORK STRUCTURE

There are other advantages in creating a regionally clustered network structure. First, based on the results of the link analysis, we are able to clear up the overlapping jurisdictions that create complications among the agencies in the maritime domain. Secondly, based on the results of the geospatial and temporal analysis, we are able to deploy operations more efficiently and effectively.

1. Link Analysis

Link Analysis shows the connection between the maritime agencies and their authorities in the maritime domain based on the specific government regulations and mandates to the maritime agencies. Moreover, link analysis identifies the overlapping jurisdictions and authorities among the maritime agencies that in some types of incidents at sea, could be handled by more than one agency, resulting in inefficient and ineffective use of the agencies' resources. The authorities' identification then are related to the hotspot areas from the geospatial analysis in order to identify which agencies are needed in certain hotspot areas.

The distribution of the maritime agencies in the archipelago seems to be concentrated in the western part of Indonesia, especially in the Malacca and Singapore Straits, and the Northern part of Java Island (see Figure 49). This map illustrates the disparity of maritime agencies between the western and eastern parts of Indonesia. Meanwhile, SLOCs are located both in western and eastern Indonesia. This particular matter needs to be considered by policy makers in order to increase maritime security capabilities.

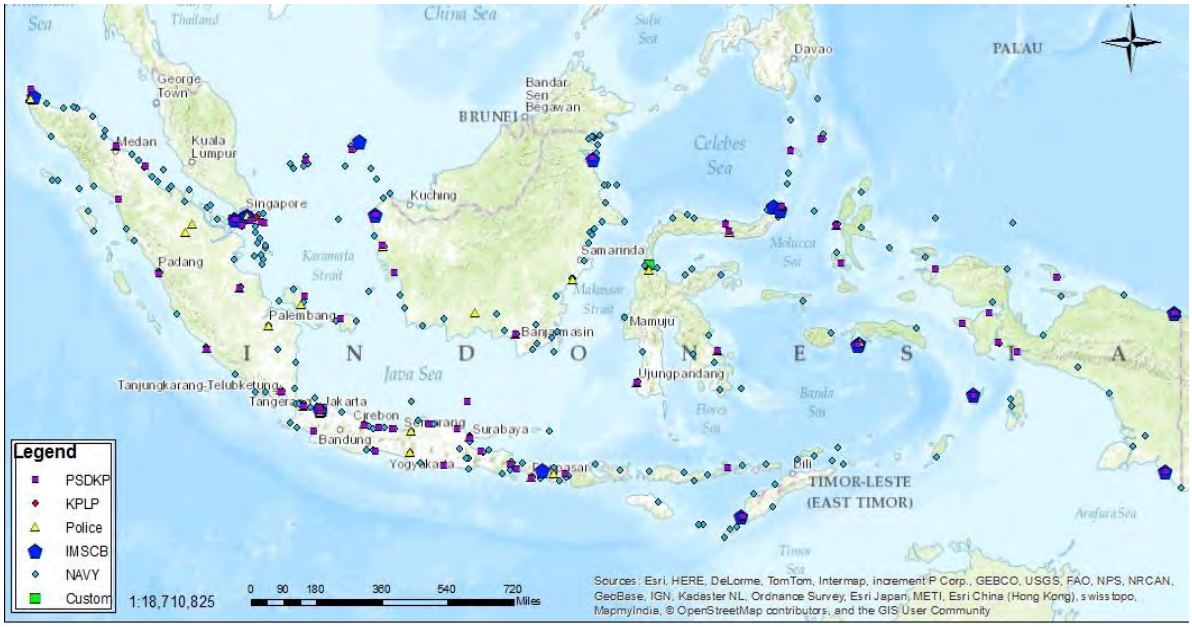


Figure 49. Indonesian maritime agencies dispersion map.

In relation to the hotspot areas provided by the geospatial analysis, there are several hotspots with an abundance of agencies. However, there are many areas that lack of agencies to monitor activities at sea let alone to handle the incidents that occur in these areas. For example, on the one hand, the Navy's resources are spread widest in the archipelago, but the Navy does not have the authorities to address all maritime issues. There are some issues that need to be addressed by the appropriate agencies. On the other hand, the KPLP (Coastal Unit) has only several agencies in the western part of Indonesia. Meanwhile the violations in which only KPLP has the right to process are occuring all over the archipelago. Table 24 illustrates the authorities of the maritime agencies involved in the maritime operation at sea.

Table 25. The authorities of maritime agencies for several types of violations.

Violation Type	IMSCB	NAVY	MARINE POLICE	CUSTOM	KPLP	PSDKP
Armed Robbery	✓	✓	✓			
Asylum Seeker	✓		✓			
Boundary Violation	✓	✓	✓			
Environmental Pollution	✓	✓	✓			
Human Trafficking	✓	✓	✓			
Illegal Fishing	✓	✓				✓
Illegal Logging	✓		✓			
Inadequate Documents	✓	✓	✓		✓	
Illicit Sea Treasure Exploration	✓	✓	✓			
Smuggling	✓	✓	✓	✓		

2. Geospatial Analysis

Spatial analysis displays the incident hotspots that occur in Indonesian territorial waters. The hotspot areas are categorized into several types: accidents at sea and violations at sea. These are sub-divided into ten sub-types of armed robbery, asylum seeker, boundary violation, environmental pollution, human trafficking, illegal fishing, illegal logging inadequate documents, smuggling, and illicit sea treasure exploration.

These hotspots are then used to identify the areas in the maritime domain that require more attention, since some hotspots lack the agencies with appropriate authorities to conduct investigations and handle incidents. The government can fill these gaps by establishing related maritime agencies in the hotspot areas to address security concerns. However, the following guidance should be considered tentative. Current observations are based on limited data and most likely do not provide a complete picture of the maritime domain incidents and accidents. Analyses and the recommendations will likely change as data collection processes improve in the future.

Accidents at sea are concentrated in the western part of Indonesia where the maritime agencies are quite sufficient. The high number of accidents could be caused by several factors: bad weather, inadequate safety precautions, and the violation of the safety regulations. These factors are independent of the maritime agencies in the areas.

However, the enforcement of safety regulations might need more attention in order to address the high number of accidents at sea.

Armed robbery takes places in areas in which the maritime agencies are also quite abundant. One issue that needs exploration is how well all the agencies involved and integrate their activities to avoid overlapping responsibilities. In addition, lax law enforcement toward the perpetrators at sea and insufficient precautions on shore are likely to contributing to the number of these types of violations (ReCAAP,2013).

Asylum seeking is a unique type of violation. Indonesia is typically not the final destination for the perpetrators, but Australia is. Looking at these hotspots, it appears that the immigration agency that has the authority to address this violation does not have the resources to go off shore. For that reason, the immigration office has to coordinate agencies that have with seagoing resources. This is especially the case for the asylum seeker hotspot situated in the southern part of Indonesia. The area does not have many maritime agencies nor do they have easily accessible resources. More resources are needed in this region to handle the violations.

Boundary violations are happening in the border areas. However, based on the hotspot analysis, the violations are quite distant from the closest agencies. From this data, it would appear that it would be more prudent to place more agencies closer to the hotspot area than to continue to rely on ships with limited range to patrol the area.

Environmental pollution hotspot areas are spread out in several parts of Indonesia. On the Northeast of Sumatra apparently the number of the maritime agencies is sufficient to address the incidents, although there are still legal and environmental enforcement issues. In other areas, even though some agencies exist, they have neither the capabilities nor resources to tackle this type of problem since the agencies presence is normally only in the form of small outposts.

Human trafficking is a serious transnational crime that requires prompt handling and response. The hotspot analysis indicates that some of the locations have sufficient maritime agencies but others lack them. The dispersion of agencies' resources towards

the most serious hotspot areas, around Kupang and Surabaya waters, would be an important first step in suppressing the human trafficking in these areas.

Illegal fishing is a common type of violation in Indonesia with its vast sea areas. The high numbers of violations indicate that either the perpetrators are increasing or the maritime agencies are losing their grip on the situation. Nevertheless, in the western part of Indonesia the numbers of agencies are somewhat equal to the number of illegal fishing incidents except in the Natuna islands that requires more resources at sea. The eastern part of Indonesia also appears to need more resources and patrol operation to suppress the number of these violations.

Illegal logging is taking place in the areas where minimum resources are located, especially in eastern Indonesia. The initial points normally are Sumatra and Borneo as the primary producer of logs. Considering what the hotspots show, more operational deployments are needed to monitor the areas.

Inadequate documents are surfacing near the ports as ships require documents to go offshore. The maritime agencies in the hotspots are required to deploy more patrols ships in the harbor area and to be attentive to ships going in and out of the ports.

Smuggling hotspots normally occur in the border areas. This type of violation requires rigorous patrol operation in the hotspot areas. It would appear that the agencies in these hotspots are sufficient to address the issue of smuggling.

Illicit sea treasure exploration is only happening in very specific areas that are assumed to hold high-value assets. The areas are also quite small. However, it takes intensive operational deployments in order to decrease the violations. In addition, the numbers of agencies and resources to handle this type of violation are deemed insufficient.

3. Temporal Analysis

The result of temporal analysis enables maritime agencies under the coordination of IMSCB to deploy more effective and efficient operations based on the peak time of incidents at sea. However, given the sparseness of the data, there are only several violation could be examined using temporal analysis method.

Accidents at sea pattern shows that the authorities should be attentive at the beginning of the year, as the number of accidents is very high then. Meanwhile, on a day-to-day basis, accidents appear to be spreading widely during the weekdays and decreasing slightly on the weekend days (see Figure 50 below).

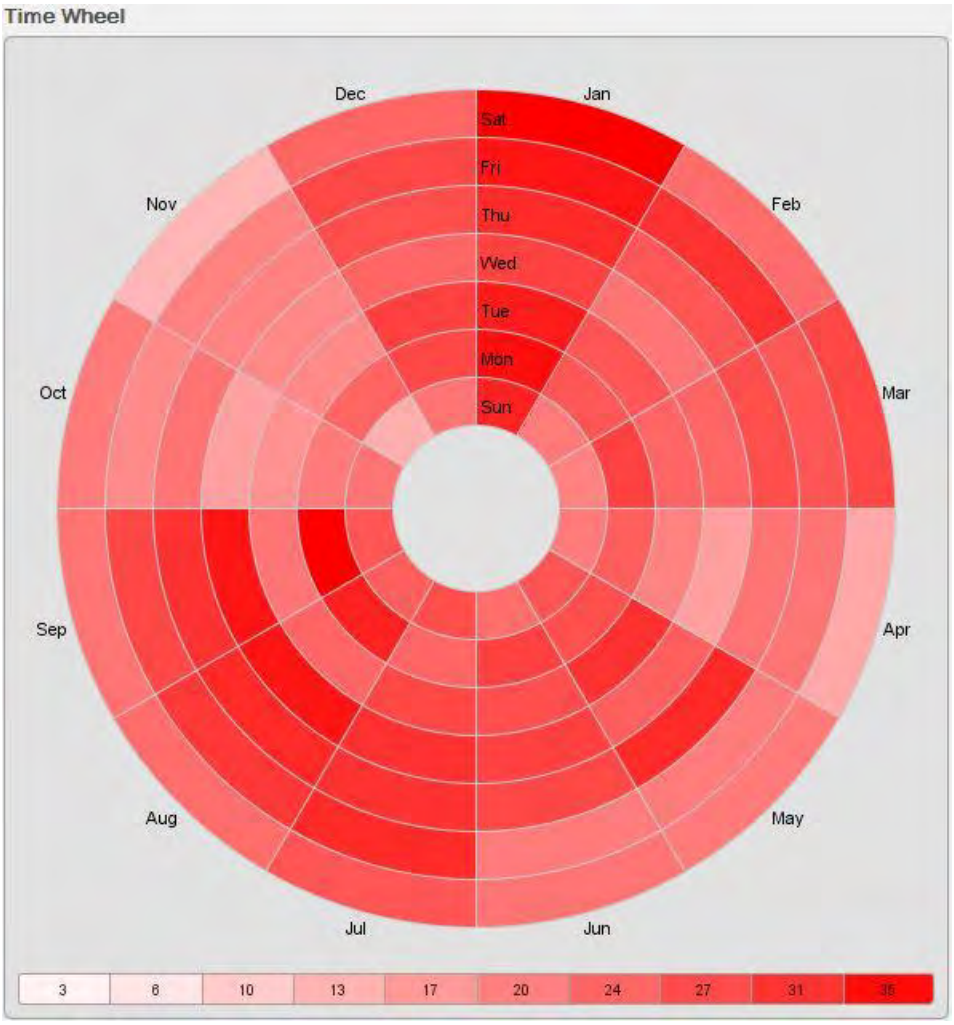


Figure 50. Accidents at sea time wheel (Data from 2008–2013).

For most *Violations at sea*, there is apparently no significant pattern to guide agency operations. Most violation patterns are scattered. However, analyzing illegal fishing on the monthly basis and inadequate documents on a weekly basis shows some violation patterns. These reveal times that could guide operational deployments of maritime agencies.

Overall, incidents are more likely to happen from February until November with the peak occurring between March and April. The lowest numbers of incidents occur between December and January. For the day-of-the-week category, Sunday and Monday are the days with the lowest numbers of incidents. Meanwhile, the peak takes place on Tuesday to Thursday as shown in the Figure 51 below.

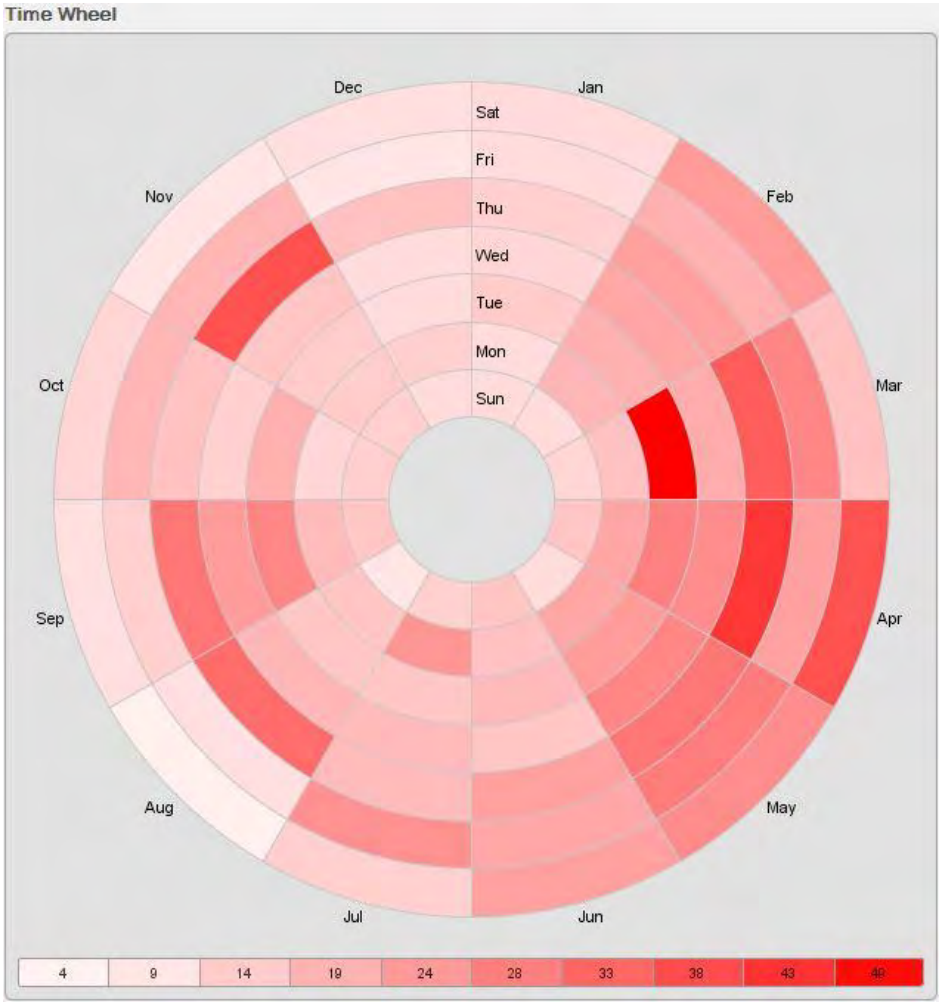


Figure 51. Violations at sea time wheel (Data from 2008–2013).

Temporal analysis indicates the distinct time that accidents and violations at sea may occur. With more significant numbers of data, the maritime agencies may identify the time pattern of these occurrences and manage their operational deployment based on the temporal analysis of information. Instead of deploying and wasting the assets without clear tasks, temporal analysis enables the maritime agencies to operate based on the critical month-of-the-year and day-of-the-week basis that enables them to save scarce resources.

VI. SUMMARY AND RECOMMENDATIONS

The complexity of the problem in the Indonesian maritime domain is putting the nation in a vulnerable position. The matter of maritime security, especially in an archipelagic nation such as Indonesia, should be a top priority that requires immediate action due to the imminent nature of the threats. Indonesia's dependence on its maritime sector should be balanced with good maritime governance of the domain.

This study is an effort to provide better alternatives to existing maritime security management. Its results are just some of the considerations for policy-makers in making improvements in the Indonesian maritime domain. Thus, it should not be taken as a "silver bullet" for all Indonesian maritime security issues, especially considering the complex nature of the maritime domain. It is merely providing additional insights for the government, in this case the IMSCB and other maritime agencies, drawn from our social network analysis and visual analytic methods used in this study.

The data included in this study are based on the data collection of IMSCB that came from reports of incidents and arrests. The data collection process is passive in nature in that the maritime agencies are not searching for data in the field. Instead, data collection is sourced from the reports that came to the agencies and channeled up to the IMSCB's data and information processing center. Without a doubt, there are still many unrecorded data that have not been successfully collected and reported to the information center. The incomplete may likely have skewed the results of the analysis. Nevertheless, the methodologies used in this study suggest the way forward when better data collection strategies have been developed and employed.

A. SUMMARY

This study has determined that the existing network structure does not adequately support the information-sharing process in order to increase maritime domain awareness and security. The current *formal authority network* does not distribute information throughout the network and coordinate it effectively. The lag-time in information diffusion also creates delays in the response time to address incidents that occur in the domain.

For that reason, this study has proposed another network structure for better coordination and information sharing within the Indonesian maritime network. The regionally clustered network structure, as described in the previous chapters, has advantages that we believe can improve coordination and information dissemination within the maritime domain. It also supports the IMSCB mandate that makes it the sole coordinator of the maritime security issues and the central actor within the network.

The *geospatial analysis* reveals the hotspot areas that require more attention from the maritime agencies in a regionally based network. It also identifies what maritime agencies are needed in other areas in order to handle particular incidents. However, the accuracy and significance of these hotspot maps are highly dependent on the quality of the data being collected. Until we have a more robust data collection process, the results should be treated as tentative.

The *temporal analysis* enables us to chart incidents at sea over time. The results enable the regionally-based maritime agencies to identify the best times to deploy their resources and to conduct operations at sea. As with the other analyses in this study, temporal analysis is also highly dependent on the quality of the data collected and the results must be treated as tentative.

B. RECOMMENDATIONS

Based on the findings of this study, we offer several recommendations. First, the maritime domain requires accurate and reliable data regarding incidents at sea. The existing system does not provide a complete picture of the incidents, e.g. when and when they are occurring. Indonesia needs an active data collection process. The existing data, which this study extracted from IMSCB information center, is still lacking in source details and reliability. The government, in this case, is the IMSCB as the coordinator of the maritime security network, needs to improve the data gathering process and include all maritime stakeholders, not just the government agencies. Instead of passively waiting for incident reports, maritime assets should actively collect data in each region's area of responsibility. This would be an important first step is gathering more reliable data and information.

In support of the previous recommendation, the proposed regionally-clustered network structure could be used to improve the network's overall data collection and distribution processes. The regionally based structure, as previously noted, is capable of delivering information faster and coordinating throughout the network by using all nodes in the system to collect data and enhance coordination. Moreover, through the IMSCB branches that are acting as hubs, the collected information is quickly diffused to the entire network for better information sharing.

The Indonesian maritime agencies should use geospatial and temporal analysis to improve the efficiency and effectiveness of resources distribution in their operational deployments. Geospatial analysis is providing hotspot area identification so maritime agencies can focus their security efforts as well as identify areas that requires more security resources and services. Temporal analysis reveals the incidents' patterns based on time. With further interpretation, this analysis could determine the better time to conduct sea patrols and maritime security operations.

This study has identified methodologies for analyzing the Indonesian maritime domain and the networks its agencies and stakeholder have created. Our analysis also has identified improvements we believe are needed to meet emerging challenges and threats in the domain. While our study does not aim to address all maritime issues that are intertwined with many other aspects in our complex and challenging environment, we offer our recommendations as merely one effort to advance maritime governance and to unravel the tangled problems in the maritime domain.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX. LIST OF INDONESIAN MARITIME AGENCIES

A. IMSCB

Index	ORGANIZATION	LEVEL
1	IMSCB HQ	HQ
2	Task Force I Batam	Task Force
3	MRCC Batam	MRCC
4	RCC Aceh	RCC
5	RCC Sambas	RCC
6	RCC TBK	RCC
7	RCC Natuna	RCC
8	Task Force II Manado	Task Force
9	MRCC Manado	MRCC
10	RCC Kema	RCC
11	RCC Tarakan	RCC
12	RCC Karang Asem	RCC
13	Task Force III Ambon	Task Force
14	MRCC Ambon	MRCC
15	RCC Kupang	RCC
16	RCC Tual	RCC
17	RCC Jayapura	RCC
18	RCC Merauke	RCC

B. NAVY

Index	Organization	Level
1	NAVY HQ	HQ
2	WESTERN FLEET	Fleet HQ
3	Main Naval Base I Belawan	Main Naval Base
4	Naval Base Sabang	Naval Base
5	Naval Post Suka Karya	Naval Post
6	Naval Post Meulaboh	Naval Post
7	Naval Post Lhoknga	Naval Post
8	Naval Post Malahayati	Naval Post
9	Naval Post Lampulo	Naval Post

Index	Organization	Level
21	Naval Post Panipahan	Naval Post
22	Naval Post Selat Panjang	Naval Post
23	Naval Post Tanjung Medang	Naval Post
24	Naval Post Sinaboy	Naval Post
25	Naval Post Muntai	Naval Post
26	Naval Base T.B. Asahan	Naval Base
27	Naval Post Tanjung Tiram	Naval Post
28	Naval Post Sei Berombang	Naval Post
29	Naval Post Bagan Asahan	Naval Post

Index	Organization	Level
10	Naval Base Lhokseumawe	Naval Base
11	Naval Post Base Susu	Naval Post
12	Naval Post Sigli	Naval Post
13	Naval Post Kuala Peudada	Naval Post
14	Naval Post Idi Rayeuk	Naval Post
15	Naval Post Kreung Geukuh	Naval Post
16	Naval Post Seruway	Naval Post
17	Naval Base Dumai	Naval Base
18	Naval Post Pulau Jemur	Naval Post
19	Naval Post Bagan Siapi-api	Naval Post
20	Naval Post Bengkalis	Naval Post
41	Naval Post Teluk Dalam	Naval Post
42	Naval Base Bengkulu	Naval Base
43	Naval Post Pulau Enggano	Naval Post
44	Naval Post Linau	Naval Post
45	Naval Post Muko-muko	Naval Post
46	Main Naval Base III Jakarta	Main Naval Base
47	Naval Post Pulau Karya	Naval Post
48	Naval Post Tanjung Pasir	Naval Post
49	Naval Base Palembang	Naval Base
50	Naval Post Jambi	Naval Post
51	Naval Post Sungai Mesuji	Naval Post
52	Naval Base Banten	Naval Base

Index	Organization	Level
30	Naval Post Bandar Khalifah	Naval Post
31	Naval Base Simeuleu	Naval Base
32	Naval Post Singkil	Naval Post
33	Naval Post Pulau Banyak	Naval Post
34	Naval Air Base Sabang	Naval Air Base
35	Main Naval Base II Padang	Main Naval Base
36	Naval Post Air Bangis	Naval Post
37	Naval Post Simaubuk	Naval Post
38	Naval Base Sibolga	Naval Base
39	Naval Post Gunung Sitoli	Naval Post
40	Naval Post Natal	Naval Post
84	Naval Post Sugi	Naval Post
85	Naval Post Pulau Galang	Naval Post
86	Naval Post Telaga Punggur	Naval Post
87	Naval Base Tarempa	Naval Base
88	Naval Post Jemaja	Naval Post
89	Naval Post Pulau Mangkai	Naval Post
90	Naval Post Memperuk	Naval Post
91	Naval Post Tambelan	Naval Post
92	Naval Post Mengkait	Naval Post
93	Naval Base Ranai	Naval Base
94	Naval Post Pulau Laut	Naval Post
95	Naval Post Pulau	Naval

Index	Organization	Level
53	Naval Post Pulau Sangiang	Naval Post
54	Naval Post Pulau Tempurung	Naval Post
55	Naval Post Pulau Panjang	Naval Post
56	Naval Post Binuangen	Naval Post
57	Naval Post Sumur	Naval Post
58	Naval Post Kronjo	Naval Post
59	Naval Base Cirebon	Naval Base
60	Naval Post Gebang	Naval Post
61	Naval Post Binakan	Naval Post
62	Naval Base Lampung	Naval Base
63	Naval Post Kota Agung	Naval Post
64	Naval Post Labuan Maringgai	Naval Post
65	Naval Post Teladas	Naval Post
66	Naval Post Bungkunat	Naval Post
67	Naval Base Bangka-Belitung	Naval Base
68	Naval Post Muntok	Naval Post
69	Naval Post Manggar	Naval Post
70	Naval Post Pulau Mendanau	Naval Post
71	Naval Post Pangkal Balam	Naval Post
72	Naval Post Pelabuhan Ratu	Naval Post
73	Naval Post Pangandaran	Naval Post
74	Naval Air Base Jakarta	Naval Air Base
75	Main Naval Base IV Tg.	Main Naval

Index	Organization	Level
	Subi	Post
96	Naval Post Pulau Sarasan	Naval Post
97	Naval Post Midai	Naval Post
98	Naval Post Sebang Mawang	Naval Post
99	Naval Post Penangi	Naval Post
100	Naval Post Sedanau	Naval Post
101	Naval Base Dabo Singkep	Naval Base
102	Naval Post Senayang	Naval Post
103	Naval Post Penumba	Naval Post
104	Naval Post Kuala Elok	Naval Post
105	Naval Post Tanjung Datuk	Naval Post
106	Naval Post Cempa	Naval Post
107	Naval Post Pancur	Naval Post
108	Naval Post Pulau Mas	Naval Post
109	Naval Post Tajur Biru	Naval Post
110	Naval Post Pulau Lalang	Naval Post
111	Naval Base Tanjung Balai Karimun	Naval Base
112	Naval Post Takong Hiu	Naval Post
113	Naval Post Leho	Naval Post
114	Naval Post Moro	Naval Post
115	Naval Base Pontianak	Naval Base
116	Naval Post Pulau Serutu	Naval Post
117	Naval Post Ketapang	Naval Post
118	Naval Post	Naval

Index	Organization	Level
	Pinang	Base
76	Naval Post Lagoi	Naval Post
77	Naval Post Berakit	Naval Post
78	Naval Base Batam	Naval Base
79	Naval Post Tanjung Sangkuang	Naval Post
80	Naval Post Tolop	Naval Post
81	Naval Post Sambu	Naval Post
82	Naval Post Pulau Nipa	Naval Post
83	Naval Post Pulau Abang	Naval Post
127	Naval Base Cilacap	Naval Base
128	Naval Post Kieces	Naval Post
129	Naval Post Purwerejo	Naval Post
130	Naval Post Logending	Naval Post
131	Naval Base Semarang	Naval Base
132	Naval Post Jepara	Naval Post
133	Naval Post Rembang	Naval Post
134	Naval Post Karimun Jawa	Naval Post
135	Naval Base Denpasar	Naval Base
136	Naval Post Pulau Nusa Penida	Naval Post
137	Naval Post Gilimanuk	Naval Post
138	Naval Post Celukan Bawang	Naval Post
139	Naval Post Pengambengan	Naval Post
140	Naval Base Banyuwangi	Naval Base

Index	Organization	Level
	Kendawangan	Post
119	Naval Post Temajo	Naval Post
120	Naval Post Paloh	Naval Post
121	Naval Post Mempawah	Naval Post
122	Naval Base Mentigi	Naval Base
123	Naval Air Base Tanjung Pinang	Naval Air Base
124	Naval Air Base Matak	Naval Air Base
125	EASTERN FLEET	Fleet HQ
126	Main Naval Base V Surabaya	Main Naval Base
171	Naval Post Sungai Danau	Naval Post
172	Naval Post Bahaur	Naval Post
173	Naval Post Sebangau	Naval Post
174	Naval Post Kuala Jelai	Naval Post
175	Naval Post Kuala Pembuang	Naval Post
176	Naval Post Kintab	Naval Post
177	Naval Base Palu	Naval Base
178	Naval Post Melantobang	Naval Post
179	Naval Post Luwuk	Naval Post
180	Naval Post Parimo	Naval Post
181	Naval Post Donggala	Naval Post
182	Naval Post Ampana	Naval Post
183	Naval Base Kotabaru	Naval Base
184	Naval Post Tanjung	Naval

Index	Organization	Level
141	Naval Post Muncar	Naval Post
142	Naval Post Pancer	Naval Post
143	Naval Post Paiton	Naval Post
144	Naval Base Tegal	Naval Base
145	Naval Post Kluwut	Naval Post
146	Naval Post Tanjung Sari	Naval Post
147	Naval Post Wonokerto	Naval Post
148	Naval Post Sigandu	Naval Post
149	Naval Base Batuporon	Naval Base
150	Naval Post Pagerungan	Naval Post
151	Naval Base Malang	Naval Base
152	Naval Post Sendang Biru	Naval Post
153	Naval Base Yogyakarta	Naval Base
154	Naval Post Sadeng	Naval Post
155	Naval Air Base Juanda	Naval Air Base
156	Main Naval Base VI Makassar	Main Naval Base
157	Naval Post Mamuju	Naval Post
158	Naval Post Pinrang	Naval Post
159	Naval Base Balikpapan	Naval Base
160	Naval Post Anggana	Naval Post
161	Naval Post Kampung Baru	Naval Post
162	Naval Post Tanah Grogot	Naval Post
163	Naval Base Kendari	Naval Base

Index	Organization	Level
	Pelayar	Post
185	Naval Post Batulicin	Naval Post
186	Naval Base Sangatta	Naval Base
187	Naval Post Mangkaliat	Naval Post
188	Naval Post Sangkuriang	Naval Post
189	Naval Post Muara Sangatta	Naval Post
190	Naval Post Bengalon	Naval Post
191	Naval Post Bontang	Naval Post
192	Main Naval Base VII Kupang	Main Naval Base
193	Naval Post Atapupu	Naval Post
194	Naval Post Lirang	Naval Post
195	Naval Post Wetar	Naval Post
196	Naval Post Romang	Naval Post
197	Naval Post Kisar	Naval Post
198	Naval Post Tanjung Tutpaleh	Naval Post
199	Naval Post Boking	Naval Post
200	Naval Base Maumere	Naval Base
201	Naval Post Pulau Alur	Naval Post
202	Naval Post Labuhan Bajo	Naval Post
203	Naval Post Oepoli	Naval Post
204	Naval Post Ende	Naval Post
205	Naval Post Mbay	Naval Post
206	Naval Post Lembata	Naval Post
207	Naval Base	Naval

Index	Organization	Level
164	Naval Post Wangi-wangi	Naval Post
165	Naval Post Bau-bau	Naval Post
166	Naval Post Kolaka	Naval Post
167	Naval Post Torobulu	Naval Post
168	Naval Post Konawe Utara	Naval Post
169	Naval Base Banjarmasin	Naval Base
170	Naval Post Kumai	Naval Post
215	Naval Post Sabu	Naval Post
216	Naval Post Dana	Naval Post
217	Naval Post Waingapu	Naval Post
218	Naval Post Pulau Seba	Naval Post
219	Naval Post Papela	Naval Post
220	Naval Air Base Kupang	Naval Air Base
221	Main Naval Base VIII Manado	Main Naval Base
222	Naval Post Arakan	Naval Post
223	Naval Post Atep Oki	Naval Post
224	Naval Base Tarakan	Naval Base
225	Naval Post Pulau Derawan	Naval Post
226	Naval Post Bunyu	Naval Post
227	Naval Post Berau	Naval Post
228	Naval Post Pulau Maratua	Naval Post
229	Naval Post Tanjung Batu	Naval Post

Index	Organization	Level
	Mataram	Base
208	Naval Post Gili Air (Senggigi)	Naval Post
209	Naval Post Bima	Naval Post
210	Naval Post Selat Alas	Naval Post
211	Naval Post Labuh Pagi	Naval Post
212	Naval Post Calabai	Naval Post
213	Naval Post Teluk Awang	Naval Post
214	Naval Base Pulau Rote	Naval Base
259	Naval Post Sarana	Naval Post
260	Naval Post Maba	Naval Post
261	Naval Post Pulau Mayu	Naval Post
262	Naval Post Pulau Bacan	Naval Post
263	Naval Post Togafo	Naval Post
264	Naval Base Morotai	Naval Base
265	Naval Air Base Tual	Naval Air Base
266	Main Naval Base X Jayapura	Main Naval Base
267	Naval Post Skow Sae	Naval Post
268	Naval Post Sami	Naval Post
269	Naval Base Biak	Naval Base
270	Naval Post Pulau Mapia	Naval Post
271	Naval Post Nabire	Naval Post
272	Naval Post Serui	Naval Post
273	Naval Base Sorong	Naval Base

Index	Organization	Level
230	Naval Post Pantai Amal	Naval Post
231	Naval Base Nunukan	Naval Base
232	Naval Post Sei Pancang	Naval Post
233	Naval Post Tanjung Ahus	Naval Post
234	Naval Post Sei Nyamuk	Naval Post
235	Naval Post Sebaung	Naval Post
236	Naval Post Sei Taiwan	Naval Post
237	Naval Post Tinabasan	Naval Post
238	Naval Base Toli-toli	Naval Base
239	Naval Post Buol	Naval Post
240	Naval Post Lokodede	Naval Post
241	Naval Base Tahuna	Naval Base
242	Naval Post Marore	Naval Post
243	Naval Post Miangas	Naval Post
244	Naval Post Tagulandang	Naval Post
245	Naval Post Talaud	Naval Post
246	Naval Post Pulau Siau	Naval Post
247	Naval Post Bunga Lawang	Naval Post
248	Naval Base Gorontalo	Naval Base
249	Naval Post Kwandang	Naval Post
250	Naval Base Melonguane	Naval Base
251	Naval Air Base Manado	Naval Air Base
252	Main Naval Base IX Ambon	Main Naval Base
253	Naval Post Pulau Buru	Naval Post
254	Naval Post Bula	Naval Post

Index	Organization	Level
274	Naval Post Pulau Feni	Naval Post
275	Naval Post Bintuni	Naval Post
276	Naval Post Waisai	Naval Post
277	Naval Base Manokwari	Naval Base
278	Naval Air Base Biak	Naval Air Base
279	Main Naval Base XI Merauke	Main Naval Base
280	Naval Post Wanam	Naval Post
281	Naval Post Torasi	Naval Post
282	Naval Post Bade	Naval Post
283	Naval Base Aru	Naval Base
284	Naval Post Benjina	Naval Post
285	Naval Base Timika	Naval Base
286	Naval Post Kaimana	Naval Post
287	Naval Post Fak-fak	Naval Post
288	Naval Post Agats	Naval Post
289	Naval Air Base Aru	Naval Air Base

Index	Organization	Level
255	Naval Base Tual	Naval Base
256	Naval Base Saumiaki	Naval Base
257	Naval Base Ternate	Naval Base
258	Naval Post Pulau Gebe	Naval Post

Index	Organization	Level

C. MARINE POLICE

Index	Organization	Level
1	POLRI HQ	HQ
2	Regional Marine Police NAD	Regional Marine Police
3	Regional Marine Police North Sumatera	Regional Marine Police
4	Regional Marine Police Riau	Regional Marine Police
5	Regional Marine Police South Sumatera	Regional Marine Police
6	Regional Marine Police West Sumatera	Regional Marine Police
7	Regional Marine Police Babel	Regional Marine Police
8	Regional Marine Police Jambi	Regional Marine Police
9	Regional Marine Police Bengkulu	Regional Marine Police
10	Regional Marine Police Lampung	Regional Marine Police
11	Regional Marine Police Metro Jaya	Regional Marine Police
12	Regional Marine Police West Java	Regional Marine Police
13	Regional Marine Police Banten	Regional Marine Police
14	Regional Marine Police Central Java	Regional Marine Police
15	Regional Marine Police DIY	Regional Marine Police
16	Regional Marine Police East Java	Regional Marine Police
17	Regional Marine Police Bali	Regional Marine Police
18	Regional Marine Police NTB	Regional Marine Police
19	Regional Marine Police NTT	Regional Marine Police
20	Regional Marine Police West Kalimantan	Regional Marine Police
21	Regional Marine Police Central Kalimantan	Regional Marine Police
22	Regional Marine Police South	Regional Marine Police

	Kalimantan	
23	Regional Marine Police East Kalimantan	Regional Marine Police
24	Regional Marine Police North Sulawesi	Regional Marine Police
25	Regional Marine Police Gorontalo	Regional Marine Police
26	Regional Marine Police Central Sulawesi	Regional Marine Police
27	Regional Marine Police South Sulawesi	Regional Marine Police
28	Regional Marine Police Southeast Sulawesi	Regional Marine Police
29	Regional Marine Police North Maluku	Regional Marine Police
30	Regional Marine Police Maluku	Regional Marine Police
31	Regional Marine Police Papua	Regional Marine Police
32	Regional Marine Police Riau Islands	Regional Marine Police

A. KPLP

Index	Organization	Level
1	DITGEN SEA TRANSPORT	Directorate General
2	Base PLP Tanjung Uban	Base
3	Base PLP Tanjung Priok	Base
4	Base PLP Tanjung Perak	Base
5	Base PLP Bitung	Base
6	Base PLP Tual	Base

D. CUSTOM

Index	Organization	Level
1	DJBC HQ	HQ

2	Operational Base Tanjung Balai Karimun	Operational Base
3	Operational Base Tanjung Priok	Operational Base
4	Operational Base Pantoloan	Operational Base
5	Operational Base Batam	Operational Base

E. PSDKP

Index	Organization	Level
1	DIRECTORATE GENERAL PSDKP	Director ate General
2	Station PSDKP Belawan	Station
3	Unit PSDKP Sabang/Lampulo	Unit
4	Unit PSDKP Sibolga	Unit
5	Unit PSDKP Bungus	Unit
6	Unit PSDKP Pulau Baal	Unit
7	Unit PSDKP Kuala Tungkal	Unit
8	Unit PSDKP Tanjung Pandan	Unit
9	Unit PSDKP Tanjung Balai Asahan	Unit
10	Station PSDKP Bitung	Station
11	Unit PSDKP Dagho/Tahuna	Unit
12	Unit PSDKP Melonguane	Unit
13	Unit PSDKP Makassar	Unit
14	Unit PSDKP Gorontalo	Unit
15	Unit PSDKP Kwandang	Unit
16	Unit PSDKP Kendari	Unit
17	Unit PSDKP Ternate	Unit
18	Unit PSDKP Bacan	Unit
19	Unit PSDKP Tarakan	Unit
Index	Organization	Level
46	Unit PSDKP Pulau Kijang/Bintan	Unit

Index	Organization	Level
20	Unit PSDKP Banjarmasin	Unit
21	Base PSDKP Jakarta	Station
22	Unit PSDKP Muara Angke	Unit
23	Unit PSDKP Lempasing	Unit
24	Unit PSDKP Pelabuhan Ratu	Unit
25	Unit PSDKP Karangantu	Unit
26	Unit PSDKP Kejawanan	Unit
27	Unit PSDKP Pekalongan	Unit
28	Unit PSDKP Tegalsari	Unit
29	Unit PSDKP Cilacap	Unit
30	Unit PSDKP Juwana	Unit
31	Unit PSDKP Batang	Unit
32	Unit PSDKP Banyuwangi	Unit
41	Unit PSDKP Larantuka	Unit
42	Unit PSDKP Labuan Lombok	Unit
43	Station PSDKP Pontianak	Station
44	Unit Batam	Unit
45	Unit Tanjung Pinang	Unit

46	Unit PSDKP Pulau Kijang/Bintan	Unit
47	Unit PSDKP Natuna/Ranai	Unit
48	Unit Tarempa	Unit
49	Unit Teluk Batang	Unit
50	Unit Moro	Unit
51	Unit PSDKP Sungai Liat	Unit
52	Unit Pemangkat	Unit
53	Unit PSDKP Tanjung Balai Karimun	Unit
54	Station PSDKP Tual	Station
55	Unit Ambon	Unit
56	Unit Biak	Unit
57	Unit Sorong	Unit
58	Unit Wimro	Unit
59	Unit Fak-fak	Unit
60	Unit Kaimana	Unit
61	Unit Avona	Unit
62	Unit Merauke	Unit
63	Unit Jayapura	Unit

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF REFERENCES

Agranoff, R. (2004). Leveraging networks: A guide for public managers working across organizations. In J. M. Kamensky, & T. J. Burlin (Eds.), *Collaboration: Using networks and partnerships* (pp. 61–102). Lanham, MD: Rowman & Littlefield.

Anklam, P. (2007). *Network: A practical guide to creating and sustaining networks at work and in the world*. Burlington, MA: Butterworth-Heinemann.

Bakohumas. (2012). *Badan informasi geospasial: Ada 13.466 pulau di Indonesia (Geospatial information body: There are 13,466 islands in Indonesia)*. Retrieved March 20, 2014, from http://bakohumas.kominfo.go.id/news.php?id=1000

Bakorkamla. (2014). *Sejarah Bakorkamla.* Retrieved October 29, 2014, from http://www.bakorkamla.go.id/index.php/profil/sejarah-bakorkamla2

Balas, A. (2011). Creating global synergies: Inter-organizational cooperation in peace operations (doctoral dissertation, University of Illinois at Urbana-Champaign).

Berry, M. J. A. & Linoff, G. S. (2004). In Malm K. A. (Ed.), *Data mining techniques* (Second ed.). Indianapolis, Indiana: Wiley Publishing.

Border Protection Command. (2014). *Border protection command.* Retrieved August 18, 2014, from http://www.customs.gov.au/aboutus/protectingborders/bpc/default.asp

Borgatti, S. P. Everett, M. G. & Johnson, J. C. (2013). In Seaman J. (Ed.), *Analyzing social networks*. London: Sage Publications.

Carley, K. M. Pfeffer, J. Reminga, J. Storrick, J. & Columbus, D. (2013). *ORA user's guide 2013* No. CMU-ISR-13-108). Pittsburgh, PA: Institute for Software Research School of Computer Science Carnegie Mellon University.

Cohn, B. S. & Marriot, M. (1958). Networks and centres of integration in Indian civilization. In L. C. Freeman (Ed.), *Centrality in social Networks conceptual clarification* (pp. 1). Bethlehem: Department of Social Relations.

Corteville, L. & Sun, M. (2009). *An interorganizational social network analysis of the Michigan diabetes outreach networks*. Michigan: Michigan Department of Community Health. (Michigan; Diabetes; Interorganizational)

Cribb, R. & Ford, M. (Eds.). (2009). *Indonesia beyond the water's edge: Managing an archipelagic state*. Singapore: ISEAS Publishing.

ESRI. (2014). *Spatial analysis.* Retrieved February 10, 2014, from http://www.esri.com/products/technology-topics/spatial-analysis

Everton, S. (2012). *Disrupting dark networks*. New York: Cambridge University Press.

Freeman, L. C. (1978/1979). Centrality in social networks conceptual clarification. *Social Networks, 1*, 215–239.

Gibbons, D. (2007). Interorganizational network structures and diffusion of information through a health system. *American Journal of Public Health, 97*(9), 1684–1692.

Gordon, U. (2008). *Anarchy alive: Anti-authoritarian politics from practice to theory*. London: Pluto Press.

Hakimi, S. L. (1965). Optimum locations of switching centers and the absolute centers and medians of a graph. In L. C. Freeman (Ed.), *Centrality in social Networks conceptual clarification* (pp. 450–459). Bethlehem, PA: Department of Social Relation.

Hocevar, S. P. (2010). Inter-organizational innovations for port security. Technical report NPS-GSBPP-10-022, Monterey, California: Naval Postgraduate School. Retrieved from http://hdl.handle.net/10945/652

Hocevar, S. P. (2012). Building collaborative capacity for maritime security. In S. Jasper (Ed.), *Conflict and cooperation in the global commons* (pp. 123). Washington, DC: Georgetown University Press.

Hocevar, S. P. Thomas, G. F. & Jansen, E. (2006). Building collaborative capacity: An innovative strategy for homeland security preparedness. *Advances in Interdisciplinary Studies of Work Teams: Innovation through Collaboration, 12*, 255–274.

Hocevar, S. P. Thomas, G. F. & Jansen, E. (2011). Inter-organizational collaboration: Addressing the challenge. *Homeland Security Affairs, 7*(1), special issue, *10 Years after: The 9/11 Essays*. Retrieved from http://www.hsaj.org/?article=7.2.5

Human, S. E. & Provan, K. G. (2000). Legitimacy building in the evolution of small-firm networks: A comparative study of success and demise. *Administrative Science Quarterly, 45*, 327.

Idrobo, I. (1997). Analysis of naval organizations within maritime national interest: The case of Colombia (master's thesis, Naval Postgraduate School).

Kenis, P. & Provan, K. G. (2009). Towards an exogenous theory of public network performance. *Public Administration, 87*(3), 440–456.

Kloth, C. & Applegate, B. (2004). *Inter-organization collaboration & partnerships: A critical analysis*. Unpublished manuscript.

Koh, T. (2008). ASEAN at forty: Perception and reality. In D. Nair, & L. P. Onn (Eds.), *Regional outlook: Southeast Asia 2008–2009*. Singapore: ISEAS Publishing.

Larsen, Richard J. & Marx, Morris L. (1981). *An introduction to mathematical statistics and its application*. New Jersey: Prentice Hall.

Malaysian Maritime Enforcement Agency. (2013). *Malaysian maritime enforcement agency.* Retrieved August 18, 2014, from https://www.mmea.gov.my/v25 /eng/index.php/en/about-us/background

Marsetio. (2014). *Sea power Indonesia*. Jakarta: Indonesian Defense University.

McGuire, M. (2003). Is it really so strange? A critical look at the "network management is different from hierarchical management" perspective. *7th National Public Management Research Conference,* 9–11.

Milward, H. B. & Provan, K. G. (2006). A manager's guide to choosing and using collaborative networks. *Networks and Partnership Series.* Retrieved February 20, 2014, from http://www.wales.nhs.uk/sitesplus/documents/829

Nitsova, S. (2012). Interorganizational coordination in peacebuilding: The case of Bosnia and Herzegovina (master's thesis, Universiteit Leiden).

O'Toole, L. J. Jr. (1997). Treating networks seriously: Practical and research-based agendas in public administration. *Public Administration Review, 57*(1), 45–52.

Palantir. (2014). *What we believe.* Retrieved October 3, 2014, from https://www.palantir.com/what-we-believe/

Paris, R. (2009). Understanding the coordination problem in postwar state building. In R. Paris, & T. Sisk (Eds.), *The dilemmas of state building. confronting the contradictions of postwar peace operations* (p. 53). New York: Routledge

Payne, J. Solomon, J. Sankar, R. & McGrew, B. (2008). Palantir: The future of analysis. *IEEE Symposium on Visual Analytics Science and Technology,* 201.

Perpres, Peraturan Presiden Republik Indonesia Nomor 81 Tahun 2005 Tentang Badan Koordinasi Keamanan Laut, (2005). Retrieved February 20, 2014, from http://www.polkam.go.id/LinkClick.aspx

Peuquet, D. J. (n.d). Time in GIS and geographical databases. Retrieved March 5, 2014, from http://www.geos.ed.ac.uk/~gisteac/gis_book_abridged/files/ch08.pdf

Peuquet, D. J. & Duan, N. (1995). An event-based spatiotemporal data model (ESTDM) for temporal analysis of geographical data. *International Journal of Geographical Information Systems, 9*(1), 7-24, Retrieved on March 19 2014, At: 22:37, from http://www.tandfonline.com/doi/abs/10.1080

Popp, J. K. MacKean, G. Casebeer, A. Milward, H. B. & Lindstrom, R. (2013). *Inter-organizational networks: A critical review of the literature to inform practice.* Retrieved March 20, 2014, from http://research4children.com/data/documents/NetworkLiReview-Feb27-2013-Final.pdf

Provan, K. G. Fish, A. & Sydow, J. (2007). Interorganizational networks at the network level: A review of the empirical literature on whole networks. *Journal of Management, 33*(479), 479.

Provan, K. G. & Kenis, P. (2005). Modes of network governance: Structure, management, and effectiveness. *Journal of Public Administration Research and Theory,*18 (2), 229–252.

Provan, K. G. & Milward, H. B. (1995). A preliminary theory of interorganizational network effectiveness: A comparative study of four community mental health systems. *Administrative Science Quarterly, 40*(1), 1.

Provan, K. G. & Milward, H. B. (2001). Do networks really work? A framework for evaluating public-sector organizational networks. *Public Administration Review, 61*(4), 414.

Ratcliffe, J. H. (2004). The hotspot matrix: A framework for the spatio-temporal targeting of crime reduction. *Police Practice and Research, 5*(1), 05–23.

ReCAAP (2013). *Piracy and Armed Robbery Against Ships in Asia Annual Report January- December 2013*. Singapore: Information Sharing Centre.

Sabidussi, G. (1966). The centrality index of a graph. In L. C. Freeman (Ed.), *Centrality in social networks conceptual clarification* (pp. 581–603). Bethlehem: Department of Social Relations.

Samozain. (2013). *Centralization versus decentralization of authority.* Retrieved 10/22, 2014, from http://business-basics.org/centralization-versus-decentralization-of-authority/

Scott, J. Tallia, A. Crossom, J. C. Orzano, A. J. Stroebel, C. DiCicco-Bloom, B. et al. (2005). Social network analysis as an analytic tool for interaction patterns in primary care practices. *Annals of Family Medicine, 3*(5), 443.

Sherman, A. (2008). *Socialtext and a theory of collaboration and networks.* Retrieved October 31, 2014, from https://gigaom.com/2008/12/01/socialtext-and-a-theory-of-collaboration-and-networks/

Smith, M. J. Goodchild, M. F. & Longley, P. A. (2012). *Geospatial analysis: A comprehensive guide to principles, techniques and software tools* (4th ed.). Winchelsea: The Winchelsea Press.

Sumaryono, D. (2009). The Indonesian maritime security coordinating board. In R. Cribb, & M. Ford (Eds.), *Indonesia beyond the water's edge: Managing an archipelagic state* (pp. 134–145). Singapore: ISEAS Publishing.

Supriyanto, R. A. & Rusdi, S. (2014, August 15, 2014). Maritime security agencies in Indonesia: More not merrier. *The Nation.*

Undang-Undang no.31 Tahun 2004 Tentang Perikanan. (2004).

Undang-Undang no. 17 Tahun 2008 Tentang Pelayaran. (2008).

U.S. Coast Guard (2005). National Plan to achieve Maritime Domain Awareness. Washington, D.C.

Tumin, Z. (2007). Maritime domain awareness: A case study in cross-boundary information sharing among the United States Navy, Coast Guard, and Department Of Transportation. Unpublished.

THIS PAGE INTENTIONALLY LEFT BLANK

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
   Ft. Belvoir, Virginia

2. Dudley Knox Library
   Naval Postgraduate School
   Monterey, California