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## A study on the e-navigation government framework: a Philippine perspective

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**A STUDY ON THE E-NAVIGATION GOVERNMENT  
FRAMEWORK: A PHILIPPINE PERSPECTIVE**

**ORLY ALCORIZA WONG**

A dissertation submitted to the World Maritime University in partial fulfillment of the requirements for the award of the degree of Master of Science in Maritime Affairs


2023

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## Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature): 

(Date): **21 September 2023**

Supervised by: **Professor Chong-Ju Chae**

Supervisor's affiliation: **Assistant Professor,  
Maritime Safety and Environmental  
Administration**

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## Abstract

Title of Dissertation: **A Study on the e-Navigation Government Framework: A Philippine Perspective**

Degree: **Master of Science in Maritime Affairs**

The dissertation studies the e-Navigation government framework from the Philippine perspective. It aims to investigate the acceptable e-Navigation government framework for the Philippines. The e-Navigation implementation is a matter of public policy. While the e-Navigation planning and implementation is a joint effort by the maritime stakeholders, the government is the impetus for its successful planning and implementation. The e-Navigation government framework is not a one-shoe-fits-all concept.

The e-Navigation government framework of member States that have been implementing e-Navigation were examined and became the basis for the formulation of four proposed e-Navigation government framework as well as the government agencies that have interest in e-Navigation and the agencies' respective roles, the lead agency for the e-Navigation planning and implementation, the activities required for the e-Navigation planning and implementation, and their existing e-Navigation government framework. This became the basis for the formulation of the questions for the questionnaire.

This study used a mixed method, a combination of quantitative and qualitative methods. Questionnaire was sent to participants from Philippine government agencies with potential interest in e-Navigation in the Philippines. The results of the respondents were collected and further analyzed using a PEST analysis.

The concluding chapters examine the results of the respondents' responses to the questionnaire and the result of the PEST analysis and discuss its implication for e-Navigation planning and implementation in the Philippines. Recommendations were made for further investigation of the subject.

**KEYWORDS:** e-Navigation, government framework, inter-agency group, lead agency, PEST analysis, Philippines

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## List of Abbreviations

- BMB – Biodiversity Management Bureau
- CCG – Canadian Coast Guard
- CDM – Collaborative Decision Making
- CG – Correspondence Group
- CGWCEISS – Coast Guard Weapons, Communications, Electronics, Information  
Systems Service
- CMDS – Common Maritime Data Structure
- CMTS – Committee on the Marine Transport System
- DBM – Department of Budget and Management
- DOTr – Department of Transportation
- ECDIS – Electronic Chart Display Information System
- ENC – Electronic Navigational Chart
- GERD – Gross Expenditure on Research and Development
- GHG – Green House Gases
- GHz – Giga Hertz
- GII – Global Innovation Index
- GMDSS – Global Maritime Distress and Safety Services
- GNSS – Global Navigation Satellite System
- IALA – International Association of Lighthouse Authorities
- IHO – International Hydrographical Organization
- IMO – International Maritime Organization
- INS – Information Navigation Service
- KCG – Korean Coast Guard
- KHOA – Korea Hydrographic and Oceanographic Agency
- LTE – Long Term Evolution
- MARINA- Maritime Industry Authority
- MSSC – Maritime Safety Services Command
- MCP – Maritime Connectivity Platform
- MOF – Ministry of Oceans and Fisheries

MPA – Marine Protected Area  
MSC – Maritime Safety Committee  
MSI – Maritime Safety Information  
MSP – Maritime Safety Portfolios  
MRC – Maritime Radio Communications  
NAMRIA- National Mapping and Resource Information Authority  
NCA – Norwegian Coastal Administration  
NCSR - Navigation, Communications and Search and Rescue  
NOAA – National Oceanic and Atmospheric Administration  
NTC – National Telecommunication Commission  
PAGASA – Philippine Atmospheric, Geophysical and Astronomical Administration  
PCG – Philippine Coast Guard  
PNT – Position Navigation Timing  
PPA – Philippine Ports Authority  
RCO – Risk Control Options  
SAR – Search and Rescue  
SIP – Strategy Implementation Plan  
SOLAS – Safety of Life at Sea  
TOS – Traffic Organization Service  
UNESCO - United Nations Educational, Scientific, and Cultural Organization  
USACE – United States Army Corps of Engineers  
USCG – United States Coast Guard  
VDES – Very High Frequency Data Exchange Service

# **1. Introduction**

## **1.1. Background**

The sea is an unforgiving environment with lot of risks to consider when navigating through it safely and efficiently. This involves proper planning and good decision-making in order to achieve the goal of safe and efficient navigation. The key component to decision-making for a safe and efficient navigation is situational awareness (Smirnova, 2018). A wrong decision is a product of inadequate assessment of the situation that could lead to accidents. According to Situational Awareness Theory, decision-making is depended on situation awareness which has three levels; level one is the perception of elements in the current state, level two is the understanding of the current situation and level three is the projection of future status. If these three levels are reached a decision is made and actions are being performed. However, situational awareness, decision-making and actions are still depended on elements such as system compatibility, interface design, stress and workload, complexity and automation (Endsley, 1995). It could be said that there should be adequate and continuous appraisal of the current situation to arrive a good decision. This is reason why there is a need for modern technological solutions to match the organizational and human resources aboard the ship where minimum safe manning is being used. In addition, there is a need for new decision support system that could unite all information about current situation of the environment and perform joint decision-making for prevention of hazards to navigation. This is one of the main objectives of e-Navigation.

e-Navigation is defined as “the harmonized collection, integration, exchange, presentation, and analysis of marine information on board and ashore by electronic means to enhance berth-to-berth navigation and related services for safety and security at sea and protection of the marine environment” (IMO, 2019). Accordingly, the “e” in e-Navigation is not “electronic navigation” because it has already existed before the e-Navigation concept was conceived but the “e” stands for “evolving” navigation as the mentioned by the IMO Secretary General Kitach Lim during his speech in

Copenhagen, Denmark in 2016 (Hagen, 2017). This would mean that maritime and non-maritime information can be seamlessly transmitted between ship and shore through electronic communications from the ship's port of origin to its destination. It intends to harmonize the marine navigational systems with supporting shore services based on user needs. This will provide the ship's crew onboard ships with more decision-making support, minimize their work-loads, and enable them to focus on navigational safety (Hong, 2015).

The Philippines is composed of 7,461 islands (Hebbar et al, 2023). This would mean that sea transport is the way to connect islands to transport goods and passengers. The numerous ships navigating the Philippine waters tend to increase the risk of shipping accidents and damage to the marine environment. It has experienced several marine casualties that caused the loss of lives and properties, such as the collision between MV Doña Paz and MT Vector 1987 (Perez et al., 2011) which resulted in over 4,000 lives. It also experienced several oil spills from Power Barge 106 at Semirara Island, Philippines in 2005 (Magramo, 2007), MT Solar 1 at Guimaras Island, Philippines in 2006 (Yender & Stanzel, 2011), and MT Princess Empress at Oriental Mindoro, Philippines in 2023 (Office of Response and Restoration, 2023 March 31). The risk level to maritime security is also high because of the long coastline, giving it a porous boundary. The implementation of e-Navigation in the Philippines will greatly benefit in terms of safety, security and the protection of the marine environment.

Based on the MARINA (the Philippine Flag Administration) Statistical Report (2017 – 2021), there was an increase of 6.1 % of the Philippine domestic fleet from 29,974 in 2020 to 31,814 in 2021 (MARINA, n.d.1). The Philippine Ports Authority reported 11,778 ship calls done by foreign vessels in 2021 compared to 11,427 ship calls (PPA, n.d.). The increase of the Philippines domestic fleet and the ship calls made to Philippine ports by foreign flagged vessels may increase the risk of marine accidents such as collision and grounding. The Philippines could not afford to have serious marine accidents that could result to human and monetary loss so the Philippines has

to make steps to reduce these accidents. According to Hong (2015), more than 65% of the direct causes of ship's collisions and groundings caused by human error could be reduced by seven kinds of risk control options (RCO) of e-navigation. However, he further added that the introduction of e-Navigation along with its cost benefit analysis will have a 22.8% reduction of collision and grounding accidents to SOLAS ships. Furthermore, the Philippines is situated at the junction of international maritime routes that converge to the Straits of Lombok and Makassar (Batongbacal, 2021) thereby the introduction of e-navigation of the area would increase the country's maritime domain awareness.

The introduction of e-Navigation to the Philippines would have to depend on its priorities on maritime safety. Will this be only applied to SOLAS vessels (foreign flagged vessels) or will this be applied to non-SOLAS vessels (domestic vessels)? This would depend on the government framework that is applicable to the uniqueness of the Philippine setting in the implementation of e-Navigation.

The Philippine political, environmental, social and technological environment are important element in the continuous and effective implementation of e-Navigation. A new government administration means new priorities that may overshadow priorities from the previous government administration. There are also overarching functions of safety of navigation distributed among different agencies under different departments. The economic stability, social support coming from the stakeholders and technological capabilities of the country are vital to the successful implementation of e-Navigation in the Philippines.

## **1.2. Research Aims and Objectives**

This study aims to understand the importance of the government framework in implementing e-Navigation in the Philippines. This is supported by identifying and describing the e-Navigation government framework of the member States that are implementing their respective e-Navigation strategic plan. The author has proposed



several e-Navigation government frameworks for the Philippines. The author shall identify the gaps in the current government framework on e-Navigation in the Philippines. Finally, find the acceptability of the proposed e-Navigation government framework of the Philippines on e-Navigation based on the comments from the questionnaire respondents.

### **1.3. Research Questions**

This study will try to answer the main research question: "What would be the acceptable e-Navigation government framework for the Philippines?" Followed by the supporting questions, "What are the existing Philippine government agencies that has interest in e-Navigation? What would be their respective responsibilities and roles in e-Navigation in the Philippines? Who will be the lead agency in the Philippine e-Navigation? What would be the activities needed for the successful implementation of e-Navigation in the Philippines? What is the different e-Navigation government frameworks that could be proposed for the Philippines?"

## **2. Literature Review**

### **2.1 SOLAS Chapter V - Safety of Navigation**

The term “safety of navigation” can be found in SOLAS 74 Chapter V, and it is younger than the maritime navigation, it was formed during the introduction of radio communication services (Kopacz et al., 2001). Safety of navigation refers to the “conditions of conducting the ships at sea which ensure that collisions, stranding or storm damage do not endanger ships.” (Kopacz et al., 2001). Part of safety of navigation is the services provided by the coastal State in the form of meteorological services and warnings, search and rescue services, hydrographic services, ship’s routing, ship reporting systems, vessel traffic service, and aids to navigation, radiocommunication services (SOLAS 74 Chapter IV) with the aim to disseminate navigational information and services from the shore to ship (Schröder-Hinrichs, 2015) and provide adequate and continuous information on the current situation to arrive a good decision to the navigators (Endsley, 1995).

The introduction of GMDSS, has ushered the start of digital communications through digital selective calling (DSC), enabling ship-to-shore and shore-to-ship communications (Lind et al., 2023), making the Maritime Safety Information (MSI) service (navigational warnings, storm warnings, weather forecast and SAR information) possible through the use of GMDSS (Kopacz et al., 2001) which uses traditional Maritime Radio Communications (MRC) and new Maritime Satellite Communications (MSC) such as Cospas-Sarsat and Inmarsat subsystems that would enable a ship to send distress message and help can be rendered. It also has the provision of MSI, which the ship could receive meteorological and navigational information worldwide at sea (Ilcev, 2020). According to Lind et al. (2022), some examples of information that is disseminated from shore to ship include: hydrographic (chart and chart updates), meteorological reports, Maritime Safety Information (MSI), VTS/pilot guidance, security information, and other information not included in SOLAS Chapter V such as port guidance and passage planning guidance, quarantine health information and charter information. In recent years, coastal States, besides

providing safety of navigation services to ships, are also requiring vessels to provide information on their contiguous and territorial waters passing through the adjacent seas as the port and coastal State are enforcing more regulations to ships going to their ports or making a passage through waters within their jurisdiction (Chae, 2023, Slide 10) and other shore-based entities such as engine manufacturer needed data on engine performance and even ports have port collaborative decision-making (Port CDM) where ports could calculate speed and arrival time to minimize waiting time and GHG emission in port (Lind et al., 2022) thereby further increasing the information exchange between ship and shore. To make these services able in supplying real time information from ship to shore and vice versa is to convert this information into digitized standard format (Lind et al., 2022) and this digitized maritime and non-maritime information can be seamlessly transmitted between ship and shore through electronic communications from the ship's port of origin to its destination (Weintrit, 2020) would be known as e-Navigation.

## **2.2 History of e-Navigation**

The start of e-Navigation began when seven countries (Japan, the Marshall Islands, the Netherlands, Norway, Singapore, the United Kingdom, and the United States) submitted a work programme on the development of an E-navigation strategy in December 2005 (IMO, 2009). The reason was that the master of the ship and those shore responsible should be equip with modern decision-support tools to make marine navigation and communication safer and more reliable to reduce errors. Meanwhile, the "E" in e-Navigation is coined from the speech of IMO Secretary-General Kitack Lim in Copenhagen, Denmark in 2016. Accordingly, the "e" is not "electronic navigation" because it already existed before the e-Navigation concept was conceived, the "e" stands for "evolving" navigation (Hagen, 2017).

## **2.3 Concept of e-Navigation**

As mentioned earlier, e-Navigation is defined as "the harmonized collection, integration, exchange, presentation, and analysis of marine information on board and

ashore by electronic means to enhance berth-to-berth navigation and related services for safety and security at sea and protection of the marine environment” (IMO, 2008 & IMO, 2009). The concept of e-Navigation is to incorporate all existing and new navigational tools as well as systems and services and integrate these electronic systems and information under the strategic plan governed by IMO to enhance safety and efficiency (Patraiko, 2007). Accordingly, technological advancement should not remain uncoordinated, this is to avoid the hampering of the development of the international shipping industry due to lack of standardization on board and on shore, incompatibility between vessels, increased and unnecessary complexity (IMO, 2009).

This is the reason, that IMO developed the e-navigation SIP to present a vision for e-navigation and providing the industry with harmonized information to begin designing products and services to satisfy the e-navigation solutions (IMO, 2019). E-navigation could be simply explained in the following: first, data such as speed and position coming from the ships are being collected and transferred to a shore facility using a physical link such as VDES, LTE, etc., these data are converted to standard formats and stored in the database. When these data are requested, these could be retrieved from the database and transferred to the shore-based system and processed into presentable data that the shore-based operator could understand, the same process applies for data requested by the ship-based operator such as weather, tides, current, etc. (Pense, 2019).

e-Navigation solutions were identified to address user requirements, after a thorough user requirements and gap analyses, e-Navigation solutions were identified to address, which mainly represent routine job issues that may cause accidents. e-Navigation SIP proposes a vision for e-Navigation and provides the maritime industry with standard information to start designing products and services to meet e-navigation solutions, which mostly reveal concerns that may cause accidents during daily routine work (IMO, 2019). IMO (2019) further added that the IMO Formal Safety Assessment (FSA) considered five solutions.:

- S1: harmonized, user-friendly bridge design;
- S2: standardized automatic reporting;
- S3: increased bridge equipment and navigation information dependability, robustness, and integrity;
- S4: graphical display of information through communication equipment;
- S5: enhanced VTS Service Portfolio connectivity outside VTS stations.

According to IMO (2018), Solutions S2, S4 and S5 focus on effective transmission of maritime information and data between all suitable users (vessel-vessel, vessel-land, land-vessel and land-land) while Solutions S1 and S3 promote the effective and pragmatic use of the information and data on the vessel. The five highlighted probable solutions guarantee a complete method and interface between the users aboard the vessel and users on land, which is at the center of e-navigation (Weintrit, 2013).

During the FSA process, the seven Risk Control Options (RCO) were identified based on the sub-solutions from the five retained categories of solutions, these became the source of the establishment of the Risk Control Options that were considered to be evident and controllable in terms of calculating in lessening the effects of risk and the associated costs (Weintrit, 2013). Therefore, the mentioned RCOs are cost-effective according to IMO FSA criteria: RCO 1: Navigation information and equipment integration, better software quality assurance; RCO 2: Bridge alert management; RCO 3: Standardized navigation equipment mode(s); RCO 4: Automated and standardized ship-shore reporting; RCO 5: Greater onboard PNT system dependability and resilience; RCO 6: Improved shore-based services; and RCO 7: Standardized bridge and workstation arrangement. In summary, RCOs 1, 2, 3, 5, and 7 improve ship navigators' safety by making information/data usable and practical onboard. While RCOs 4 and 6 aim to efficiently transmit maritime information/data between suitable users, decreasing reporting burden and making navigational information available. (Weintrit, 2013).

The other component of e-Navigation is the Maritime Safety Portfolios (**Table 1**) which is defined by Wentrit (2020) as a collection of operational Maritime Services and related technical services delivered in digital format. Furthermore, MSP was conceptualized to provide these services to the six identified areas: port areas and approaches, coastal waters and confined or restricted areas, open sea and areas, areas with offshore and/or infrastructure developments and the Polar areas (IMO, 2018).

**Table 1** *Maritime Safety Portfolio*

<b>Service No.</b>	<b>Identified services</b>
<b>1</b>	VTS Information Service (INS)
<b>2</b>	Navigational Assistance Service (NAS)
<b>3</b>	Traffic Organization Service (TOS)
<b>4</b>	Local Port Service (LPS)
<b>5</b>	Maritime Safety Information Service (MSI)
<b>6</b>	Pilotage service
<b>7</b>	Tug service
<b>8</b>	Vessel Shore Reporting
<b>9</b>	Telemedical Assistance Service (TMAS)
<b>10</b>	Maritime Assistance Service (MAS)
<b>11</b>	Nautical chart service
<b>12</b>	Nautical publication service
<b>13</b>	Ice Navigation Service
<b>14</b>	Meteorological INS
<b>15</b>	Real-time hydrographic and environmental INS
<b>16</b>	Search and Rescue (SAR) service

Note: Adapted from “*Conceptual Research on a Display System for Autonomous Navigation Assistance Service*” by Jeong & Shin (2022)

These include dissemination of information navigational decision-making, assistance from unexpected situation, information of vessel traffic build-up leading to dangerous situation, port services provided by port Authority, information through GMDSS,

information on pilot and tug services, report submission to authorities, information on medical evacuation, general-purpose information from different stakeholders, information on nautical chart and publication, ice information, meteorological information, environmental and hydrographic information and search and rescue information (Hoeft et al., 2021)

## **2.4 Member States with National e-Navigation Strategy**

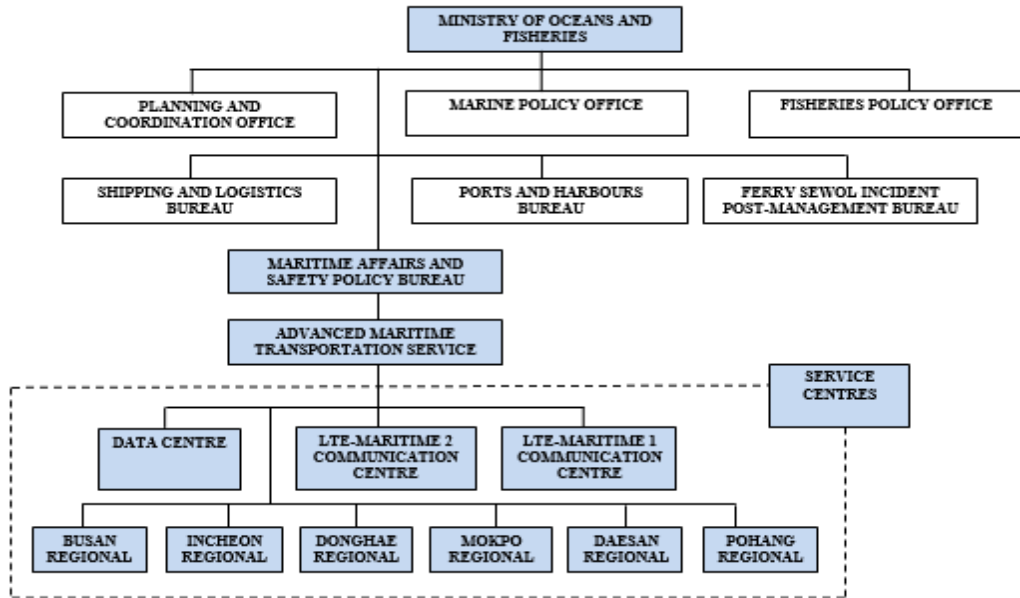
### **2.4.1 Korea**

The Ministry of Oceans and Fisheries (MOF) is the lead Korean government ministry in the e-navigation implementation. It is mandated by virtue of Act No. 16901 dated 29 January 2020 also known as the “Act on Promotion of the Provision and Use of Intelligent Maritime Transport Information Services” that the Minister of Oceans and Fisheries to create and execute an intelligent marine transport information service master plan and a maritime wireless communication system (Korea Legislation Research Institute, 2019).

The Ministry has delegated this mandate to the Maritime Affairs and Safety Policy Bureau and further delegated to the Advance Maritime Transportation Service Team (Ministry of Oceans and Fisheries, n.d.) in the operation of the maritime wireless communication and the data (**Figure 1**) being contributed by Hydrographic and Oceanographic Agency for hydrographic information (Korea Hydrographic and Oceanographic Agency, 2020), the Korean Coast Guard for the maritime traffic order (Korea Coast Guard, 2018) both are under the MOF and the Korea Meteorological Administration (meteorological information) under the Ministry of Environment (Korean Meteorological Administration, 2022).

**Figure 1**

*e-Navigation Government Framework of Korea*



**Note:** Adopted from “*Organization Structure*” by Ministry of Oceans and Fisheries (n.d.)

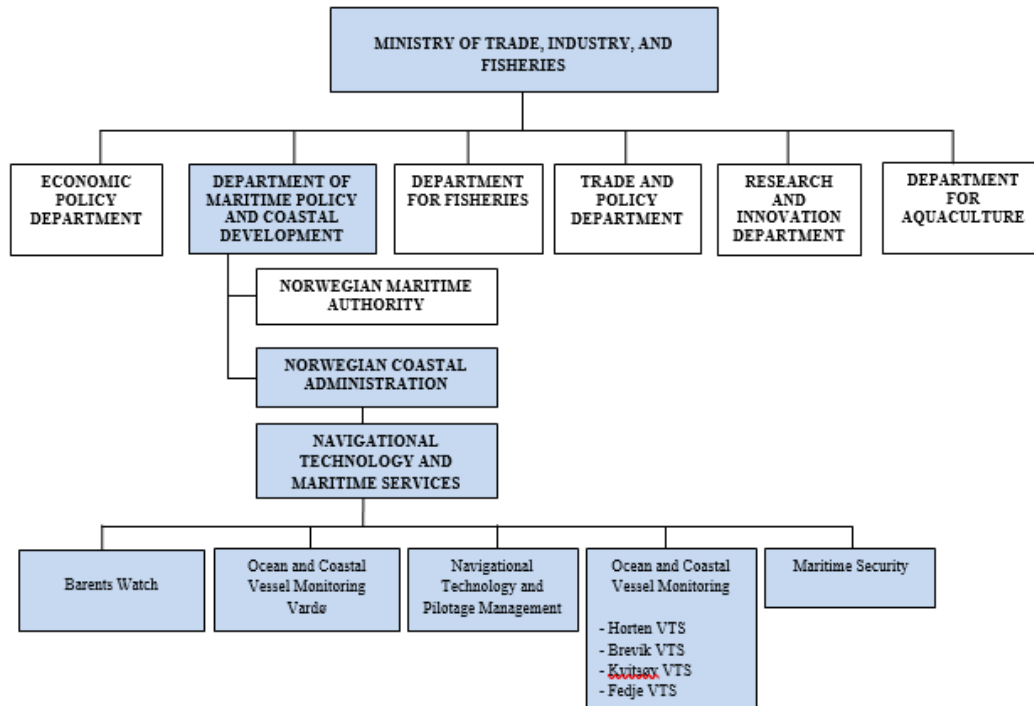
### 2.4.2 Norway

Norway has been one of important member States that contributed much in the advancement of e-navigation starting from the establishment of the IMO e-navigation correspondence group in 2009 until the delivery of the main output of the work which is the finalization of the IMO E-navigation SIP by its adoption of IMO in 2014 (Hagen, 2017). Norway also headed the three IMO working group on e-navigation which were related to safety, communications, SAR and training and human element issues; it has also collaborated IMO associated work like the harmonized display of navigation equipment on board and headed an IALA working group on the extended development on MSPs which focuses mainly in the development of a guideline for practical and operational implementation of MSPs (Hagen, 2017). In Norway, the Norwegian Coastal Administration (NCA) together with the Norwegian Maritime Authority (navigational equipment on board) facilitates the development of the e-Navigation in Norway (Kystverket, n.d. 1). From the name of the organization itself, it caters to the coastal State obligations of Norway (Kystverket, n.d.2).



**Figure 2**

*e-Navigation Government Framework of Norway*



**Note:** Adapted from “*Organisation*” by Ministry of Trade, Industry and Fisheries (n.d.) and “*Organisation and Management*” by Norwegian Coastal Administration (n.d.3)

The Norway Coastal Administration (**Figure 2**) leads the implementation of Barents Watch Centre, which gathers, develops, and disseminates Norwegian coastal and marine areas information, this information could be accessed through an internet portal which information such as Arctic Info, voyage-related information for safe navigation in the Arctic waters; wave forecast on selected fairways and areas on the coast of Norway and NAIS as well fishing activity in Norway could be accessed (Barents Watch, n.d.). The Norwegian Hydrographic Service under the Norwegian Mapping Authority is the agency responsible for making and revising nautical charts of the Norwegian waters as well as in the Antarctic, as well as the only authorized maker of official nautical charts and ENC in Norway (Kartverket, n.d. 1), it is responsible for information dissemination on navigable waterways, tidal waters, and currents and

responsible for the maintaining the bathymetric database (Kartverket, n.d.2). Meanwhile, the Norwegian Meteorological Institute under the Ministry of Climate and Environment is responsible for the public meteorological services either for civil or military use, the other part of its responsibility is the collection of meteorological data in Norway, bordering sea areas and on Svalbard and a meteorological information contributor to the Barents Watch (Norwegian Meteorological Institute, n.d.).

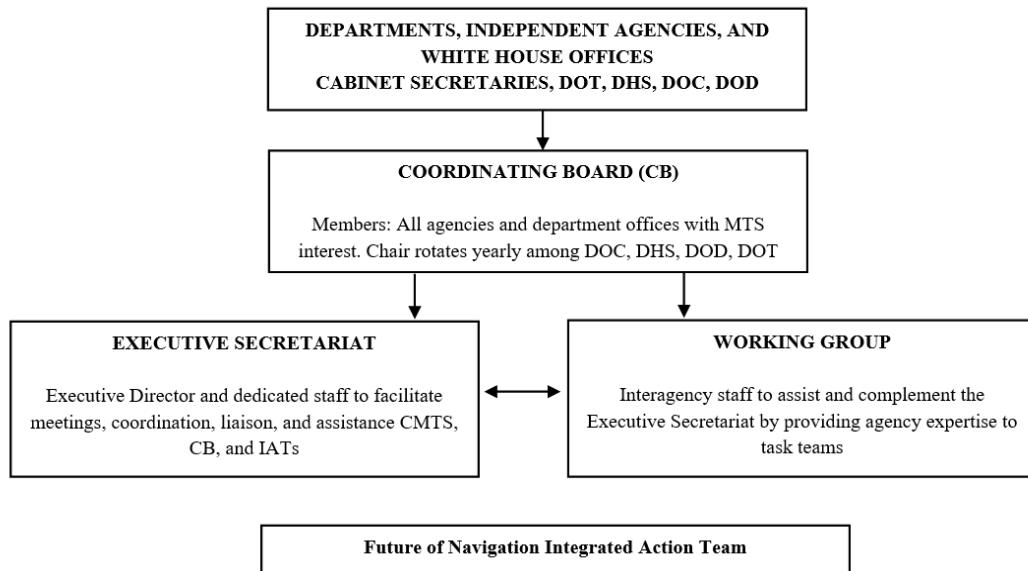
### **2.4.3 United States of America**

In the United States of America, the e-Navigation policy-making body is the U.S. Committee on the Marine Transport System (**Figure 3**), a federal maritime policy coordinating committee that the Secretary of Transportation heads with the intention to create a partnership of federal departments and agencies with having responsibility for the Marine Transport System, this is by virtue of the Coast Guard and Maritime Transportation Act of 2012 signed by President Barrack Obama on 20 December 2012 (U.S. CMTS, n.d.1). The Committee is composed of the Cabinet Member Committee, Coordinating Board, Executive Secretariat, Working Group, and CMTS Integrated Action Teams and Task Teams (U.S. CMTS, n.d. 2 and Hagen, 2017 p. 107).

The implementation of the e-Navigation strategy will be coordinated by the Future of Navigation Integrated Action Team (Future Nav IAT) where it will be co-led by the US Coast Guard (USCG), U.S. Army Corps of Engineers (USACE) and the National Oceanic and Atmospheric Administration (NOAA), these three federal agencies that is part of the Action Team due to their e-navigation capabilities such as US Coast Guard has the operational expertise in relation to several components related to e-navigation since it represents the U.S in international bodies such as IMO, IALA and the International Electrotechnical Commission (IEC), US Army Corps of Engineers (USACE) due to their expertise in coastal and inland water infrastructure and National Oceanic and Atmospheric Administration (NOAA) due to their expertise in hydrographic, oceanographic and meteorology information for e-navigation use. (US CMTS, 2021).

**Figure 3**

*e-Navigation Government Framework of United States of America*



**Note:** Adapted from “*Organizational Structure*” by U.S. Committee on the Marine Transport System (n.d.) and from “*CMTS Organization*” by Hagens (2017, p.107)

#### 2.4.4 Canada

Canada adopted a national vision for e-navigation and a concept of operations; and also established a governance structure composed of a national committee and regional committees (**Figure 4**), which are co-chaired by a Coast Guard director and marine stakeholder representative (Hagen, 2017).

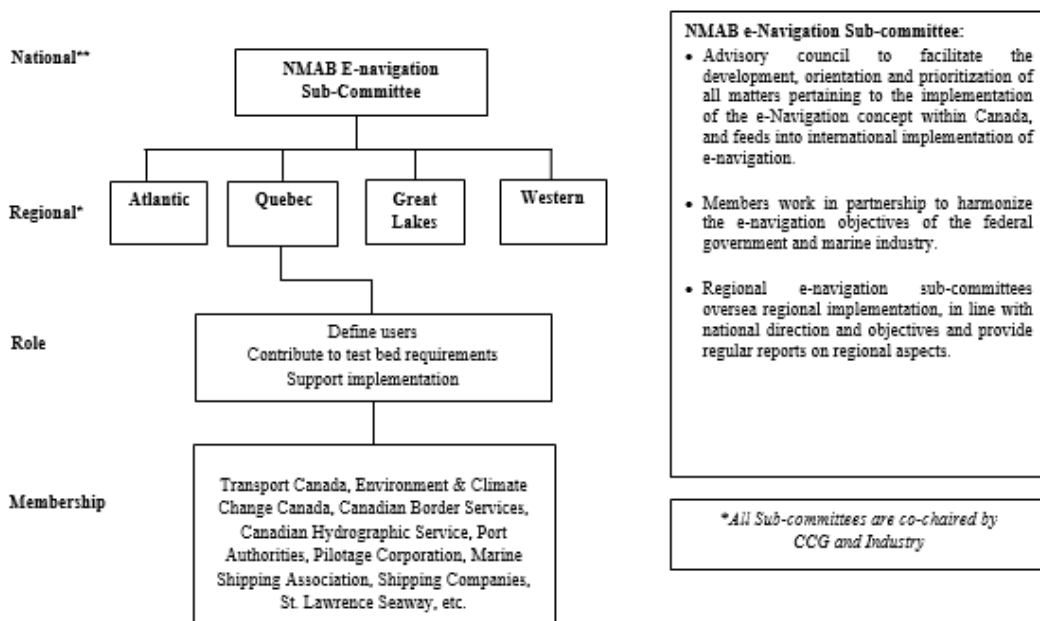
Canada’s E-navigation vision and strategy works is further continued between federal partners, including Transport Canada, Environment Canada, the Canadian Hydrographic Service and the Canadian Coast Guard (Breton et al., 2016). The Canadian Concept of Operations is when the shore authorities use a portal that is a website that provides information from recognized resources in a standard format called the Maritime Information Portal which will make the data accessible to users (Breton et al., 2016).

Part of Canadian Concept of Operations is the use of a Maritime Information Portal

now known as the E-navigation portal, where all official electronic data such as marine weather, charts and publications, notice to mariners, currents, tides, etc., and the information providers to this portal are Canadian Coast Guard, Canadian Hydrographic Service, Environment and Climate Change Canada and Fisheries and Ocean Canada (Government of Canada, n.d.1).

**Figure 4**

*e-Navigation Government Framework of Canada*



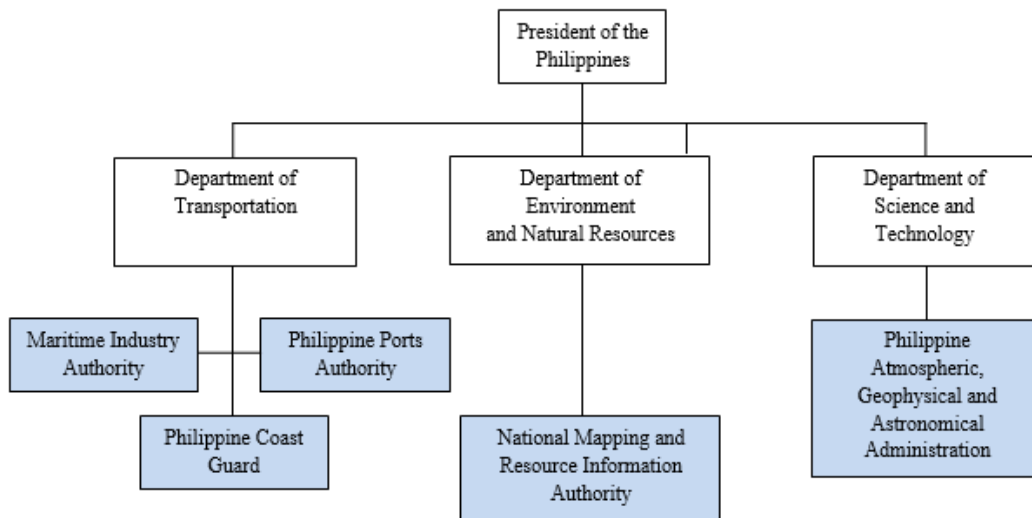
**Note:** Adapted from “*E-navigation in Canada and Modern Marine Navigation Services*”, by Mes (2022)

## 2.5 Government Framework of Maritime Safety Services in the Philippines

In the Philippines, the Department of Transportation (DOTr) is the government department that is over-all in-charge in all aspects of transportation: land, air, and water transport in the Philippines (Dimailig et al., 2017). Hebbbar et al. (2023) identified other main governmental agencies that is under the DOTr and those outside the said agencies that is involved in the governance of the domestic passenger shipping industry in the Philippines, which are (**Figure 5**):

**Figure 5**

*Maritime Safety Services Government Framework of the Philippines*



**Note:** Adapted from Department of Transportation (n.d.), National Mapping and Resource Information Authority (n.d.) and Philippine Atmospheric, Geophysical, and Astronomical Administration (n.d.)

the Maritime Industry Authority (MARINA) which is the flag State administration of the Philippine that issues the safe manning certificate of Philippine flagged ships, the Philippine Coast Guard implements VTS (in coordination with PPA), ship's routing, ship's reporting system, SAR, the establishment of aids to navigation; the National Mapping and Resource Information Authority (NAMRIA) the conducts hydrographical and oceanographic surveys and publishes nautical charts and publications and the Philippine Atmospheric, Geophysical and Astronomical Administration (PAGASA) that conducts weather forecasting and sea state, issues gale warnings and forecast storm movement. MARINA and PCG are agencies under the Department of Transportation, NAMRIA is under the Department of Environment and Natural Resources, and PAGASA is under the Department of Science and Technology.

### **3. Research Methodology**

#### **3.1 Research Design**

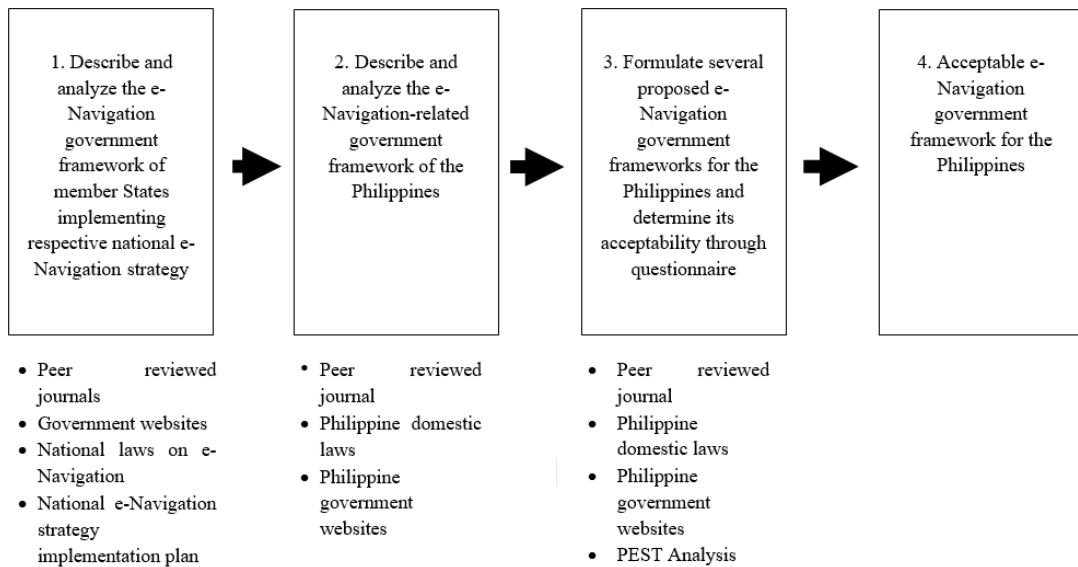
This study focused on the acceptable e-Navigation government framework of the Philippines. There has been an e-Navigation government framework on every member State belonging to the developed countries (Korea, Norway, USA, and Canada). However, the author did not encounter articles on the e-navigation government framework of developing countries such as the Philippines. To have an acceptable e-Navigation government framework in the Philippines, government agencies that have an interest in e-navigation implementation should be presented with a proposed e-navigation government framework and asked for their reason for choosing the framework and if they disagree with the framework, asked for the reason behind it. To attain this, this research used a mixed method wherein it used both quantitative (the number of respondents who chose and those who did not choose the proposed government frameworks) and qualitative data (the reasons for choosing and not choosing the proposed government frameworks) that were collected and analyzed within the study group (Shorten and Smith, 2017).

#### **3.2 Conceptual Framework**

It started by describing and analyzing the e-Navigation government framework of member States that are implementing their respective e-Navigation strategy implementation plan. In the course of literature review, the author identified four member States (Korea, Norway, United States of America, and Canada) according to Hagen (2017). The author examined the member States respective e-Navigation government framework by visiting the member States government website and the developments in their e-Navigation implementation strategy such as adoption of e-Navigation law, the establishment of e-Navigation inter-agency group, the government agencies that is involved in providing the information service relating to e-Navigation, the organizational chart of the government agency that is mandated to take the lead in the e-Navigation implementation.

**Figure 6**

*Conceptual Framework*



Moreover, to describe and analyze the e-Navigation-related government framework of the Philippines, the author examined the Philippine government agencies that is mandated to perform coastal State obligation services and other government agencies and the current government framework for possible e-Navigation implementation. The author also examined the organizational chart of the respective Philippine government agencies to identify the if the government agency concern is under one department whose mandate is related to e-Navigation or the government agencies whose functions are e-Navigation related are under from the different departments.

Furthermore, following the analysis of the steps 1 and 2, questions were formulated which will be further explained in the questionnaire section. The questionnaire was submitted to the REC for review and approval. Once the questionnaire is approved, it is encoded in the QuestionPro software and e-mailed to the respondents from Philippine government agencies such as PCG, NAMRIA, PPA, MARINA, NTC, BFAR and BMB. The reason is that these agencies' mandates are closely related to e-navigation services. The response from the open-ended questions in the questionnaire by each responded are examined and looked for the commonality from all of the

respondents.

After the response to the questionnaire is collected, the analysis of data collected from the questionnaire. The answers to the open-ended questions are coded to find the commonality between answers from the other respondents. While the answers to the closed-ended questions are tabulated. The comments and suggestions on the four proposed are considered and each proposed government framework are analyzed using a gap analysis method called PEST analysis which stands for political, economic, socio-cultural, and technology.

### **3.3 The Questionnaire**

The questionnaire is composed of eight questions composed of four multiple-choice questions and four open-ended questions (the respondents need to write down the answer). The respondents are asked to examine member States' existing e-navigation government framework (Korea, Norway, United States of America, and Canada). The respondents are asked what agencies of the Philippines that has an interest in e-navigation and the roles of the chosen government agency in the Philippine e-navigation, and what government agency is the lead agency in e-navigation implementation in the Philippines. The questionnaire also presented the four proposed e-navigation government frameworks for the Philippines and asked to choose among the four and the reason for choosing the said government framework. If the respondent did not choose among the four government frameworks, they are asked the reason for not choosing and describe their idea of an e-navigation government framework. The questions were encoded in QuestionPro software and e-mailed to the respondents.

The questionnaire consists of the following:

E-navigation government framework of Korea

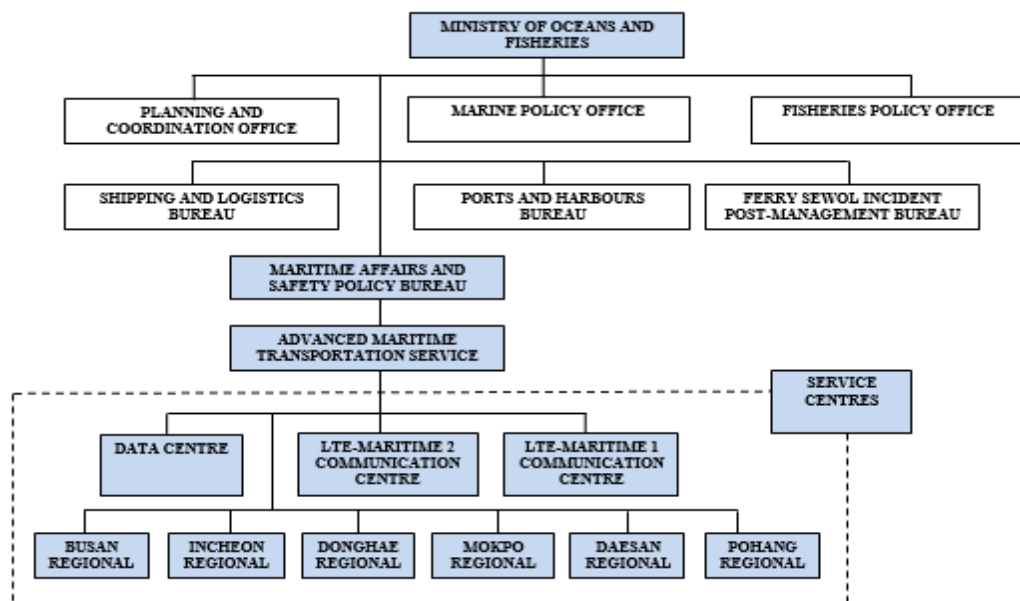
The e-Navigation government framework of Korea is mentioned in “ACT ON PROMOTION OF THE PROVISION AND USE OF INTELLIGENT MARITIME TRANSPORT INFORMATION SERVICES”. This Act mandates the Ministry of Oceans and Fisheries to formulate and implement a master plan on the use of



intelligent maritime transport information services every five years. It has also mandated MOF to establish and operate maritime wireless communication network. It was also mandated to build and operate an intelligent maritime transport information system to collect, store, search, analyze, process, and manage maritime transport information and to effectively provide intelligent maritime transport information services (Korea Legislation Research Institute, 2019). To effectively implement the mandate, MOF has delegated this to the Maritime Affairs and Safety Policy Bureau which formed the Advanced Maritime Transportation Service Team to operate and manage the intelligent maritime transport information services.

**Figure 7**

*e-Navigation Government Framework of Korea*



**Note:** Adopted from “*Organization*” by Ministry of Oceans and Fisheries (n.d.)

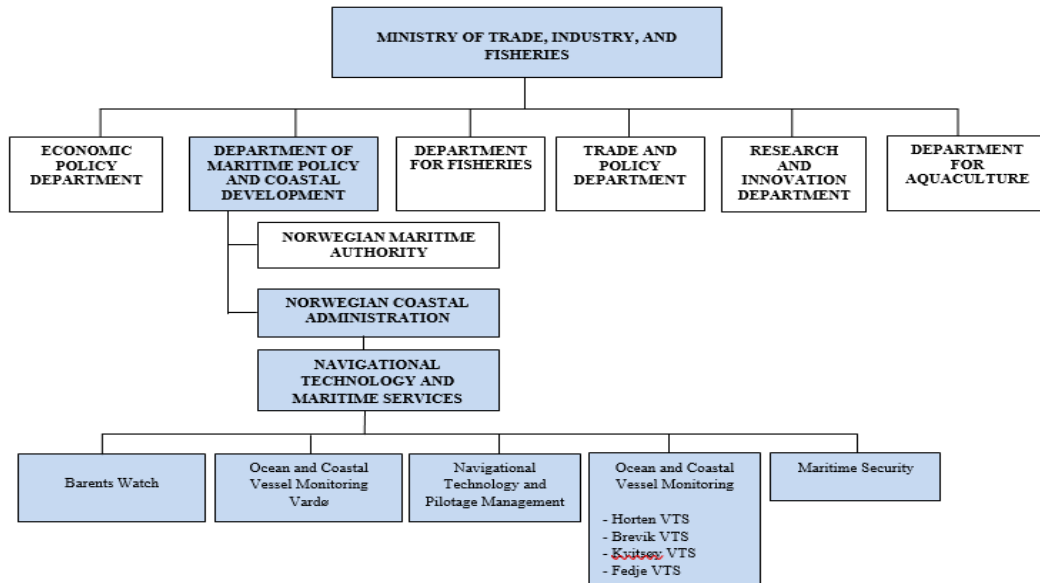
### Norway e-navigation government framework

Based on the IMO's e-navigation strategy, the Norwegian Coastal Administration is digitizing maritime information services, simplifying and facilitating the necessary information for navigators as part of the Norwegian e-navigation framework. One of the NCA's e-navigation efforts is the digital route service, which allows routes to be

inserted directly into electronic chartplotters on board vessels. The NCA's Navigational Technology and Maritime Services is primarily responsible for managing, developing, and operating the digital infrastructure. (Kystverket, n.d.).

**Figure 8**

*e-Navigation Government Framework of Norway*



**Note:** Adapted from “*Organisation*” by Ministry of Trade, Industry and Fisheries (n.d.) and “*Organisation and Management*” by Norwegian Coastal Administration (n.d.)

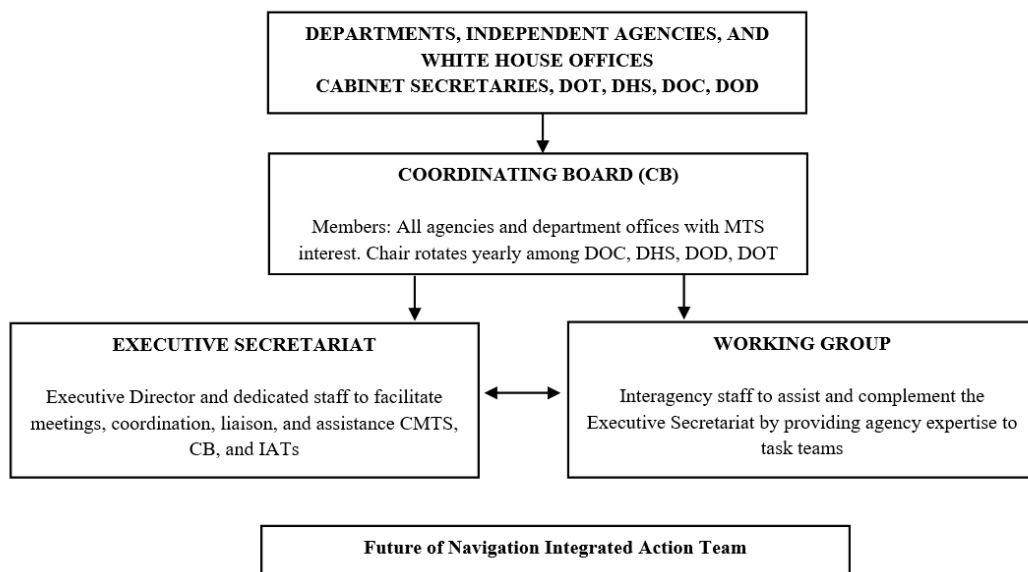
### The U.S. E-navigation Government Framework

E-navigation, known as the future of navigation, is governed by the Committee on Marine Transport System (CMTS) under the Coast Guard and Maritime Transportation Act of 2012. Cabinet-level committee, coordinating board, executive secretariat, working group, and integrated action team (future of navigation integrated action). This group seeks to unite federal entities involved in maritime transport. The Transportation Secretary leads the cabinet-level committee of U.S. agencies and departments. The coordinating board manages and advises over twenty-five maritime transport system-related entities and departments. The Secretaries of Transportation, Defense, Commerce, and Homeland Security form the CMTS coordinating council annually. The Board reviews and approves the CMTS work plan quarterly. Task or

Integrated Action Teams complete work plans. CMTS operations follow the Marine Transportation System National Strategy. The Executive Secretariat staffs CMTS, Coordinating Board, and task team functions. under "Topics/Projects" The Coordinating Board's Executive Secretary and CMTS Executive Director oversees employees. The Executive Secretariat and interagency teams receive specialist employees from CMTS member agencies. The Executive Secretariat oversees a "working group" to promote and organize multi-agency staff involvement and activity. Members propose, direct, and support work plan tasks at monthly meetings (CMTS, n.d.).

**Figure 9**

*e-Navigation Government Framework of United States of America*



**Note:** Adapted from “*Organizational Structure*” by U.S. Committee on the Marine Transport System (n.d.)

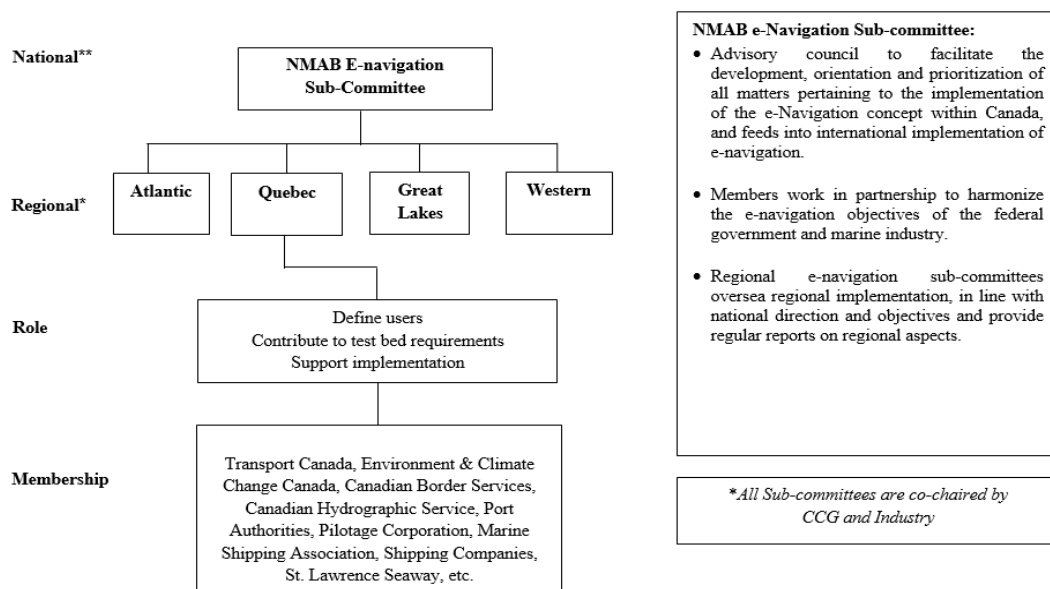
### The Canada E-navigation government framework

The Canada E-navigation government framework focuses on whole of government approach to marine navigation which is an inter-agency effort. The Canadian Coast Guard is jointly working with other Federal agencies such as Transport Canada,

Environment and Climate Change Canada, and the Canadian Hydrographic Service to provide services to mariners in Canadian waters. The Canadian Coast Guard is also jointly working with industry that has interest in e-navigation as well as the marine transport in the e-navigation sub-committee. In the government framework shown, it is the Canadian Coast Guard that has a lead in the modernization of marine navigation service and the e-navigation implementation in Canada (Mess, 2022).

**Figure 10**

*e-Navigation Government Framework of Canada*



**Note:** Adapted from “*E-navigation in Canada and Modern Marine Navigation Services*”, by Mes (2022)

Questions:

1. Listed below are different Philippine government agencies. Which of these government agencies has relative interest to e-Navigation in the Philippines? (You may choose more than one)

Maritime Industry Authority

Philippine Coast Guard

National Mapping and Resource Information Authority

Philippine Atmospheric, Geophysical, and Astronomical Service  
Administration

Philippine Ports Authority

Bureau of Fisheries and Aquatic Resources

Biodiversity Management Bureau

2. What would be the role/s of the chosen government agency or agencies for the effective implementation of e-Navigation?

3. Lead Agency

Lead agency refers to the agency delegated by the competent authority to plan and execute the e-Navigation strategy plan. Which government agency shall be the lead agency for e-Navigation planning and execution?

Maritime Industry Authority

Philippine Coast Guard

4. To implement e-navigation in the Philippines, what are the activities needed to be done?

Adopt an E-navigation law of the Philippines

Adopt a Philippine E-navigation Strategic Implementation Plan

Form a Philippine inter-agency group on e-navigation

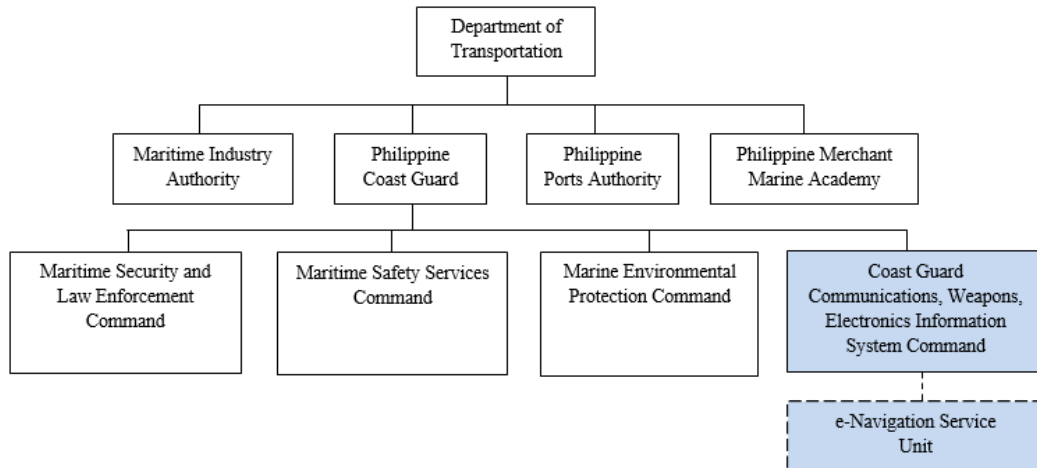
Others: \_\_\_\_\_

**Below are the four proposed Philippine e-Navigation government frameworks based on IMO member State.**

First. The Philippine Coast Guard has the Coast Guard Weapons Communications Electronics Information System Command, which could organize a branch that will provide the e-navigation service (**Figure 11**). As the name itself, since the e-Navigation deals with the communications and information system, the Office will be in-charge of the Maritime Connectivity Platform (MCP) and other digital infrastructure of the Philippine e-Navigation.

**Figure 11**

*First Proposed e-Navigation Government Framework*

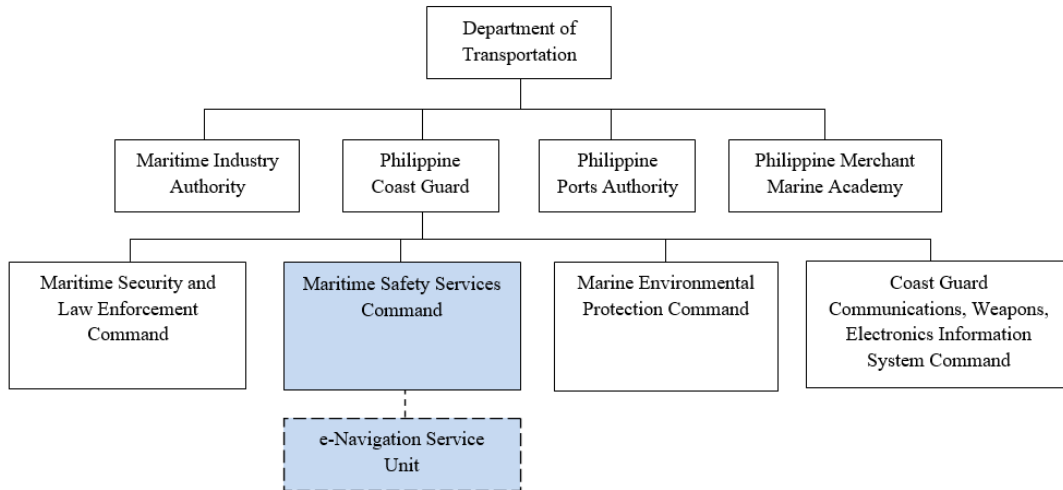


**Note:** Adapted from “PCG Organizational Structure, OLD and NEW” by Freedom of Information Philippines (n.d.)

Second. In this government framework, the e-navigation service is placed to the Maritime Safety Services Command of the Philippine Coast Guard (**Figure 12**). Currently, this Command is mandated to provide maritime safety services such as aids to navigation, ship’s routeing, ship’s reporting system, vessel traffic services This is a new government agency under the Department of Transportation that will be mandated to provide coastal State obligations services such aids to navigation, VTS, ship’s routeing, ship’s reporting system, hydrographic information, nautical charts, and publication, etc. and e-navigation service will also be provided by this new agency.

**Figure 12**

*Second Proposed e-Navigation Government Framework*

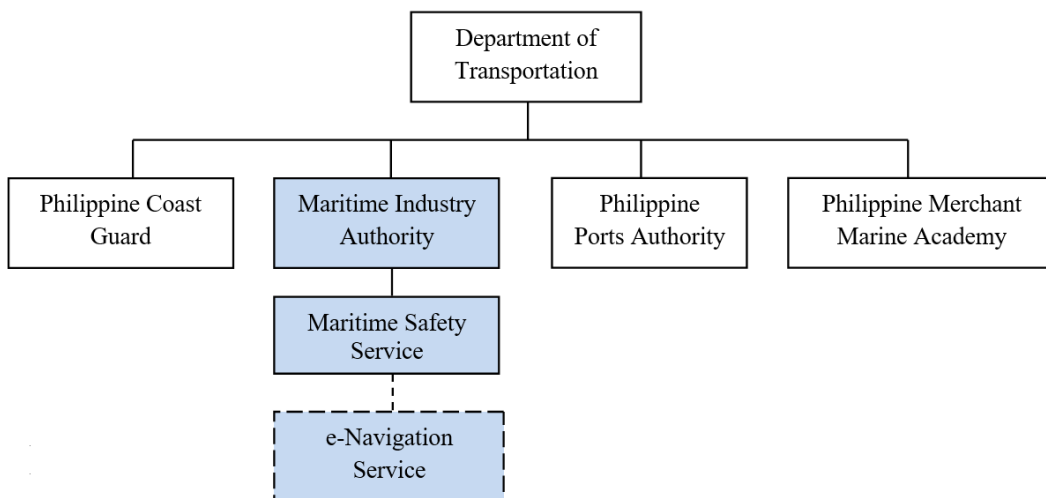


**Note:** Adapted from “PCG Organizational Structure, OLD and NEW” by Freedom of Information Philippines (n.d.)

Third. In this government framework, the e-navigation service is placed in the Maritime Safety Service, (**Figure 13**) one of the Offices of the Maritime Industry Authority. The term “maritime safety” used by the Maritime Industry Authority refers to safe management of companies, ships, seaworthiness of ships, and the protection of the marine environment.

**Figure 13**

*Third Proposed e-Navigation Government Framework*

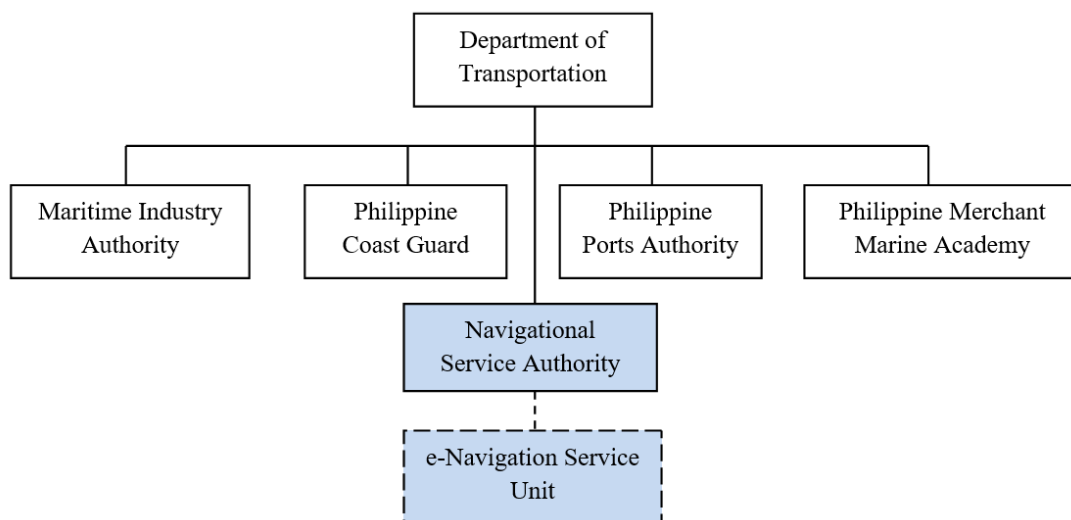


**Note:** Adapted from “Services” by the Maritime Industry Authority (n.d.2)

Fourth. In this government framework, the coastal state obligation services of the Philippines which is being provided by the Philippine Coast Guard such establishment and operation of aids to navigation, VTS, ship's routing, ship's reporting system as well as the hydrographic information, nautical charts, and publication from NAMRIA will be transferred to this new government agency attached to the Department of Transportation wherein the e-navigation service will be one of the services that the Navigational Safety Authority will provide.

**Figure 14**

*Fourth Proposed e-Navigation Government Framework*



**Note:** From the author

5. Among the four proposed e-navigation government framework, which is applicable and acceptable for the Philippine setting?

First proposed e-navigation government framework

Second proposed e-navigation government framework

Third proposed e-navigation government framework

Fourth proposed e-navigation government framework

None of the above

6. Why do you think that the e-navigation government framework you chose is applicable and acceptable to the Philippine setting?



7. If you have not chosen from the four proposed e-navigation government framework, why do you think it is not applicable and acceptable to the Philippine setting? (Write)

The information that is expected to be achieved from the respondents from the questionnaire are: their preferred Philippine government agencies that has the interest and their roles and service that these agencies could contribute to e-Navigation. The information from the respondents on their preference of which agency between PCG and MARINA would be the lead agency in the e-Navigation planning and execution and other agency that is not included in the question. The respondent's preference on what should be activities needed to be done to implement e-Navigation in the Philippines. The information on the respondent's preference on the four proposed e-Navigation government framework of the Philippines, the reason for choosing that proposed government framework and the information on the respondents' reason for not choosing among the four proposed government and their own version of an e-Navigation government framework of the Philippines.

### **3.4 PEST Analysis**

PEST analysis is an acronym which stand for Political, Economic, Social and Technological and it denotes a macro-environmental analysis (**Table 2**). The successful integration of e-Navigation within a government framework necessitates the formulation of a strategic development plan. In this study, the author identified the factors on the four macro-environmental setting that is applicable to the respondents' responses in the questionnaire.

This plan should carefully consider the contextual environment in which it is being implemented, ensuring the efficacy and longevity of the government framework. To achieve this, a thorough analysis of four key factors is imperative: politics, economy, society, and technology. This was used by Ha and Coghill (2006) for the e-Government in Singapore, Rezazadeh et al. (2011) for the e-Governance in Iran, and by Vasileva (2018) for its application for strategic planning of regional development.

Most political environment evaluations are based on macro environment analyses. Government aid is integral to public sector policymaking. Different countries and regions have different political systems. The results of the same approach may differ among political circumstances. Throughout strategy design, the political environment inside the government framework must be carefully assessed to maximize its influence. (Zhang, 2023).

**Table 2**

*PEST Table*

<p>Political</p> <ul style="list-style-type: none"> <li>• government change and term</li> <li>• current laws and policies</li> <li>• budget allocation</li> <li>• Philippine legislation process</li> </ul>	<p>Economic</p> <ul style="list-style-type: none"> <li>• economic stability</li> <li>• allocation of resources</li> </ul>
<p>Social</p> <ul style="list-style-type: none"> <li>• stakeholder attitudes and opinions</li> <li>• cost implications</li> <li>• inter-agency collaboration</li> </ul>	<p>Technological</p> <ul style="list-style-type: none"> <li>• research and development</li> <li>• e-Navigation equipment upgrade</li> <li>• communication infrastructure</li> </ul>

**Note:** Taken from “*PEST Analysis*” by Smart Draw (<https://www.smartdraw.com/pest-analysis/>)

The economic picture must be assessed using many important indicators. These include the domestic economic situation, condition of overseas economies, market and trade cycles, interest and exchange rates and world trade/financial issues. Strategic plans and policy development must protect the economic basis, which defines the superstructure. The public sector may develop growth-promoting strategies based on economic circumstances. Understanding that economic and environmental evaluations encourage public sector policy formation is vital. (Zhang, 2023).

The social environment is crucial to strategy or policy execution; hence it must be considered throughout design. Changeable social environment assessment methods are needed. A preliminary study is needed to evaluate social dynamics. Additionally, cultural characteristics peculiar to a nation or region should be addressed. Culture, created through time, is a nation's greatest asset. Culture impacts people's needs and public sector strategic decision-making. Thus, reassessing the social environment before developing a plan is essential. If the public sector fails to assess social issues while formulating plans, even a successful one may not be accepted. (Zhang, 2023).

Technological environment must be analyzed. Current trends impact public sector plan formulation. Due to improvements in science, technology, informatization, and public sector governance modernization, technology appraisal before strategy design is essential. This review is essential for technological implementation. Successful technology supports the orderly growth of the strategic system, creating the framework for strategy formation and maintaining relevance throughout the strategic process. (Zhang, 2023).

According to Zhang (2023) and Vasileva (2018), PEST analysis is a key role in environmental analysis of the strategy formulation process. Since the establishment of an e-Navigation government framework is part of the e-Navigation formulation strategy. In this study, the author identified the factors on the four macro-environmental setting that is applicable to the respondents' response in the questionnaire (**Table 2**) which the analysis and discussion are found on the next succeeding chapters.

#### 4. Analysis

This chapter presents the analysis of the findings from the gathered data from the responses coming the questionnaires. The questionnaire was sent electronically to respondents coming from different Philippine government agencies that has an interest in e-Navigation such as MARINA, PCG, NAMRIA, PAGASA, BFAR, BMB and NTC with a total of 35 possible respondents. 16 out 35 respondents responded to the questionnaire wherein seven came from the Philippine Coast Guard, five from the PPA, one each from NAMRIA and MARINA and two from NTC (**Table 3**).

**Table 3**

*List of Respondents*

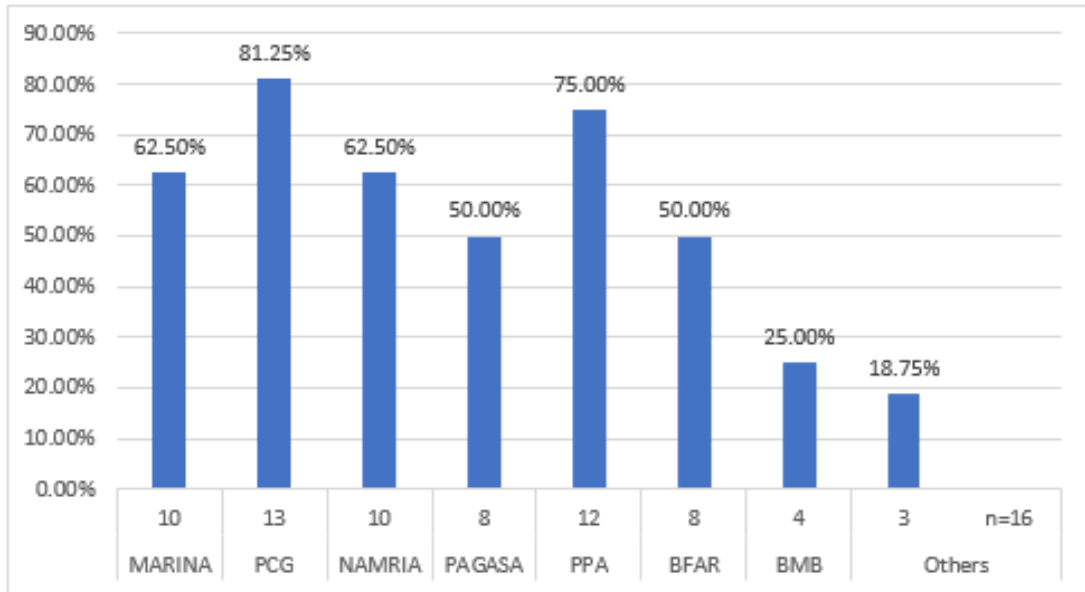
<b>Respondent</b>	<b>Name of Agency Affiliated</b>	<b>Number of Years Working in the Agency</b>
<b>1</b>	PPA	12
<b>2</b>	PPA	11
<b>3</b>	PPA	12
<b>4</b>	NAMRIA	15
<b>5</b>	PPA	11
<b>6</b>	PCG	20
<b>7</b>	PCG	8
<b>8</b>	PCG	7
<b>9</b>	PCG	11
<b>10</b>	PCG	6
<b>11</b>	NTC	21
<b>12</b>	PCG	20
<b>13</b>	NTC	21
<b>14</b>	MARINA	10
<b>15</b>	PPA	11
<b>16</b>	PCG	4

## 4.1 Analysis of Response from Questions 1 to 4

### Question 1

Figure 15

*Respondents' Preference on Government Agency*



The results showed that from sixteen respondents, majority of of respondents, preferred the Philippine Coast Guard (81.25%) as the Philippine government agency that has interest in e-Navigation in the Philippines. Followed by the Philippine Ports Authority (75%), Maritime Industry Authority and National Mapping and Resource Information Authority both having 63.50%. While Bureau of Fisheries and Aquatic Resources (50%), Philippine Atmospheric, Geophysical, Astronomical Services Administration (50%), Biodiversity Management Bureau (25%), and the National Telecommunications Commission (18.75%) were also preferred by the respondents. This indicated that based on respondents' preference, the higher the percentage, the higher the involvement of the agency to e-Navigation, the lower percentages the lower involvement of the agency to e-Navigation in the Philippines. This made the PCG having the highest involvement to e-Navigation while NTC having the lowest involvement to e-Navigation in the Philippines.

The distribution of responses among various agencies should be carefully taken into account. The groups PCG and PPA exhibit a notable proportion of respondents, perhaps influencing the results. This would imply that the higher proportion of PCG and PPA respondent in the study leads to their preference that these agencies having possess a significant interest in e-Navigation. Moreover, having a small sample size of sixteen respondents would not give a generalization of the results, since it did not include the larger representation of the preference coming from the whole maritime stakeholders in the Philippines. Nevertheless, the results of this study provide essential valuable understanding about the perception of the respondents to the agencies that have the necessary expertise and mandate to effectively implement e-Navigation in the Philippines.

In conclusion, the results of the study emphasized the importance agency preference of the respondents to the implementation of e-Navigation in the Philippines, it highlighted the importance of government agencies such as PCG, PPA, MARINA and NAMRIA as agencies having interest in e-Navigation in the Philippines and acknowledge the presence of different perceived interest among these agencies by the respondents. However, the limited sample size and representation from the mentioned agencies because of limited sample size and limited representation, these findings are unable to give a conclusive understanding of agency preferences. Therefore, future study is needed to arrive a more comprehensive results.

### **Question 2.**

Respondents 1, 2 and 4 acknowledge that the Philippine Ports Authority through its vessel traffic management system has been a vital role in e-Navigation through the digitization of marine information. According to them, this is expected to facilitate electronic coordination, exchange of data/information, cooperation between ports, participating vessel and other parties thereby providing the user information assistance and support at will all times and will ensure safety of navigation of vessels.

Respondent 3 stated that the role of the agencies is to have a sustaining and continuous inter-agency coordination based on the agencies' respective mandate and roles based on a comprehensive national government strategy that has cooperation between agencies and is active in providing information assistance and support at all times.

Respondent 6 stated that the chosen agency's role is the regulatory aspect that will provide a state-of-the-art platform. The regulatory and main arm provides an exquisite and state-of-the-art platform to ensure efficiency and maintain secure and safe seas in implementing e-navigation.

Respondents 7, 11, and 15 stated that the role of the chosen government agency is the supervision, inspection, and implementation of guidelines and policies relative to e-Navigation to ensure its effective implementation in the Philippines.

While Respondent 13 stated the Philippine government agencies could provide policy and regulatory framework to support the development and use of e-navigation technologies, provide technical support to organizations and individuals that would adopt e-Navigation technologies and promote e-Navigation technologies through public awareness campaigns.

Respondent 12 described the roles of each chosen agency: PCG has the mandate to draft and implement rules and regulations pertaining to safe navigation within the Philippine territorial waters, NAMRIA has the mandate to provide reliable map making services which is a key component of navigation while PPA is responsible to ensure smooth flow of water borne commerce passing through the Philippine ports. While Respondent 14 also described each of the chosen agency namely PCG, its role in the safety management information. PPA its port services related information. NAMRIA, its hydrography and mapping information. PAGASA, meteorological information. BFAR, fisheries information. DENR-BMB, marine protected area information. DICT-NTC, radio and telecommunication frequencies/bandwidth.

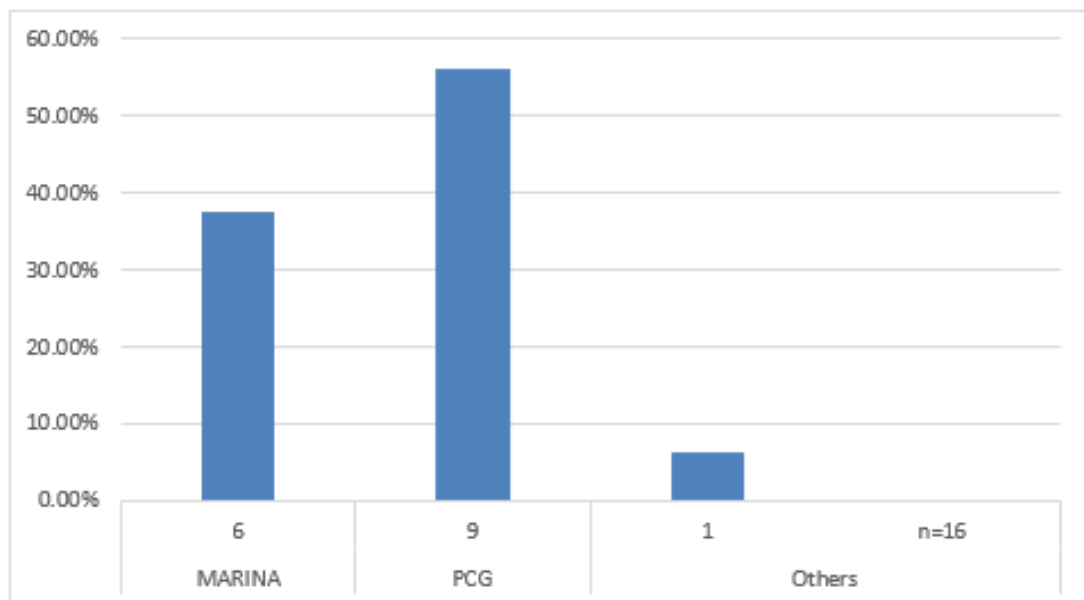
The results showed that only Respondents 12 and 14 had clearly described the roles of their chosen Philippine government agencies, which they believed had interest in the e-Navigation implementation in the Philippines. While the rest of the respondents the agency where they belong the respective roles in the e-Navigation implementation in the Philippines. The two has some understanding on the roles of their chosen agencies in the e-Navigation implementation in the Philippines while the rest of the respondents have understood the specific roles of the agencies where they belong in the e-Navigation implementation in the Philippines.

### Question 3.

Out of the total sample size of 16 participants, a majority of 9 individuals preferred to designate the Philippine Coast Guard as the primary organization responsible for the strategic formulation and implementation of e-Navigation initiatives (**Figure 16**).

**Figure 16**

*Respondents Preference between MARINA and PCG as Lead Agency*





A majority of the respondents expressed a preference for the Maritime Industry Authority (MARINA) to assume the primary role. One participant suggested an alternative strategy including the establishment of many agencies with designated technical leadership positions. It is observed that a significant proportion of the participants are affiliated with the PCG. Within the sample of respondents who selected PCG as the primary agency, it is noteworthy that five individuals are affiliated with PCG. This observation implies that their association with PCG may have impacted their decision.

Within the group of respondents who selected MARINA as the primary agency, it is noteworthy that two individuals are affiliated with the PCG, while another two are affiliated with the PPA. This observation suggests that their respective affiliations may have impacted their inclination to examine other agencies for assuming the lead position. The potential impact of the Canadian government's e-Navigation framework on the choices of the respondents should also be considered. The inclination of respondents towards PCG as the lead agency may be attributed to the influence of the Canadian government's strategy, which assigns a central role to the Canadian Coast Guard in the implementation of e-Navigation.

Alternatively, it could be due to the perception that PCG's proficiency in safety management and navigation renders them highly suitable for the implementation of e-Navigation. Respondents who selected MARINA expressed the belief that MARINA, as a flag Administration, had a comprehensive understanding of mariners' requirements in terms of navigation safety, therefore placing it in a more advantageous position to assume a leadership role.

Meanwhile, one respondent suggested for each agency to assume a distinct lead position in certain technical aspects of e-Navigation, demonstrates an appreciation for the diverse contributions that agencies may make depending on their respective technical proficiencies within the many dimensions of e-Navigation. The other

proposed a co-led strategy, similar to that of the United States government framework model, suggests a dispersed leadership model where agencies cooperate based on their specialized technological skills in various e-Navigation components. In conclusion, the preferences of the respondents are influenced by several factors like as their connections, the international government framework on e-Navigation, the missions of their respective agencies, and their technical knowledge.

#### **Question 4.**

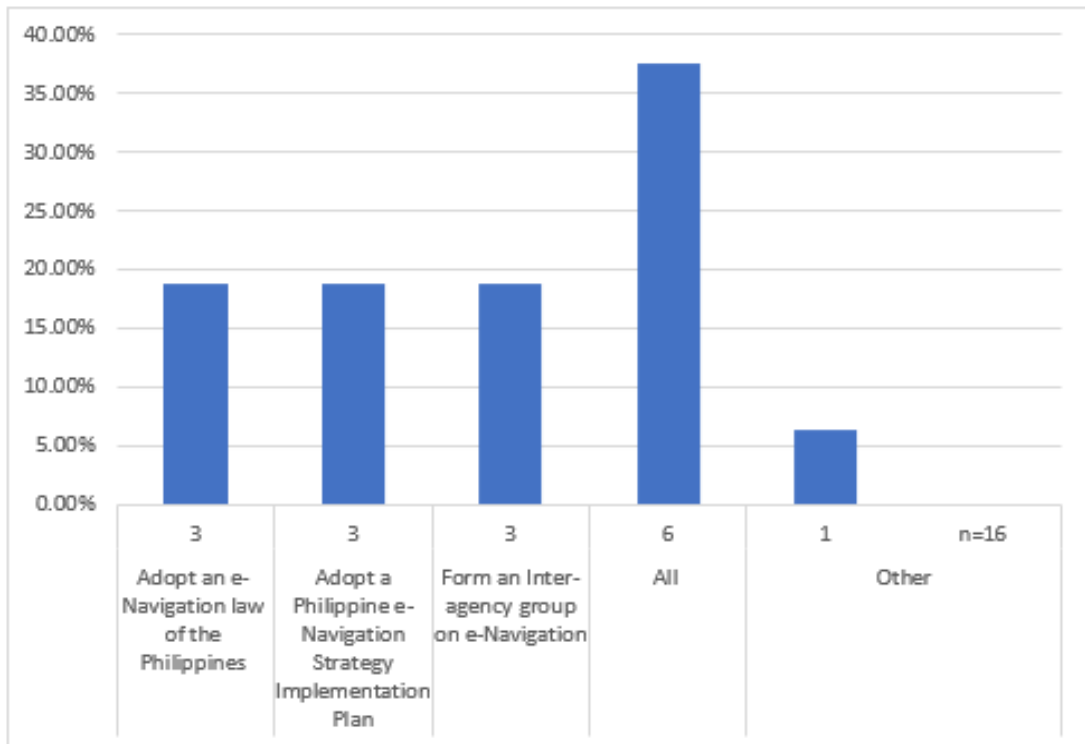
This section analyzes the preferences of the 16 respondents regarding the various activities that needed to be undertaken for the e-Navigation implementation in the Philippines. Six out of the sixteen respondent chose all the mentioned activities, indicating their belief that a comprehensive and holistic approach is needed to implement e-Navigation in the Philippines successfully (**Figure 17**). This would mean that an effective e-Navigation implementation would require several coordinated activities.

Meanwhile, three out of the sixteen respondents selected “Adopt an e-Navigation Law in the Philippines” suggesting that these respondents believed that enacting a law on e-Navigation in the Philippines is essential and a crucial step in the establishment of a e-Navigation government and regulatory framework.

Three out of the sixteen respondents selected “Adopt a Philippine e-Navigation Strategic Plan,” which means that the respondents understood the importance of having a well-organized and structured strategic plan that could guide and advance efforts toward the successful integration of e-Navigation components into its eventual implementation.

**Figure 17**

*Respondents' Response on the Associated Activities in the e-Navigation Implementation in the Philippines*



Three respondents out of sixteen selected "Form a Philippine Inter-Agency Group on e-Navigation." These respondents emphasize the significance of collaboration and coordination among government agencies, believing that a dedicated inter-agency group can facilitate effective communication, resource sharing, and decision-making, thereby ensuring that e-Navigation efforts are aligned and harmonized.

One out of sixteen respondents selected "Others," indicating a different perspective. Before moving forward with specific activities, the respondent emphasized the importance of e-Navigation-supporting research. This perspective emphasizes a data-driven strategy in which decisions are founded on a comprehensive comprehension of the prospective benefits and challenges of e-Navigation.

In summary, the findings indicated that the respondents' selections reflect the most vital steps or aspects necessary for the successful implementation of e-Navigation in the Philippines. Those who selected multiple activities recognized the complexity of e-Navigation and believed in a holistic approach. Those who selected only a single activity would like to highlight a particular aspect, they deem essential while other activities are not essentially required to do so. Lastly, the "Others" option indicates a preference for decision-making based on evidence and that a study should precede from the other mentioned activities.

## **4.2 Analysis of the Response from Questions 5 to 8**

### **Question 5.**

The result showed that out of the sixteen participants, five respondents preferred for the second proposed government framework (33.33%). Four respondents preferred the fourth proposed government framework (26.67%). Three respondents did not choose among the four proposed government framework (20.00%). The remaining four respondents are equally divided between the first government framework (13.33%) and third proposed government framework (13.33%). This indicated that majority of the respondents showed preference to the second proposed government framework (**Figure 18**).

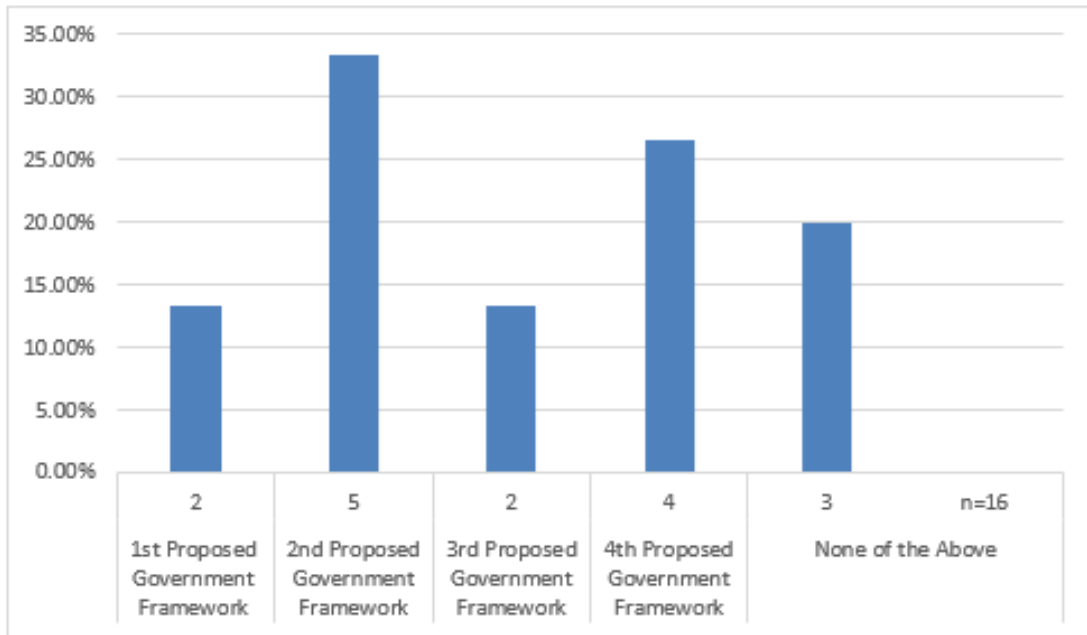
In the first proposed government framework, it is in the e-Navigation Services is placed under the Coast Guard Weapons Communications Electronics Information System Command ensuring that digital infrastructure of the e-Navigation service is maintained and operated properly due to its expertise in communications, electronics and information related components of e-Navigation.

Those who chose the second framework would assume that placing the e-Navigation service under the Maritime Safety Services Command will ensure its smooth implementation due to its mandate in providing most of the coastal State obligation

services of the Philippines.

**Figure 18**

*Respondents Preference on the Four Proposed e-Navigation Government Framework*



Those who chose the third government framework would assume that placing the e-Navigation service under MARINA would ensure its smooth implementation because as the flag Administration, the agency is familiar to the kind of information service that the mariners need that support navigational safety which is the basis of e-Navigation.

Those who chose the fourth framework they would assume that the creation of a new government agency would ensure that the smooth implementation of e-Navigation because most of the coastal State obligations are transferred to this new agency and will promote the agency to further develop their e-Navigation expertise in the further development of e-Navigation in the Philippines.

**Question 6.**

The following are the respondents' comments and reason for choosing among the four proposed government framework for e-Navigation for the Philippines.

The respondents that chose the first proposed government framework collectively agreed that it is the more practical because the system is already established which suggested a preference for establishment of an e-Navigation system upon existing infrastructure and capabilities.

Those that chose the second proposed government framework because of the respective reasons: the Philippines should enhance the capabilities of existing agencies to avoid duplication and properly delegate the functions, the purpose of e-Navigation is to ensure all vessels safely navigate from port of origin to port of destination which involves navigating through coastal waters which has always been the mandate of the PCG and recognized that MSSC (the unit mentioned in second government framework) has been the Functional Command of the PCG that is primarily in-charge of the safety of navigation at sea in the Philippines. This would show that respondents agree that relevant agencies, particularly with navigational safety mandates should be strengthen.

Those that chose the third government because collectively believed that MARINA is the agency responsible for the regulation of the maritime industry that included the certification of e-Navigation equipment and the other provisions of the e-Navigation services in the Philippines. This could be interpreted that the respondents point out MARINA's regulatory mandate to add the carriage of e-Navigation equipment to a vessel thereby e-Navigation service is placed under MARINA.

Those that chose the fourth government framework cited several reasons. The new government agency is expected to ensure a practical and scientific-based planning, formulation of applicable and consistent regulations, standards and guidelines on the emergence of new technologies such as e-Navigation. One respondent mentioned

about having a specialized agency that has deep expertise in e-Navigation technologies, having enhanced safety and risk management where the single agency could consolidate data, conduct comprehensive analysis and transmit this information to stakeholders, effective resource allocation where the new agency could optimize both financial and human resources supporting the development, implementation, and maintenance of e-Navigation systems, a centralized agency that could provide timely response and assistance by using its expertise and resources. This reason highlights that creating a new agency would have the benefits of centralized expertise, streamlined regulations, safety management, and efficient resource allocation.

**Question 7.**

Those that did not choose any among the four proposed government framework stated their reasons. One respondent stated that e-Navigation should be instituted under the DOTr, believed that having a new government agency will not speed up the e-Navigation implementation, maintain balance between mandates of existing agencies that is pragmatic and adaptable, and the e-Navigation plan should be based on the current Philippine setting. The other respondent commented that the current Philippine setting and financial requirements of the four proposed government framework are factors for not choosing among the government framework, one also commented that e-Navigation should be aligned with the Philippine government priorities, specific and applicable to the Philippine setting are the conditions for choosing among the four proposed Philippine government frameworks. And lastly, one respondent assumed that there should first be an inter-agency institution that be tasked to develop an e-Navigation strategic plan, from that plan, any of the first three government framework could be the tentative/short/medium term set-up. While the fourth proposed government framework shall the established as a permanent government framework in the long-term set-up. The comments from the respondents showed leverage of existing government agencies, aligning strategies with the Philippine context and priorities, and considering short-, medium- and long-term planning in the establishment of e-Navigation government framework in the Philippines.

**Question 8.**

The responses from Respondent 3 and Respondent 11 presented an alternative perspective on the e-Navigation government framework in the Philippines. These suggest careful leveraging existing agencies and transitioning to a more comprehensive, unified approach.

Respondent 3 proposed that DOTr should be the lead agency while specific components of e-Navigation such infrastructure be assigned to PPA, the implementation of e-Navigation implementation to PCG and the e-Navigation processes be assigned to MARINA, suggesting similarity to the government framework of United States of America, DOTr is assisted by the attached agency and each agency co-leads on e-Navigation related functions which the agency has their respective operational expertise in relation to e-Navigation components.

Respondent 11 explained that there shall be a derived framework, the combination of the first three government frameworks and will eventually become the fourth government framework. This would mean that the first three proposed government frameworks are the short and medium term while the fourth proposed government framework is for the long and permanent term.

**4.3 PEST Analysis**

This section analyses the Political, Environmental, Social, and Technological Environment, factors that will affect establishment of e-Navigation government framework in the Philippines:

**Political Environment**

Government Change and Term: The Philippines is a democratic republic with a six-year presidential term. New administrations may prioritize various projects, which may have an effect on the continuation of e-Navigation initiatives. The strategy should take into account the limited window of opportunity that exists during a single



presidential tenure.

**Current Statutes and Policies:** While there is no current law on e-Navigation in the Philippines, the incumbent President of the Philippines has showed his enthusiasm in strengthening the Philippine maritime industry, which could create an opportunity for e-Navigation to align with this new maritime policy of the Philippines.

**Budget and Fund Allocation:** The budget allocation procedure in the Philippines is composed of multiple stages, ranging from agency proposals, budget deliberations in the Department of Budget and Management, House of Representatives and Senate to presidential approval. In obtaining the necessary funding for e-Navigation in the Philippines, it is essential that the Department of Budget and Management (DBM) involvement during the planning process to prove the project's alignment to the country's national priorities.

**The Legislation Process:** e-Navigation initiatives require legislative support, so it is essential to create consensus and obtain political support. However, the legislative procedure in the Philippines is in and involves both Houses of the legislative branch and the President. Therefore, part of the e-Navigation implementation plan is having a plan to create consensus and obtain political support within the term of the elected lawmakers and the term of the President.

### **Economic Environment**

**Economic Stability:** Due to the COVID-19 pandemic and external factors such as the Ukrainian-Russian conflict, the Philippines have faced economic challenges. These obstacles could divert government funds away from e-Navigation initiatives. A thorough analysis of the economic benefits of e-Navigation could aid in the initiative's prioritization.

**Allocation of Resources:** The government may prioritize subsidies and anti-inflation

and anti-instability measures, which could impact the allocation of resources to e-Navigation. Advocates for the initiative must make a compelling case for its contribution to economic development.

### **Social Environment**

**Public Awareness and Support:** In the Philippines, e-Navigation is a new concept. Building awareness and obtaining public support is crucial, particularly since taxpayers will finance the infrastructure. Communication and education campaigns must be effective.

**Inter-agency collaboration and support:** Collaboration with multiple government agencies, including local administrations, is essential. Initially, some may not see the relevance of e-Navigation to their roles; therefore, advocacy and coordination efforts are required.

### **Technology Environment**

**Research and development (R&D):** The Philippines had been insufficiently investing on research and development which is essential in keeping up with the technological advancement of e-Navigation. Therefore, the Philippines should increase their budget spending in research and development as well forging partnership with member States that has been implementing e-Navigation for technical and research and development assistance.

**Infrastructure Upgrades:** e-Navigation is dependent on both onshore and onboard digital infrastructure. To ensure the initiative's success, the government and shipowners must be willing to upgrade existing equipment.

**Communication Infrastructure:** Communication link is essential as this will connect between the ship and shore enabling it to seamless transfer information in digital form. However, every communication links has its own advantage and disadvantage on the

factors such as connection speed and coverage area, which the Philippines should consider based on its own setting.

In conclusion, the successful implementation of e-Navigation in the Philippines would depend on political alignment, economic viability, social acceptance, and technological readiness. Advocates should focus on gaining political and public support, conducting a comprehensive economic impact analysis, and addressing technological obstacles while coordinating with the appropriate government agencies.

#### **4.4 Limitations**

This study has some limitations. Firstly, limited number of respondents to the questionnaire. While the questionnaire was sent to respondents belonging to various government agencies that has interest in e-Navigation, some of the respondents did not respond to the questionnaire resulting to only 16 respondents in total. Furthermore, when respondents were asked to choose one or more government agencies from the list and in Question 2 asked the respondents for the roles of their chosen government agencies. Respondents chose more than one government agency but only described the role of the government agency they belong without mentioning the roles of other government agency they chose. The question should be “What government agency you belong to and what would be your agency’s role in e-Navigation?” Despite of these, the data collected which from the respondents were reliable and useful for this study.

### **5. Discussion**

This chapter is dedicated to provide discussion of the findings and initial analysis of the results. The overall aim of this study was to examine the acceptable the e-Navigation government framework for the Philippines. This chapter is divided into four sections: discussion on the analysis of Question 1 to 4, discussion on the analysis

of Question 5 to 8, discussion on the PEST analysis and recommendation

### **5.1 Discussion on the Analysis of Question 1 to 4**

Question 1 identifies Philippine government departments interested in e-Navigation. Lind (2022) states that shore-distributed information includes hydrographic (chart and chart updates), meteorological, MSI, VTS/pilot guidance, and other information. The Philippine Coast Guard was preferred by 81.25% of respondents as their preferred government agency with an interest in e-Navigation, followed by the Philippine Ports Authority (75%), MARINA and NAMRIA (63.50%), BFAR and PAGASA (50%), BMB (25%), and NTC (18.75%). The proportion may imply that these agencies are less involved in or related to e-Navigation. According to Anish et al. (2023) found that NAMRIA provides nautical chart, publication, and hydrographic information, PAGASA provides meteorological reports, PCG provides navigational safety information, and PPA provides VTS/pilot guidance within their port jurisdiction in the Philippines. With the findings of Lind (2022), these mentioned agencies interested in e-Navigation in providing this information. Respondents preferred PCG and PPA because they believed they had the expertise and mandate to implement e-Navigation. However, most respondents came from these two agencies, which may explain why other agencies had different degrees of interest. Limited sample size and representation prevent a convincing understanding of agency preferences and their implications. Faber and Fonseca (2014) found that a lower sample size increases the likelihood of accepting the incorrect assumption. Thus, the researcher can only report the survey results and not assume that the respondents' preferences and comments represent the entire Philippine government. They recommend a larger sample size and more government agencies interested in e-Navigation.

The results from Question 2 indicated different respondents' perspectives on the roles of their chosen government agencies involved in e-Navigation. Some respondents have directly described the roles of their chosen agency in disseminating information services. This information, such as hydrographic information, meteorological information, and navigational safety information, was mentioned by Lind et al. (2022).

This information is provided by agencies such as NAMRIA, PAGASA, and PCG, as further elaborated by Hebbbar et al. (2023) findings that these are described government agencies' roles. The mention of PPA's vessel traffic control and ensuring seamless maritime traffic in Philippine ports could be explained in the contents of the Maritime Safety Portfolios (**Table 1**), where services like Maritime MS1 (VTS Information Service), MS2 (Navigational Assistance Service), and MS3 (Traffic Organization Service) are critical in port areas and approaches, which is one of the six identified areas where MSP is to be delivered as mentioned by MSC.1/Circ. 1595. The fisheries information and marine protected areas information dissemination are the roles that BFAR and BMB were identified by a respondent, which could be explained by the MSP these services could be incorporated in MS 15 (Real-time hydrographic and environmental INS), which provides dissemination of additional hydrographic and environmental information such as the marine environment and its bathymetry and the detailed description of the sea area (Hoeft et al., 2021). This information is vital since the Philippines has been observing closed-season fishing for sardines and mackerel (Rola et al., 2018) and has an estimated 1,800 MPAs (Cabral et al., 2014).

The other respondents also underlined the government agencies' participation in e-Navigation policy and regulation formulation for efficient implementation. They also stressed inter-agency collaboration based on agency mandate and functions related to e-Navigation. The respondents would have similarly referenced it to the Canada e-Navigation government framework, based on the Canada Coast Guard e-Navigation Strategy Plan in October 2008, emphasizing collaboration between government agencies and all stakeholders (Government of Canada, n.d.). While other respondents stressed that the Philippine government agencies should provide policy and regulatory framework to support the development and use of e-Navigation technologies and offer technical assistance to stakeholders who would use e-Navigation technologies. The view of the respondent could be linked to the MSC 81/23/10 that if technology advancement is uncoordinated due to lack of standardization on board and onshore, incompatibility between vessels and the additional complexity to the users of e-

Navigation. With this in mind, the e-Navigation government framework would include regulations for on-board and on-shore hardware and software standards so as to avoid the mentioned challenges.

The results from Question 3 revealed that majority of the respondents showed preference for PCG as the lead agency for e-Navigation implementation over MARINA. Recalling the definition of e-Navigation, it involves the components the on-board side, the shore side and the communication or physical link which will digitally connect the two components.

According to Weintrit (2013), the IMO e-Navigation SIP Solutions S2, S4, and S5 focuses on the efficient transfer of maritime information and data between all appropriate users (ship-ship, ship-shore, shore-ship and shore-shore) while S1 and S3 refers to the use information and data on board. S1 and S3 refers to bridge design and bridge equipment which is under the regulatory framework of the flag Administration in this case MARINA while S2, S4, S5 refers to standard reporting format, the graphical displays of information on communication equipment and improved communication which is under the regulatory framework of the government agency that is performing coastal State obligations. In the communication side, it is the PCG that is mandated by Republic Act 9993 Section F to “To coordinate, develop, establish, maintain and operate aids to navigation, vessel traffic system, maritime communications and search and rescue facilities within the maritime jurisdiction of the Philippines” (The Law Phil Project, n.d.).

On the one hand, these two agencies are contenders to lead the e-Navigation implementation in Philippines due to their specialized expertise with e-Navigation components, ship side is MARINA while the communication and the digital infrastructure side is the PCG. On the other hand, each agency cannot lead over the other because of the different mandate. As suggested by one respondent, the PCG would take lead on the shore side and the communications component while MARINA

would lead on aboard ship side component. This would promote e-Navigation implementation in the Philippines based on their respective technical expertise on the e-Navigation components while maintaining collaboration and coordination to meet seamless implementation of e-Navigation in the Philippines.

The results on Question 4 showed that the majority of the respondent believed that to successfully implement e-Navigation in the Philippines, it has to undergo the three activities. The respondents' attitudes could be explained by the generic policy cycle by Cairney (2020). One good example of this is the case of Norway, where a white paper was submitted with a detailed study on the risks of coastal waters pollution in Norway and gave strategies to mitigate the risks being e-Navigation as one of the strategies (Hagens, 2017). This is where it identified the problem and called for government intervention, and the approval of the white paper by the legislative branch would mean support in the form of authority, financial and manpower resources given to the government agency to implement the public policy such as e-Navigation (Cairney, 2020).

## **5.2 Discussion on the Analysis of Question 5 to 8**

The replies and opinions presented in Questions 5 to 8 demonstrate a wide range of viewpoints and factors to be taken into account in relation to the governmental structure for the implementation of e-Navigation in the Philippines.

Although results suggest that majority of the respondent chose the second proposed government framework, the choices of the respondents are split into two camps: one group supports the integration of e-Navigation within current government agencies, while the other group advocates for the establishment of a new specialized agency. The selection among these alternatives often depended on variables such as the proficiency of the organization, official mandate, and the apparent capacity to proficiently administer e-Navigation.

The respondent who chose the first government framework, which incorporates pre-existing systems, reflects a pragmatic perspective that aims to use the present infrastructure as a foundation for further development. The proposed strategy has the ability to save resources and accelerate implementation. Multiple respondents, express support for enhancing the capacity of current agencies to prevent redundancy and delegate responsibilities.

The respondents contend that bolstering the capabilities of organizations such as the Philippine Coast Guard (PCG) can effectively safeguard the security of maritime traffic. The data indicates that the participants expressed a preference for assigning the e-Navigation governance framework to the PCG, independent of the MSSC or CGWCEISS. The author contends that once the determination has been made to assign e-Navigation to the Philippine Coast Guard (PCG), the decision will be made by either the Maritime Safety Services Command (MSSC) or the Coast Guard Western Command Electronic Information Systems Services (CGWCEISS). The implication of this decision is whether MSSC will serve as both the provider of e-Navigation information services and the operator of the e-Navigation digital infrastructure in the Philippines, or if these responsibilities will be divided between the two PCG units. Specifically, MSSC would function as an e-Navigation information service provider, while CGWCEISS would assume responsibility for the operation and maintenance of the e-Navigation digital infrastructure in the Philippines. The decision on this matter would need to be carefully considered by the PCG (Philippine Coast Guard) once they assume responsibility for the implementation of e-Navigation. Another consequence of the findings is that the survey participants may possess knowledge about the potential risks associated with the establishment of a new agency.

On the one hand, the establishment of a novel agency would mean transferring of authority from an existing agency to the newly formed agency. This would include reallocating resources, such as personnel, and reducing the existing agency budget, since it would be assigned to the newly established agency. According to Laking



(2005), one potential alternative is to establish the agency as a subsidiary of an established department or ministry. In this arrangement, the agency would operate under a performance agreement with its parent department or ministry, and would be granted substantial managerial autonomy, similar to the case of the PCG and MARINA discussed in this study. This is the rationale for the respondents' inclination towards selecting an established agency instead of a newly established one.

Conversely, proponents of the fourth governmental framework argue that establishing a novel government entity, such as the Navigational Safety Administration (NSA), would facilitate specialization, effective allocation of resources, and coordination among agencies with technical expertise. Some of the respondents have shown a particular emphasis on the advantages associated with centralized knowledge and simplified rules. The participants who selected the aforementioned fourth governmental framework did so based on their comprehension of the intricate nature of e-Navigation, which therefore calls for the establishment of a novel governmental entity tasked with overseeing the digitization of maritime information. Laking (2005) asserts that while contemplating the establishment of a specialized agency, it is essential to ascertain the underlying rationale for the proposed change. Furthermore, it is said that the course of action to be pursued should be superior than maintaining the existing state of affairs. Hence, the survey participants hold the view that the current governmental entities in the Philippines are insufficient in addressing the future challenges posed by e-Navigation. Consequently, they advocate for the establishment of a specialized government agency to effectively tackle this issue.

The respondents also expressed their preference for the inclusion of e-Navigation within the jurisdiction of MARINA, citing its regulatory authority over the maritime sector and its role in equipment certification. This implies a prioritization of guaranteeing adherence to regulations and maintaining safety standards within the marine industry. This preference may be linked to the governmental structure of Norway, in which the Norwegian Coastal Administration and the Norwegian Maritime

Authority play a significant role in promoting the advancement of e-Navigation in the country (Kystverket, n.d. 2). It is important to note that e-Navigation encompasses the synchronized gathering, integration, sharing, display, and examination of maritime data both on vessels and on land through electronic methods. This definition is derived from IMO (2018), which highlighted the two fundamental components of e-Navigation.

Weintrit (2013) argued that the five solutions of e-Navigation encompass various aspects. Specifically, Solutions S1 and S3 are identified as contributing to the enhancement of the bridge design, as well as the reliability, resilience, and integrity of the equipment and navigation information utilized onboard. These solutions are deemed crucial in facilitating the effective and feasible utilization of information in a maritime setting. This implies that the flag Administration, namely MARINA, would be responsible for overseeing and verifying that the bridge equipment facilitating e-Navigation adheres to the prescribed requirements aboard boats. This oversight would include ensuring interoperability across vessels and the user-friendliness of the technology (IMO, 2019). According to the e-Navigation government framework of Norway, it is evident that the establishment of e-Navigation inside the government agency is distinct from its implementation on board (by the Norwegian Maritime Authority) and on shore (by the Norwegian Coastal Administration).

Based on the Philippine setting, it would appear that the Maritime Industry Authority (MARINA) have the responsibility of regulating the installation of e-Navigation-related equipment on ships. However, the author would argue that the establishment and operation of e-Navigation in the Philippines should not be given to MARINA but instead to the PCG to prevent burdening the former agency with additional mandates such as the e-Navigation implementation. Nonetheless, MARINA should be made a member of the inter-agency group for e-Navigation having a advisory and consultative function.

Some of respondents emphasized the prioritization of flexibility and integration within the existing framework and the collaborative approach among the agencies under the Department of Transportation (DOTr). However, as shown in **Figure 5**, not all agencies that has interest in e-Navigation is under the DOTr. Therefore, DOTr does not have mandate over them. The effective collaborative approach between the different agencies could only be achieve if these agencies are members of an inter-agency group on e-Navigation in the Philippines.

In the short and middle term, the President of the Philippines could issue a directive to form an inter-agency group among the agencies that has interest in e-Navigation or revive an existing coordinating group such as the Maritime Safety Coordinating Council through Executive Order 314 in 1996 during President Fidel V Ramos' administration (Badajos, 1999). Accordingly, the Council is headed by the Executive Secretary and co-headed by the Secretary, Department of Transportation and Communications and comprised of various government agencies and stakeholders with vested interests in the maritime industry (Executive Order No. 314 of 1996).

The Council would develop the implementation strategies on e-Navigation such government framework, conduct of consultation and surveys, e-Navigation research and development and other e-Navigation-related activities. As a respondent suggested it would be done in phases, once a suitable government framework is selected and indicated in the plan, the Council would convince the Philippine Congress to enact a law to give legitimation (Cairney, 2019) to the government agency to implement e-Navigation in the Philippines while the Council would remain as consultative group on e-Navigation in the Philippines in the long-term.

In summary, the various responses indicate the intricacy of determining the most acceptable e-Navigation government framework for the Philippines. It showed there is no one-shoe-fits-all solution that can be adapted, and the decision would depend on several factors such as technical expertise and mandates of the agency concern, the

allocation and distribution of resources, and the alignment to the country's interests, priorities, and current situation. Therefore, it is noteworthy to take into account that the e-Navigation strategy for the Philippines should be flexible, adaptable to dynamic conditions, and involves long-term planning.

### **5.3 Discussion on PEST Analysis**

This section will discuss on the PEST analysis of the e-Navigation government framework and its implementation implication in the Philippines where the political, environmental, social and technological environment are discussed upon.

#### **Political Environment**

Office terms. Philippines is a democratic presidential government. The President is the head of State and cannot be re-elected. The legislative branch of government is composed of a Senate with 24 members and the House of Representatives with 315 members coming from the legislative districts and party lists. President and Vice-President are elected every six years, while Senators, House of Representatives members, and all elective provincial, city, and municipal officials are elected every three years, except for the twelve Senators. (Nicolas & de Vega, n.d.). This would present a challenge due to the limited office terms of the key government officials. The advocates of e-Navigation in the Philippines should lobby the e-Navigation initiative to the succeeding new government administration to maintain its implementation continuity.

e-Navigation legislation and policy. The incumbent President of the Philippines has ordered a whole-of-government approach to strengthen a new maritime industry program, which implementation of digitalization and adopting an effective and efficient maritime administration governance system are two of the eight priority programs to be implemented to support the said approach (Presidential Communications Office, 28 February 2023). This presents an opportunity for the implementation of e-Navigation in the Philippines as e-Navigation implementation in

the Philippines could be integrated to the said priority program since there is no current legislation or policy on e-Navigation in the Philippines.

Budget and fund allocation. Funds used by the Philippine government entities follows a process before it appropriated or authorized for use. Agencies would submit and justify their proposed budgets before the DBM for review, consolidate the proposed budget from all agencies and submitted to the legislative branch of government. The agencies shall explain in detail their proposed budgets to the separate hearings from the House of Representatives and Senate to include in the General Appropriation Bill. The said bill becomes the General Appropriations Act once the it is signed the President (Department of Budget and Management, n.d.).

Law-making process. The Philippines has a complicated bill-to-law procedure. After being submitted in the House of Representatives, the measure must be revised, discussed, and voted on in the third reading. Disapproved bills are archived. If passed, the measure will head to the Senate for the same procedure. If the Senate approves the measure in the third reading, a Joint Committee of House and Senate members harmonizes and reconciles the bill, sometimes creating a new law. The Joint Committee signs the report and sends the President copies of the measure approved by the Senate President and House Speaker for signing to become law. Cairney (2020) states that the law-making process and budget allocation are part of legitimation, a generic policy-making process that legitimizes new government agencies and budget allocations through executive and legislative approval of government proposals.

In summary, the change of administration would mean that any projects and plans of the previous administration would not be the priority of the new administration, so a project of the current administration needs to be implemented within the six-year term because there is a high probability that projects and plans are discontinued on the next term, the continuity should be part of the e-Navigation strategy implementation plan. The other factor is the budget and fund allocation for the e-Navigation implementation

to push through. In ensuring the budget appropriations will be allocated to e-Navigation implementation in the Philippines, DBM should be part of the inter-agency group so that they are aware of the plan and would offer advice on the implications of the budget requirements for e-Navigation implementation. There could be an opportunity for e-Navigation in the Philippines because of the current President's public policy to strengthen a to strengthen a new maritime industry program by a whole-government approach wherein e-Navigation could be considered as part of the said policy.

#### Economic Environment

Economic stability. The Philippine economy is affected by two events namely: the COVID 19 pandemic and the Ukrainian-Russian conflict. With regards to the COVID 19 pandemic, COVID 19 health restrictions has been lifted in the Philippines where the President Ferdinand R. Marcos Jr. issued Proclamation No. 297 "Lifting the State of Public Health Emergency throughout the Philippines due to COVID-19" in 21 July 2023 (Presidential Communications Office, n.d.). Its implication is that the Philippines will enter in the "Business as Usual" scenario in its economy where the unrestrictive movement of people due to lifting of COVID 19 health restriction that it will stimulate economic recovery to the Philippines. However, the Ukrainian-Russian conflict has an indirect effect to the economy of the Philippines. It has resulted to increased inflation causing the prices of basic commodities to increase significantly. As well as an "indirect shock" to the commodities market, financial market, investments and the effects to the Philippines' fiscal well-being (Tupas, 2023).

Resource Allocation. Another challenge is how to convince the economic managers of the Philippines that the effect on e-Navigation to economic development. The implications of these are that the Philippine government would prioritize on the government projects on how to mitigate the effects of the conflict to the Philippine economy such as providing subsidies on agriculture, food commodities and fuel subsidies. This would consider other projects such as e-Navigation implementation as

a less priority project and would be implemented. To make it a priority project, there should be a study on the possible contribution of e-Navigation to the Philippine economy to convince the economic managers to consider incorporating it to the Philippine national budget.

In summary, the Ukraine-Russian conflict have an effect in the implementation of e-Navigation to the government's priority due to the objective of reducing the effect of the conflict to the economy of the Philippines. Therefore, to persuade the economic managers to prioritize it during the national budget allocation by providing a study on the benefits of e-Navigation to the Philippine economy.

#### Social Environment

**Public Awareness and Support.** e-Navigation is a new concept to the Philippine stakeholders and to the public. Its implementation is for the Philippine citizens to enjoy its benefits to the economy and to the safety of the passengers and cargo of the maritime transport and the e-Navigation implementation, and infrastructure and its funding is source out from the taxes collected from the Filipino people. Therefore, the challenge is to persuade the stakeholders to support e-Navigation in the Philippines.

**Inter-agency Collaboration and Support.** The other factor for the successful implementation of e-Navigation in the Philippines is by getting support from other government agencies that have no interest in e-Navigation, such as the local government units such regional, provincial, city, municipal, and barangays (the smallest administrative political unit in the Philippines). This issue could be resolved from the Korean e-Navigation case where the Ministry of Oceans and Fisheries shall notify the heads of relevant central administrative agencies, city mayors and governors the master plan or implementation its formulation and amendment (Korea Legislation Research Institute, 2019). The reason for this is that IMO e-Navigation Strategy Implementation plan stated that e-Navigation implementation should be based on user needs rather than technology-driven (IMO, 2018). It would mean the stakeholders'

required information is adequate and will not be overburdened with information causing fatigue and additional workload during navigation to the mariners.

#### Technology Environment

**Research and Development.** e-Navigation should be kept in phase with technological changes and e-Navigation equipment and digital infrastructure would be upgraded regularly. The Philippines' willingness to fund e-Navigation research and development is the issue. In the 2022 Global Innovation Index (GII), the Philippines ranked 75th in GERD at 0.34%, far below the global average of 2.04% and the UNESCO-recommended 1%. Sunio et al. (2023) attribute this to the sector's low innovation and use of science and technology solutions and interventions. Thus, the Philippines would be forced to import e-Navigation technology from other nations. The challenge is if the Philippine government and shipowners would replace and improve shore-based and aboard e-Navigation equipment in return for new technology due to recent technological improvements and changing user expectations, MSC.1/Circ.1595 recommends considering the need for new equipment for future e-Navigation systems and applications (IMO, 2018).

**Communication Infrastructure.** Communication link is an integral factor in e-Navigation for the seamless transfer of information from shore to onboard and vice versa. The Philippines should consider all forms of communication link that could facilitate the transfer of e-Navigation-related information in digital form as part of its e-Navigation strategy plan. One consideration is LTE-Maritime, showing potential and practical solution to ship-to-shore communication, which allows the user to access to services that needs high data rates while it could only cover the distance of 100 km from a shore (Jo & Shim, 2018).

The other consideration is the LTE-based satellite communications technology, which according to Guidotti et al., (2018) is possible solution that could extend coverage to areas with limited LTE or 5G coverage. However, they pointed out the challenge



which is the large delays and Doppler shifts on the satellite channel stand as severe technical challenges to LTE or 5G systems. In summary, the Philippine e-Navigation government framework should consider the communication technology links that is applicable for the Philippine setting and further improve the existing communication link infrastructure to support the e-Navigation system in the Philippines.

#### 5.4 Recommendation

The findings and insights from the provided data and respondent perspectives had opened several avenues for future studies that could contribute to a deeper understanding of e-Navigation governance and implementation not only for the Philippines but also to other developing member States with similar setting with the Philippines. The following are recommended additional studies to e-Navigation government framework and implementation:

- How each of the government agencies (or similar agencies in other countries) identified in the survey could collaborate based on their core expertise and service they provide to ensure a coordinated approach to e-Navigation?
- What are the challenges in the establishment of a new government agency for e-Navigation in the Philippines?

## 6. Conclusions

This study examined the preferences, roles and perceptions of respondents from various Philippine government agencies regarding the government framework and implementation of e-Navigation in the Philippines. The data collected from 16 respondents offered valuable insights into the preferred agencies, roles, and government activities for effective e-Navigation implementation. This study also examined respondents' perspectives on proposed government frameworks on e-Navigation.

The results of the study revealed that:

**Preference to Agencies having Relative Interest in e-Navigation.** The results showed that majority of the respondents preferred the Philippine Coast Guard and the Philippine Ports Authority (PPA) as the two agencies that have a relative interest in e-Navigation implementation. While agencies, such as MARINA and NAMRIA, was also preferred by the respondents suggesting their practical involvement in the promotion of navigational safety, one of the critical objectives of e-Navigation as the reason for the respondents

**Identification of Agency Roles on e-Navigation.** The study revealed that the respondents identified the roles of the various agencies that would potentially undertake e-Navigation. They described the roles of their affiliated agencies, their respective mandates, and their technical expertise. This emphasizes collaboration and coordination between these agencies to have a successful implementation of e-Navigation in the Philippines.

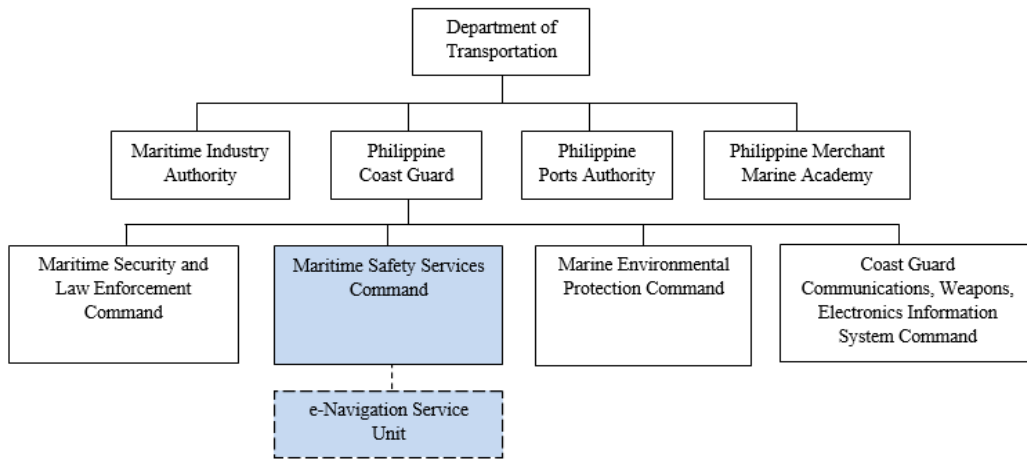
**Identifying the Leading Agency:** The results showed that the majority of the respondents preferred PCG over MARINA, suggesting the probable influence of the Canadian e-navigation government framework where the Canada Coast Guard is the lead agency and the respondents' perception that PCG's proficiency in navigational

safety management makes them highly suitable for the implementation of e-Navigation in the Philippines.

**e-Navigation Strategy Implementation Activities:** Results showed that most respondents preferred that all of the stated activities be undertaken, suggesting a comprehensive and holistic approach is required for the successful implementation of e-Navigation in the Philippines.

**Proposed e-Navigation Government Framework:** Based on the results, the respondent preferred the second proposed e-Navigation government framework (**Figure 19**) where the e-Navigation government framework is placed under the Maritime Safety Services Command, under the Philippine Coast Guard, which could be due to its current mandate in ensuring navigation safety in the Philippines.

**Figure 19** *Second Proposed e-Navigation Government Framework*



In conclusion, the research demonstrates the intricate nature of e-Navigation implementation within the context of the government structure in the Philippines. The preferences expressed by the respondents regarding essential agencies, the designation of a lead agency, and government frameworks highlight the need to adopt a collaborative and coordinated approach. The results of the study demonstrated the

significance of using the knowledge and skills of agencies, aligning with the country's goals, and constructing a versatile framework that is flexible to the unique setting of the Philippines.

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