10-31-2021

An analysis of domestic ferry safety and the pre-departure inspection enforcement in the Philippines

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AN ANALYSIS OF THE DOMESTIC FERRY SAFETY AND THE PRE-DEPARTURE INSPECTION ENFORCEMENT IN THE PHILIPPINES

By

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A dissertation submitted to the World Maritime University in partial fulfilment of the requirements for the reward of the degree of

MASTER OF SCIENCE
in
MARITIME AFFAIRS

(MARITIME SAFETY AND ENVIRONMENTAL ADMINISTRATION)

2021

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):
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(Date):
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Supervised by:
..

Supervisor's affiliation**.......**

ACKNOWLEDGEMENT

All praises to the Great Architect of the Universe, the Most Merciful and the Most Gracious. Thank You for the breath of life and for the touch of Your warm love.

To the Philippine Coast Guard, my beloved organization, thank you for giving me the opportunity to study at the World Maritime University (WMU) most especially to CG Admiral Joel S Garcia Ph.D.,H.D.,Al-Haj for nominating me and to my bunkmate and lockermate, CG CAPT Dennis A Pandeagua, for encouraging me to pursue my WMU journey.

To the beautiful men and women of WMU from the President down to the HSR Staff, thank you for all the motivation, assistance and support. Also, to all our mentors and most especially to our MSEA Professors namely: Professor Baumler, Professor Dalaklis, Professor Hebbar and Professor Sheehan, thank you for inspiring us to give more.

To my dissertation Supervisors led by the very able Professor Jens-Uwe Schröder-Hinrichs and assisted by the very supportive Professor Serdar Yildiz and Cdr Mirza Zeeshan Baig, thank you Sirs for all your encouragement and guidance!!!

To the WMU Class of 2021 most especially to my MSEA family led by our dearest Queen Laura, thank you for the fun memories and the laughter that we shared. UUU

To the Filipino Community in Sweden including Sir Max Mejia, Sir Leo, Tita Linda C, Tita Linda S, Mommy Dolores, Tito Carding and Tita Linda Cruz, Ate Glo, Kuya Nilon, Madam Anne and the rest of the gang. And to all my fellow Filipino Mafia members, friends, colleagues and bunkmates, who helped me in one way or the other. Maraming salamat Po!!!

To our host country for 14 months, Sweden and its awesome people, thank you for the very warm accommodation.

To my gorgeous and lovely better half, Rosemarie and my two beautiful and thoughtful daughters, Rhian Ashley Isabelle and Raya Aizelle (plus Cookie), the source of my

joy and inspiration, my home and my life, thank you for all your sacrifices and unfading love.

Finally, to my loving and caring mother, Mama Letty and to all my family elders namely: Lola Maring, Auntie Mila, Ning, Linda, Baby and Imee- the family's prayer warriors, thank you for your daily devotions.

Dios mabalos Po saindo gabos!!!

ABSTRACT

Title of Dissertation: **An Analysis of the Domestic Ferry Safety and the Pre-Departure Inspection Enforcement in the Philippines**

Degree: **Master of Science**

Philippines domestic ferry safety is very notorious, globally, for its humongous count of fatalities in its record. Relatively, the ferry industry faces a number of serious maritime safety challenges. Also, most often than not, the Philippine Coast Guard is put on the bad light by the press every time there are sea mishaps because it is mandated to conduct PDI on all domestic watercrafts prior sailing. Because of the limited understanding, the public, through the press, blindly believes that pre-departure inspection shortcomings entirely cause the maritime accidents.

In this regard, this research aims to extract and analyze the domestic ferry causal factors vis-a-vis with PDI accident-related causal factors and further identify the PDI's strengths and weaknesses. As such, HFACS and Accimap accident causation models were employed as a tool to achieve the above objective.

The results showed that the Philippines domestic ferry industry has a poor safety culture demonstrated by the numerous violations and errors of safety rules and regulations committed in the various levels of the ferry organization. Relatedly, shortcomings in the safety enforcement ushers the proliferation of said safety violations and lapses.

Also, analysis of the identified accident causal factors from both the domestic ferry industry and PDI highlights that PDI is only effective in ocular inspections of items that are tangible. On the other hand, PDI inspectors have difficulties and are not so effective in technical matters like determining ferry seaworthiness and stability and crew competence because such are beyond the capability of the naked eyes. Furthermore, a substantial number of accident causal factors are not covered by PDI and needs to be addressed by other safety enforcement activities.

Furthermore, the findings show that enforcement gaps stem from the various government agencies' fragmented, loose and unverified safety enforcement activities, which are exacerbated by the lack of a centralized safety enforcement information system policy and infrastructure, as well as safety inspectors' performance oversight, to establish control over the ferry industry and the government's regulators.

KEYWORDS: Domestic Ferry Safety, Pre-Departure Inspection, MCI Reports, HFACS, AcciMap, Accident causal factors, Interrelationships

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LIST OF ABBREVIATIONS

ACCIMAP	Accident Mapping
ACM	Accident Causation Model
ANCORS	Australian National Centre for Ocean Resources and Security
ATON	Aids to Navigation
BIP	Bangladesh, Indonesia & Philippines
BMI	Board of Marine Inquiry
CAR	Cordillera Autonomous Region
FRAM	Functional Resonance. Analysis Method
GISIS	Global Integrated Shipping Information System
HFACS-MA	Human Factor Accident Classification System- Maritime Accident
HFACS-MARINE	Human Factor Accident Classification System-Marine
HFACS-MSS	Human Factor Accident Classification System-Machinery Spaces Systems
HFACS-PDI	Human Factor Accident Classification System-Pre-departure inspection
HFACS-PV	Human Factor Accident Classification System- Passenger Vessels
HMS	Her Majesty Ship
IFC	International Finance Corporation
IMO	International Maritime Organization
ITCP	International Technical Cooperation Programme
KMST	Korea Maritime Safety Tribunal
KNKT	National Transportation Safety Committee
LCT	Landing Cargo Tank
LR	Lloyd's Register
MAII	Maritime Accident and Incident Investigation
MARINA	Maritime Industry Authority
MARPOL	Marine Pollution
MBCA	Motor banca

MCI	Marine Casualty Investigation
MCIS	Marine Casualty Investigation Service
MEPC	Marine Environmental Protection Committee
MIDP	Maritime Industry Development Plan
MIMUN	Marine institute, Memorial University of Newfoundland
MOP	4M Overturned Pyramid
MSC	Maritime Safety Committee
MSSC	Maritime Safety Services Command
MV	Motor vessel
PCG	Philippine Coast Guard
PD	Presidential Decree
PDI	Pre-departure Inspection
PTA	Problem Tree Analysis
RA	Republic Act
SAR	Search and Rescue
SBMI	Special Board of Marine Inquiry
SMS	Safety Management System
SOLAS	Safety of Life at Sea
STAMP	Systems-Theoretic Accident Model and Processes
STCW	Standard for Training and Certification in Watchkeeping
SU	Solent University
UK	United Kingdom
UNESCAP	United Nation Economic and Social Commission for Asia and the Pacific
WFSA	Worldwide Ferry Safety Association
WMU	World Maritime University

Chapter 1

INTRODUCTION

Since the dawn of time up to the present, ferries and waterways, alike, have served as an important and effective mode of transportation around the world. (Passenger Ferries – An Effective Mode of Transportation, 2017). In the absence of infrastructures such as roads and bridges, ferries and bodies of water jointly linked people, communities, societies, and civilizations and facilitated their individual and mercantile free movement. Inevitably, this feat, further, paved the way for people's lives' betterment and national progress. However, this maritime sector is not spared from human frailties and the wrath of nature, thus, resulting in mishaps. Relatedly, this paper intends to examine these ferry accidents.

1.1 Background

According to Oxford Dictionary (2010), by definition, “a ferry is a boat or ship for conveying passengers and goods, especially over a relatively short distance and as a regular service.” Furthermore, ferries can range in size from tiny boats transporting passengers across a harbor, lake, or river to massive ocean-going ships transporting passengers, vehicles, trucks, and other heavy goods over long distances requiring overnight sleeping facilities (Interferry, 2021).

Moreover, ferry operations play a critical role in the movement of people and products between islands, along the coast, and through inland waterways and riverine systems (China, 2019). The global ferry sector is comparable in size to that of commercial airlines, conveying around 2.1 billion passengers per year, as well as 250 million vehicles and 32 million trailers (not including China) (Interferry, 2021).

According to Interferry (2021 as cited in China, 2019), frequent ferry accidents, mostly involving domestic ferries, have resulted in a huge number of fatalities. Over 60,000 people have died in ship accidents in the last 50 years. From 2000 to 2014, the Philippines, Indonesia, and Bangladesh were the top 3 countries with the most number of ferry accidents (Golden, 2015).

Relatedly, the Philippines is a sovereign archipelagic country with over 7,107 islands and a total area of over 300,000 square kilometers. Vietnam borders it on the west, Taiwan on the north, Indonesia on the south, Malaysia on the southwest, and Palau on the east (Mendoza, 2015). In terms of economic and social activity, the Philippines is inextricably linked and reliant on the maritime domain due to its geographical configuration, as shown in Figure 1-1 (Angeles,2015).

Because of the country's archipelagic character and relatively long coastline, coastal provinces, cities, and towns make up a larger proportion of the country's provinces, cities, and towns than landlocked provinces, cities, and towns. Coastal provinces account for 66 (or 81.48 percent) of the 81 provinces. Twelve of the 15 landlocked provinces are located on the island of Luzon, while three are located on the island of Mindanao. The cities along the shore outweigh those on the land by a factor of 88 (or

60.69%). (57). The majority of the municipalities, 812 (or 54.53 percent), are also coastal, while 677 are landlocked. (Philippines – PhilAtlas, 1903).

Furthermore, the Philippines coastline stretches up to 36,289 kilometers. The numbers of its seas, gulfs, bays, straits, lakes, and rivers are 8, 8, 30, 24, 100, and 412, respectively. However, the Philippines, which is located along the Pacific typhoon belt, is hit by an average of 20 typhoons each year, five of which are destructive (Asian Disaster Reduction Center (ADRC), 2019).

Figure 1-1 *Political Map of the Philippines* (klaus kästle - nationsonline.org, 1998)

Relatedly, the Philippines domestic ferry safety is very notorious globally for its high number of sea accidents and fatalities. According to Jumalil (2010), Philippine maritime authorities reported an average of 183 incidents per year, from 1990-2002. Meanwhile, the sinking of MV Doña Paz – I resulted in the loss of more than 4.000 precious lives, recording the worst peacetime maritime disaster in modern history. (Perez et al., 2011)

Over the years, due to its litany of sea tragedies coupled with the public's clamor and the government's awakening, the country's maritime administration embarked on many safety measures to prevent such undesirable occurrences. The Philippine Government reorganized and restructured its maritime agencies including the Philippine Coast Guard (PCG) and the Maritime Industry Authority (MARINA). Subsequently, PCG and MARINA formulated safety policies and enforcement mechanisms to address the problems at hand. Nevertheless, Interferry (2019) noted powerful pieces of evidence that the Philippines' domestic ferry climate is changing for the better. These preventive measures included the Philippine Coast Guard's (PCG) conduct of pre-departure inspection (PDI) on all domestic vessels, most especially to domestic ferries. However, despite the many regulatory safety initiatives such as PDI, maritime accidents, still, continue to happen.

1.2 Aims and Objectives

This research aims to investigate domestic ferry accidents and incidents in the Philippines from 2008 up to 2020 based on official Maritime Accident and Incidents

Investigations (MAII) reported by the Philippine Coast Guard. Furthermore, the above general aim is specifically elaborated through the following objectives:

- To evaluate domestic ferry accidents in the country and consolidate associated human and organizational factors;
- To identify and scrutinize the role of PCG's PDI regulations and enforcement in accident prevention as a preventive measure;
- To recognize interrelationships between PDI and Philippines domestic ferry accidents; and
- To propose solutions to enhance the country's domestic ferry safety regulation and enforcement.

1.2 Research Questions

The following specific questions help address the objectives of this study:

- What are the human and organizational factors leading to domestic ferry accidents in the Philippines?
- What are the role and effectiveness of PDI regulations and enforcement in accident prevention as a preventive safety measure?
- How are PDI and Philippines domestic ferry accidents interrelated?
- What safety recommendations can further enhance the country's domestic ferry safety and maritime safety enforcement activities including PDI?

1.4 Hypothesis

The Philippines' domestic ferry safety can be further enhanced by equipping its safety inspectors with a centralized and computerized information system covering ship risk profile, inspection, certification, deficiencies, detentions, and others. Furthermore, the institutionalization of the safety inspector's performance oversight is also crucial in the said process. The above proposals are geared to establishing tight control over the ferry industry and the regulators themselves.

1.5 Methodology

Twenty (20) maritime accidents and incidents were collated and processed using HFACS and AcciMap accident causation models to identify and analyze the Philippines' ferry industry and the PDI regulatory and enforcement accident causal factors and further provide appropriate recommendations for the country's domestic ferry safety enhancement.

1.6 Expected Outcomes

The compiled findings of this investigation should serve as comprehensive information for the PCG as well as various stakeholders on contributory factors associated with Philippine domestic ferry accidents, as a probable solution to enhance domestic ferry safety in the country, as policy reference for improving the process of maritime safety regulation and enforcement including PDI, and finally, as a straightforward proposal for the implementation of future safety regulations to sustain the country's commitment to preventing maritime accidents and casualties.

1.7 Key Assumptions and Limitations

This research assumes that the problem of the country's domestic ferry safety is partially rooted in the loosely controlled ferry industry and the lack of audit, monitoring, and oversight mechanisms for the safety inspectors. In the conduct of this study, there are some limitations to consider. First, the data set focuses only on domestic ferry accidents with greater emphasis on passenger ships flying the Philippine flag. Secondly, extracted accident reports revealed non-standardization demonstrated through irregular reporting format utilized by the responsible agency. Due to the irregularities, the researcher explored other avenues to clarify accident causal factors, as well as to elaborate accident information of each incident. Thirdly, the availability of accident reports, safety figures, and statistics was very limited. For this reason, out of all accidents occurring between 2008 up to 2020, only a total of 20 accidents were included.

1.8 Structure of the Study

To achieve the above aim, this paper follows the following order:

Chapter I introduces the topic of domestic ferry safety describes the problem being tackled and discusses the main and secondary objectives of this dissertation.

Chapter II presents background information on domestic ferry safety enforcement and regulations in the country, as well as discusses both domestic and foreign literature and studies concerning the topic.

Chapter III reserves the discussion of the methodology prescribed throughout the dissertation, specifically on two accident causation models: HFACS and Accimap.

Chapter IV presents the HFACS-PDI data results and discussion about the Philippines' ferry industry human and organizational and the PDI regulations and enforcement accident causal factors.

Chapter V illustrates the Accimap data results and discussion per accident and incident type.

Chapter VI summarizes the findings, provides conclusions, and forwards appropriate recommendations for various stakeholders.

Chapter 2

LITERATURE REVIEW

This Literature Review summarizes and discusses the interrelation between an ideal safe ferry model and ferry accident causal factors gathered from different studies and sources of the world ferry industry to have a clear overview of its status, challenges, and direction. Furthermore, this review, also, delves into the Philippine domestic ferry industry and regulatory organization, functions, enforcement mechanisms, challenges, improvements, and possible areas for advancements.

2.1 Safe Ferry Model

The International Maritime Organization (IMO) recognized the human element as inseparable from the commission of maritime disasters especially for domestic ferries (IMO, 2019). The current Strategic Plan compiled by IMO for the six years from 2018 to 2023, exclusively, focuses on the people involved in shipping. Regulatory bodies, member states, shipping companies, seafarers, and the riding public all share the big responsibility of promoting safety in all types of waterborne voyages, most especially involving domestic ferries.

In one of the Expert Group Meetings held by the organization last March of 2020, the report highlighted the significant development of a Ferry Safety framework by around 2022. Rahim (2020), the incumbent Secretariat of the IMO, realized that present domestic ferry regulations do not seem to reduce accidents even with the best intention and efforts. Since the International Convention for the Safety of Life at Sea

(SOLAS, 1974), every plan conceived to confront this international issue was mostly repetitive. This problem is not specific to any country because most of the issue arises due to human factors. The human element plays a huge role and many regulations models ever since warranted its discussion.

In light of the above developments, this study, attempting to assess ferry safety issues in the Philippine domestic ferry industry, require the discussion of a ferry safety model as a baseline. In this case, the researcher decided to focus on the conceptualized model by Dalziel & Weisbrod (2012). The authors attributed the safety of ferries to the realization of five (5) key elements, as shown in Table 2-1. Each of the elements can help investigations in singling out causal factors, directly and indirectly, contributing to accidents in the domestic ferry shipping industry. The arrangement of the elements in the definition of a safe ferry also bears a relatively huge impact on the outcome of a voyage. On the other hand, the lack or absence of one of these key elements can possibly lead to accidents.

Table 2-1 *Safe Ferry Model* (Dalziel & Weisbrod, 2012)

Safe Ferry Model
1. Ferry operator safety culture: -ships suitable for intended service -well-maintained ships -properly operated, crewed ships
2. Regulatory regime: -appropriate regulations & standards -enforcement
3. Hazardous weather notification
4. Emergency response -communication - alerting / location -rescue / assistance resources
5. Knowledgeable passengers

Table 1-2 *Safe Ferry Model* (Dalziel & Weisbrod, 2012) *and Causes of Ferry Accidents* (IMO, 2019)

SAFE FERRY MODEL	CAUSES OF FERRY ACCIDENTS
1. Ferry operator safety culture:	Lack of safety culture
	Poor shore-side support
	Pressure to sail
-ships suitable for intended service	Domestic ferries unfit for purpose
	Unsafe design
	Impracticable conversions/ modification of second-hand craft to domestic ferries
	Stability issues, particularly lack of damaged stability data
	Shortage and/or unreachability/poor quality of lifesaving equipment
	Lack of communication (alerting/location)
-well-maintained ships	Lack of crew competence
	Lack of compliance
	Fatigue
-properly operated, crewed ships	Poor bridge management
	Ignorance of navigational warnings
	Inadequate maintenance programmes
	Inadequate guidance on handling of
	Poor look out
	Poor passenger management
	Overloading/ overcrowding
	Improper stowage of cargo
	Improper carriage of dangerous goods
	Complacency
	Alleged/ apparent / actual corruption
2. Regulatory regime: -appropriate regulations & standards -enforcement	Lack of enforcement
	Unclear demarcation of responsibilities
	Lack of all- encompassing/ overlapping/ scattered/absent legislation on domestic ferry safety
	Fatigue
	Complacency
	Alleged/ apparent/ actual corruption
3. Hazardous weather notification	Sailing in bad weather
	Sudden hazardous weather
4. Emergency response -communication (alerting / location) -rescue / assistance resources	Inadequate rescue response
5. Knowledgeable passengers	Undeclared mass on board
	Complacency
	Alleged/ apparent/ actual corruption
	Pressure to sail
Aids to Navigation (ATON)	Inadequate provision and inadequate maintenance of aids to navigation

Table 2-2 reveals the five elements of the safe ferry model by Dalziel & Weisbrod (2012) relative to the International Maritime Organization (IMO) domestic ferry non-exhaustive list of causal factors IMO (2019). Almost all identified causes fitted to the safe ferry model except for the inadequate provision and inadequate maintenance of aids to navigation which can fall to another key category which is Aids to Navigation.

Nonetheless, ferry operator safety culture gets the highest number of causes totaling twenty-nine (29) causes. It is secondly followed by the regulatory regime with eleven (11) causes. The remaining three (3) elements get two (2), one (1), and seven (7) causes, respectively. Based on the identified number of causes, the authors were indirectly suggesting that the operator's implementation of safety regulations enforced and mandated by the corresponding regulatory regime play a significant role in accidents.

Furthermore, Lloyd's Register Foundation's (2018) nine (9) proposed fatality causes are, likewise, fitted to the Dalziel & Weisbrod (2012) Safe Ferry model (See Table 2-3). Eight (8) out of nine (9) causal factors matched the safe ferry model. Meanwhile, the human/social issues are not found in the model but are an additional element to the broad domestic ferry safety causal factors.

Table 2-2 *Safe Ferry Model* (Dalziel & Weisbrod, 2012) *and Accident Causal Factors* (Lloyd's Register Foundation, 2018)

<table>
<tr><th>Safe Ferry Model</th><th>Lloyd's Register Foundation
Accident Causal Factors</th></tr>
<tr><td rowspan="5">1. Ferry operator safety culture:
-ships suitable for intended service
-well-maintained ships
-properly operated, crewed ships</td><td>Unseaworthy / vessel design</td></tr>
<tr><td>Safety equipment</td></tr>
<tr><td>Competence/ training</td></tr>
<tr><td>Poor seamanship</td></tr>
<tr><td>Overcrowding</td></tr>
<tr><td>2. Regulatory regime:
-appropriate regulations & standards
-enforcement</td><td>Regulatory</td></tr>
<tr><td>3. Hazardous weather notification</td><td>Weather</td></tr>
<tr><td>4. Emergency response
-communication - alerting / location
-rescue / assistance
Resources</td><td>Inadequate search and rescue</td></tr>
<tr><td>5. Knowledgeable passengers</td><td></td></tr>
<tr><td></td><td>Human/ social issues</td></tr>
</table>

Comparably, Lloyd's Register Foundation (2018) suggested the same. Non-committing to regulation and safety culture, together with suboptimal vessel design, technology, and safety equipment, connive to create a perfect storm for domestic ferries. Table 2-4 showed how these elements were confirmed by various safety expert entities. The nine (9) attributed causes highlight the influence of the five (5) elements as pursued by Dalziel & Weisbrod (2012) and by many others. Although some experts disagree on the significance of a relationship between regulation and ferry fatalities, Lloyd's Register believed inadequate regulations or failure to enforce existing regulations, when it particularly leads to vessel unseaworthiness, play a huge role in ferry fatalities.

Table 2-4 *Fatality causes as proposed by contributors* (Lloyd's Register Foundation,2018)

	ANCORS	WFSA	MIMUN	CHIRP	Nesta	Interferry	SU	Evercat	LR
Competence/training	x		x	x		x	x	x	x
Poor seamanship	x	x	x						
Unseaworthy/vessel design	x	x		x	x			x	
Safety equipment	x				x	x			
Overcrowding	x	x	x			x		x	
Human/social	x			x	x		x		
Inadequate SAR		x				x			
Regulatory	x		x		x			x	x
Weather		x	x	x		x			

Additionally, the safe ferry model's five (5) elements are non-exhaustive list. Port facilities, aids to navigation, classification societies, insurers, accident investigations and others can also contribute to a very ideal and safe domestic ferries.

2.2 Marine Casualty Investigation

Accidents in the ferry sector, like in other industries, can be minimized but still occur despite extensive mitigating efforts. Nevertheless, these accidents through proper investigations can be a source of very valuable information of determining the accident root causes and other surrounding factors to be used in preventing future accidents. Thus, Lawson and Weisbrod, (2005) included investigation as one of the functions in its Post Event Responsibilities, as shown in Table 2-5.

Furthermore, IMO (2019) states that “every marine casualty or incident of navigation on the high seas involving a ship flying its flag and causing loss of life or serious injury to nationals of another State, serious damage to ships or installations of another State, or serious damage to the marine environment shall be investigated by or before a suitably qualified person or persons. The flag State and the other State will cooperate in the investigation of any such marine casualty or navigational mishap conducted by the other State.”

Moreover, “each Administration is required by International Convention for the Safety of Life at Sea (SOLAS) regulation I/21 and the International Convention for the Prevention of Pollution from Ships (MARPOL) articles 8 and 12 to conduct an investigation into any casualty involving ships under its flag that are subject to those conventions, and to provide the Organization with pertinent information regarding the findings of such investigations. The examination of casualties is also required by Article 23 of the Load Lines Convention. State and the other State will cooperate in any investigation conducted by the other State into any such maritime casualty or navigational mishap” (IMO ,2019). Thus, Marine Casualty Investigation (MCI) Reports value in future accident prevention is, likewise, of utmost importance.

Table 2-5. *Post Even Responsibilities for Ferry Safety in Developing Countries* (Lawson and Weisbrod, 2005)

Function	*Issues/Area of Inquiry*
Investigation	What agency investigates ferry accidents? How are involved parties informed of results? Are accident investigation reports disseminated in a timely and well-publicized fashion so that operators and regulators can learn from them?
Documentation of accidents	Where, who, how and what if there isn't any? Is there an active press to track and continually publicize incidents and the role of government and industry in implementing safe conditions on ferries?
Sanctions	What is the record of sanctions to those who violate the safety rules? Consider that the innate sanction of loss of asset for owners is not a feedback mechanism because the vessel is already depreciated. What would be effective?
Insurance	Do vessels need to have insurance to operate legally? Is insurance available? Are liability coverage provisions enforced?
Victim support	Are victims given compensation, through an insurance system, which would have the effect of discouraging reckless behavior?

2.3 Philippines Domestic Ferry Industry

According to Badajos (1999), there is a demand for a specific activity, as in every market economy (maritime transport, in this case). This demand gives rise to the development of a shipping firm due to its apparent profitability. The company's formation necessitates the purchase of vessels as well as the hiring of seafarers to run the vessels. The government enters the framework to protect the interests of both the public (who required the activity) and the private sector (who is willing to supply for the activity) because there are two sectors engaged. (See Figure 2-1)

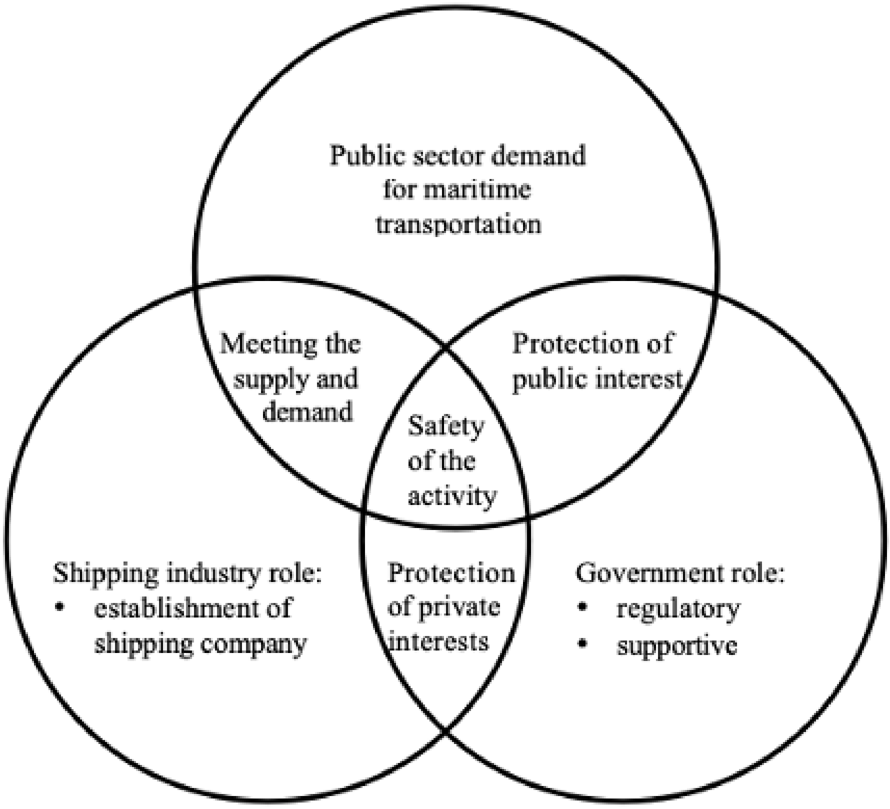

Figure 2-1. *Framework of Maritime Transport* (Badajos,1999)

The shipping industry is regulated by the Philippine government through the then Ministry of Transportation and Communications, which is now a responsibility of the Department of Transportation (DOTr) (See Figure 2-2). When the Philippines became a member of the International Maritime Organization back in 1964, subject to international laws and provisions like the International Labor Organization (ILO) and United Nations Convention on the Law of Sea (UNCLOS), the country formed the Philippine Maritime Administration which consists of all government agencies having primary and supporting responsibilities in implementing mandatory international instruments.

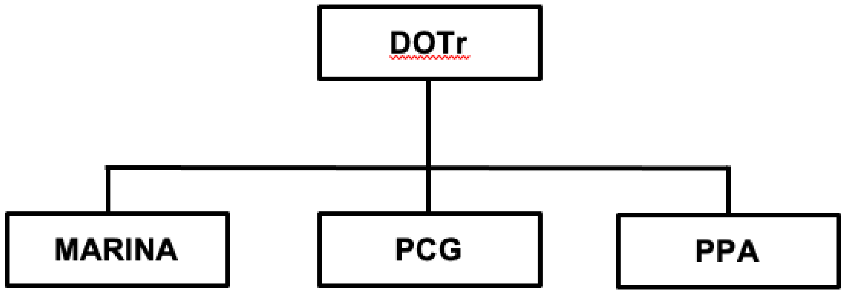

Figure 2-2 *Maritime related organizational structure*

DOTr's "attached agencies are the Maritime Industry Authority (MARINA) which is mandated to integrate the development, promotion, and regulation of the country's maritime industry; the Philippine Coast Guard (PCG) is responsible for the promotion of safety of life and property at sea, safeguard the marine environment and resources and enforce all applicable maritime laws; and the Philippine Ports Authority (PPA) whose responsibility as a developer, operator, maintainer and regulator of all the ports under its jurisdiction" (Dimailig et al., 2011).

As shown in Table 2-6, the Philippines' domestic fleet is composed of 29,974 registered domestic ships/boats in the country. Passenger ships, fishing boats, and other types of boats have 11,898, 12,989, and 5,087 counts, respectively. The domestic ferries are further divided into 773 big ferry vessels and 11,125 small ferry boats (MARINA, 2020).

Table 2-6 *Number of Domestic Ferries* (MARINA ,2020)

TYPE OF SERVICE	NUMBER		
	2018	2019	2020
LARGER VESSELS	3,866	3,727	4,114
Passenger	817	618	773
Cargo	1,672	1,653	1,773
Tanker	220	225	230
Fishing	395	364	428
Others	762	867	910
MOTOR BANCA/BOAT/ FISHING BANCA / BOAT	20,263	24,483	25,860
Passenger	8,122	10,474	11,125
Cargo	1,178	1,515	1,606
Fishing	10,544	11,995	12,561
Others	419	499	568
TOTAL	***24,129**	**28,210**	**29,974**

Moreover, Figure 2-3 shows the different domestic shipping routes of the country. Shipping routes are classified as primary, secondary and tertiary routes.

Figure 2-3. *Domestic Shipping Routes* (Dimailig et al., 2011)

In addition, Table 2-7 is the Summary of Port Statistics of the PPA in 2020. The below record shows the dependence of the country on sea transport in the movement of people and goods.

Table 2-7. *Summary of Port Statistics in 2020* (PPA ,2020)

PARTICULARS	TOTAL	1st Quarter				
		MANILA/ N. LUZON	SOUTHERN LUZON	VISAYAS	NORTHERN MINDANAO	SOUTHERN MINDANAO
1. Shipcalls	**119,814**	**4,696**	**31,510**	**47,469**	**16,552**	**19,587**
Domestic	117,445	3,692	30,981	47,270	16,386	19,116
Foreign	2,369	1,004	529	199	166	471
4. Passenger Traffic	**16,574,835**	**243,760**	**4,912,424**	**6,269,035**	**2,459,637**	**2,689,979**
Disembarked	8,318,194	122,564	2,479,932	3,146,238	1,237,927	1,331,533
Embarked	8,235,027	111,954	2,425,561	3,117,356	1,221,710	1,358,446
Cruise Ships	21,614	9,242	6,931	5,441	0	0
5. RoRo Traffic	**1,821,837**	**62**	**539,012**	**727,522**	**385,484**	**169,757**
Inbound	911,620	1	262,802	367,578	194,927	86,312
Type 1	220,041	0	23,157	76,324	76,725	43,835
Type 2	328,376	1	107,455	124,672	70,178	26,070
Type 3	114,110	0	44,935	41,041	19,896	8,238
Type 4	249,093	0	87,255	125,541	28,128	8,169
Outbound	910,217	61	276,210	359,944	190,557	83,445
Type 1	225,690	0	28,397	77,825	77,056	42,412
Type 2	317,759	1	110,939	114,865	66,892	25,062
Type 3	98,130	37	27,716	42,423	19,353	8,601
Type 4	268,638	23	109,158	124,831	27,256	7,370

2.3.1. Maritime Industry Authority

The Maritime Industry Authority was established in June 1974 to enforce any quasi-judicial function about water transportation. On January 30, 1987, EO No. 125 (amended in the same year by EO 125-A) reorganized the Department of Transportation and Communications which further enhanced the responsibility of MARINA to the country's maritime sector. That same year the Doña Paz accident happened. Pimentel (2019) of Manila Times stated that MARINA could not have averted the disaster simply because the eight-month period before the tragedy may not be enough. She cited the frequent opposition to MARINA's assuming the mandate which further stalled the implementation of the Executive Order. Despite the tragedy testing MARINA's integrity, the agency was able to consistently perform its mandate presiding over the Philippine shipping industry as well as in the area of domestic ferry safety. According to Baird's (2018) review of the country's safety record, it was not until the 2012 increased coordination of MARINA's functions that MARINA's competitiveness was assured. The author cited the strategic plan "Philippines: Transport Sector Assessment, Strategy and Road Map in 2012" as the most influential in terms of gearing the Philippines toward greater safety awareness.

2.3.2. Philippine Coast Guard

As a coastal and port state, the Philippine Coast Guard protects the country, performing both armed and civilian services for its coastlines and ports. The agency was part of the military before its transfer from the Department of National Defense, to the Office of the President, and eventually to the Department of Transportation and Communications on April 15, 1998, through Executive Order 475 and 477, signed by President Fidel Ramos. The conversion has led to the organization being offered various assistance from other countries such as vessels, equipment, technology, services, and cooperation.

The Coast Guard Law of 2009, through Republic Act 9993, further strengthened the agency's role in nation-building. The law helped strengthen its authority over any shipping fleet, gearing itself as the forefront fishnet to ensure maritime safety in territorial waters. Today, PCG projects included the following: establishing radar sites (such as the proposed ZamBaSulTa or Zamboanga, Basilan, Sulu, and Tawi-Tawi triangle), issuing navigational warnings such as the NAVTEX warnings in partnership with PAGASA, improving Search and Rescue (SAR) services, performing Vessel Traffic Services (VTS), monitoring environmental pollution in the waters, and, as the lighthouse authority, sustaining aids to navigation (AtoN) across all coastlines.

The projects entered into by the Philippine Coast Guard demonstrate the many responsibilities it currently subsumes. The agency serves as the policing and enforcing arm in the maritime transport industry. As such, the Philippine government recognized the more comprehensive role of the PCG. Thus, all memorandums were consolidated and integrated under the Republic Act (R.A.) 9993, known as the Coast Guard Law of 2009.

Based on the Coast Guard Law of 2009, the PCG (2012) released Memorandum Circular 07-2012 coinciding with the strategic plan conceived by the Philippine Government. This pre-departure inspection policy references the DOTC (2012) Department Order 2012-01 entitled "Mandating the Strict Implementation of Precautionary, Safety and Security Measures to Ensure Safe, Fast, Efficient and Reliable Transportation Services, the Immediate Implementation of Quick Response Protocols, and the Immediate Investigation of Transformation-Related Incidents". The pre-departure inspection function was based on a prior memorandum circular released by the PCG in 1998 known as MC 04-98 or the Mandatory Pre-Departure Inspection.

The Coast Guard Law of 2009 calls the PCG to conduct "pre-departure inspection of all merchant's vessels calling at domestic ports to promote their continuing compliance with safety standards prescribed by the existing policies, rules, and regulations, marine pollution prevention, standards on manning and competency of seafarers." Any shipmaster and shipowner/company failing to comply with safety requirements will be penalized after due notice and investigation. The memorandum consists of a total of thirteen (13) policies under three (3) general provisions.

Furthermore, based from R.A. 9993's Rule 3 (j) PCG is likewise tasked "to investigate and inquire into the causes of all maritime accidents involving death, casualties and damage to properties" (Congress of the Philippines, 2010) .

2.4. Philippine domestic ferry accidents

Meanwhile, according to the PCG (2018), every few years, the country is hit by a wave of maritime incidents, the most of which can be traced back to three main causes: 1) Ship management (vessel maintenance, crew competency); 2) government regulatory enforcement (MARINA & PCG); and 3) the general public. Furthermore, as an archipelago, the Philippines necessitates a well-functioning water transportation system. However, this is not the case right now.

The domestic shipping business is known for its high pricing, poor service quality, and poor safety record (The World Bank and IFC, 2014). Also, Zen and Anandhika (2016) noted poor congestion management, high stevedoring rates, inefficient handling equipment, regulatory burden through extensive red tapes, fragmented port operations and non-sterile ports contribute to the inefficiency of the archipelagic state. Also, despite being the leading source of seafarers globally, the country may not be able to offer more as estimates of officer shortages may increase after 2020 (MARINA, 2020). When taken together, the Philippine Coast Guard may not be able to properly engage in proactive prevention, much more on reactive measures to mitigate accident fatalities within the expansive coasts and seas of the archipelago.

As shown in Table 2-8 is the list of disasters involving passenger ships in Philippine waters (Dimailig et al., 2011). Four notable accidents were recorded as the most famous. This included the collision of M/V Cebu City and Kota Suria in Manila Bay with 140 fatalities; the collision of M/V Doña Paz and the oil tanker MT Vector with 1,800 fatalities; the sinking of Doña Paz's sister ship M/V Doña Marilyn with 250 fatalities; and the capsizing of M/V Princess of the Stars with 800 fatalities (Dimailig et al., 2011).

Table 2-8 *List of Maritime Accidents in the Philippines from 1987-2010* (Dimailig et al., 2011)

VESSEL / DATE	NATURE OF ACCIDENT
Doña Paz (1987)	Collided/Sunk with M/T Vector. 1,800 died, but 4,341 persons were allegedly killed.
Dona Marilyn (1988).	Ferry sunk, more than 250 dead.
Cebu City (1994).	Collided with a cargo ship, about 140 dead.
Princess of the Orient (1998)	Ferry sank in typhoon. About 150 died. Survivor waited for 12H to be rescued.

Annahanda (2000)	Overloaded/Sunk. About 100 people died.
Superferry-12 (2003)	Collision with MV San Nicholas. 43 dead and 21 missing.
Superferry-14 (2004)	Bombed/Terrorism, 116 dead.
Solar I (2006)	Sunk in bad weather. 190,000 liters of oil spilled.
Princess of the Stars (2008)	Sunk in typhoon. 700-800 passengers and about 30 crews died/missing.
Don Dexter (2008)	Small wooden-hulled ferry sunk in freak winds leaving 42 dead.
Maejan (2008)	Ferry capsized, leaving 30 dead.
Commander-6 (2009)	Wooden-hulled motorized banca had cracked open and sunk, leaving 12 dead.
Superferry-9 (2009)	Tilted sharply and sunk. 9 killed
Catalyn B (2009)	Wooden-hulled motorized banca collided with Fishing boat. 4 died, 23 still missing.
Baleno-9 (2009)	Ferry sunk due flooding. 3 died and at least 22 others were still missing.
Gold Trans 306 (2010)	Barge aground during the typhoon, part of its coal cargo lost overboard.
West Ocean 1 (2010)	Caught fire following an explosion on board.

So far, the country ranked second next to Bangladesh in the list of a total number of known fatal ferry accidents as compiled by Baird (2018) from 1966 to 2015. Baird believed the total number of recorded incidents comprised only about 66% of the actual total. Many accidents before the 2000 reporting may have been unreported, unknown, or un-recorded. As per recorded fatalities, the Philippines ranked first with 10,370 next to Bangladesh's 9,820. Baird (2018) noted this to be the case due to the majority of passenger vessels registered in the country are motor bancas. National media may not actually care for those with few casualties while the PCG has limits overseeing all possible accidents. In fact, major tourist guides warn foreigners and travelers against taking ferries to enjoy the Philippines' majestic sceneries because of the high accident potential of motor bancas and small wooden-hulled ferries.

Still, many experts lauded the Philippines' breakthrough in the decrease in ferry accidents and fatalities after previous catastrophic disasters. Baird (2018) declared that the regulatory regimes of the country can more than adequately conceive strategies and plans which directly impact safe inter-island travels. The more open environment fueled mostly by the free press consequently became part of the solution. This considerable decrease can be attributed to the numerous safety policies formulated and implemented by the government. Several key safety improvements can be attributed to the collective efforts made by the MARINA and PCG as two main governing bodies enforcing these developments.

However, the 2.5 accidents and 35 fatalities per year in the ferry industry remains to be a huge challenge. In this regard, the MARINA and PCG need to continuously step up their efforts to promote domestic ferry safety. Thus, this study is being conducted.

2.5. Philippines domestic ferry safety challenges and improvements

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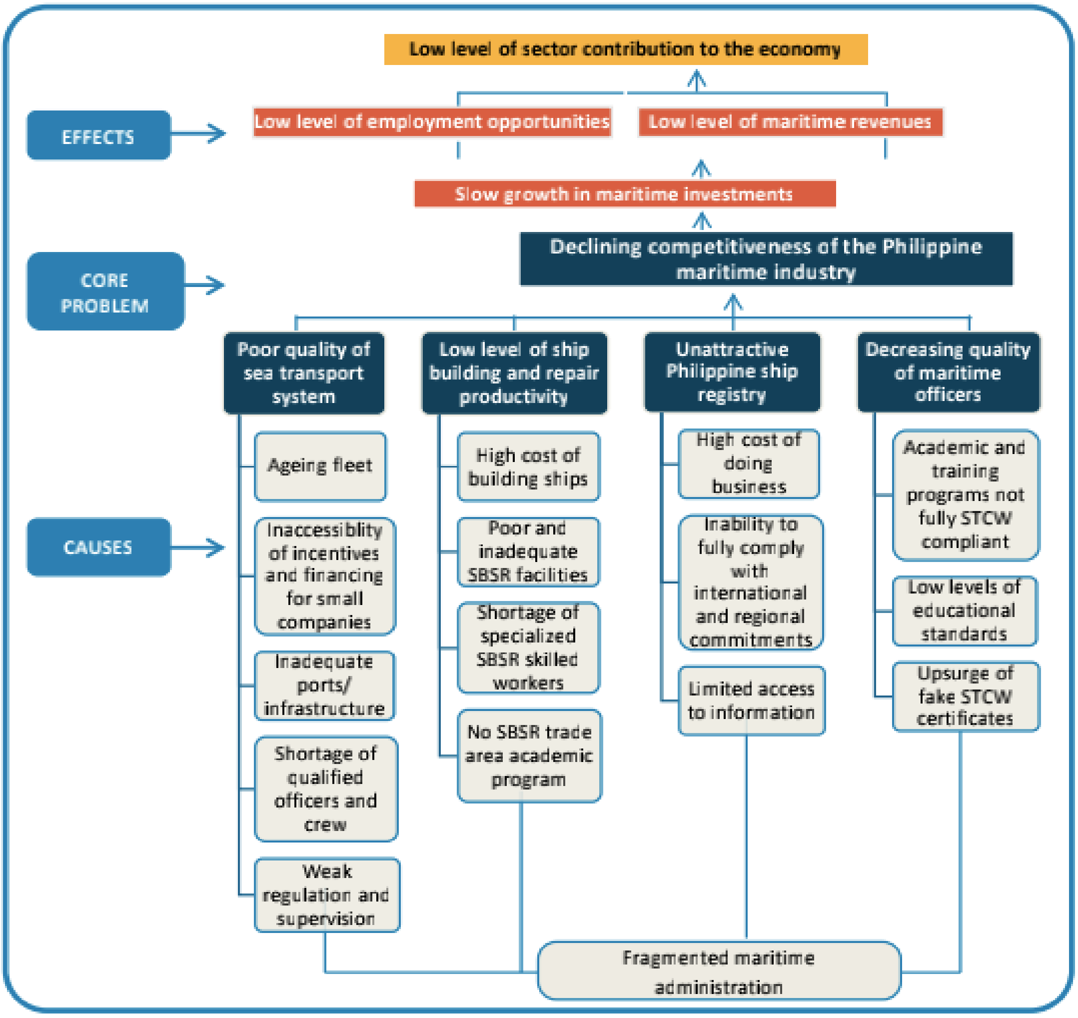

Figure 2-4 *Problem Tree Analysis (PTA) of Maritime Industry* (MARINA,2018)

According to MARINA (2018), the poor quality of the sea transport system is attributed to the following five factors:

- Aging ships mostly imported secondhand from other countries, which pose a high risk to human life at sea due to the conversion of some old cargo ships to passenger ships;

• Inadequacy of ports and port facilities, with the poor condition of some ports attributed to the type of management arrangement;

• Shortage of qualified officers and crew for both domestic shipping and fishing enterprises;

• Inaccessibility of affordable financing and lack of attractive incentive packages, particularly for small- and medium-sized domestic shipping companies; and

• Weak regulation and supervision of shipping, fishing, and other maritime-related enterprises and activities including law enforcement

Apart from the comprehensive review by Baird (2018), a recent study by Dimailig, Kim & Rim (2017) noticed that underreporting of incidents is outright prevalent in the Philippines. The authors attributed the cause to the incapacity of the Philippine Coast Guard to monitor all coastlines of the archipelago. They declared that this inability is due to procedural lapses and lack of equipment. They believed the government must re-study and revise the functions of the different maritime agencies (PCG, MARINA, PPA, etc.) and to revolutionize the safety monitoring system of the country through procurements, installations, and upgrades.

Another study points in the same direction. Kim & Baek (2019) investigating the country's coastal shipping policy cited the necessity of re-assessing law and institutional systems and government support, and improving IT systems, navigation safety systems, and infrastructures.

Hernandez (2019) proposed the creation of an archipelagic state by establishing archipelagic sea lanes (ASL) in the Philippines. In his master's thesis, he suggested that the government must negotiate with the International Maritime Organization Maritime Safety Committee (IMO-MSC) in enacting these lanes which, according to the author, can strengthen the monitoring and surveillance capabilities of the PCG. Strengthening the National Coast Watch System (NCWS) and providing more seaborne patrol assets are also priorities if the country wishes to strengthen maritime security and protection of marine resources.

Highlighting the importance of the regulatory regime is one of the recommendations for preventing accidents in the maritime zone. Based on the safe ferry model by Dalziel & Weisbrod (2012), the enforcement of regulations and legislations highly substantiate already weakened systems in ships, among ferry operators and crew members, which unsurprisingly lead to accidents, loss of lives and properties. It is therefore in the hands of MARINA as the brain and PCG as the body to properly enforce its regulations. One such important mechanism believed by the researcher to promote a culture of safety is to improve PDI. A ship considered unseaworthy, manned by underqualified personnel and crewmen can be prevented to sail therefore preventing human errors and judgment when they ply the dangerous waters of the archipelago. Strengthening the system by any means possible can and will prevent accidents and fatalities in the future.

One officer from the PCG even requested that the system altogether be transferred from the government in the contention that the current regime is incapacitated to fulfill such a hugely impactful responsibility (Tarriela, 2019). Golden & Weisbrod (2016) argued that common accident factors like human error, sailing in hazardous weather, and overcrowding already have solutions. The problem is how to make those solutions (mostly technological and technical in nature) available to ferry operators and passengers.

Apart from all the conventional and non-conventional recommendations, the key takeaway is that the Philippine Coast Guard needed to continue modernization. The only way to achieve this is for the agency to be supported by various stakeholders involved under the amalgamated Philippine Maritime Administration. This could be realized through the additional support of various organizations like the IMO, Interferry, more developed neighbor nations, classification societies, international development banks, and even NGOs seeking to help the poor rise out of poverty. Baird (2018) sees the country on the right path towards rapid improvement because, as a democratic country, the case is already analyzed, discussed, and presented; the only right thing to do now is for the government to act on it. For researchers, the assessment of accidents and the contributory factors may help distinguish pertinent issues that may need patching in the meantime. This study revolves around urgently informing stakeholders and giving them practical recommendations to improve and fix appropriate systems. The goal is to maximize the potential of state resources toward preventing future maritime accidents and fatalities in allegedly 'dangerous' Philippine waters.

2.6. Insights

Domestic ferry safety, as a topic, is very broad in scope. From the five (5) elements of a safe ferry model, other elements such as port facilities, aids to navigation, classification societies, overcrowding, overloading, and human/ social issues, investigation, documentation of accidents, sanctions, insurances, and victim support, also play a significant role to the overall ferry safety. Nevertheless, out of the five (5) key elements of the safe ferry model, the ferry operator safety culture is the most crucial having the highest number of accident causes. Moreover, human error, which is directly under the ferry operator safety culture element, remains to be the highest contributor to accidents. Consequently, the safety regulations and their stringent enforcement are devised to serve as an additional line of defense to preclude such tragic accidents. Similarly, these enforcement activities, aside from preventing accidents, also educate the riding public and the ferry industry about safety thereby increasing their individual levels of safety awareness which is the best way to achieve the goal of minimizing accidents and fatalities.

Chapter 3

METHODOLOGY

This part discusses the HFACS and Accimap accident causation models. It describes the origins of the framework and relays important points to demonstrate the usefulness of the different elements for this study. Likewise, HFACS-MSS adaptation and modification into HFACS-PDI is also explained and elaborated. Their subsequent usage among scholars and researchers in the field of maritime accident investigation is also enumerated.

3.1 The HFACS Model

The Human Factors Analysis and Classification System (HFACS) was created in the United States Navy to improve human performance in complex systems. HFACS can be described as a reductionist, linear accident causation model as a complex model. "Accident causation models (ACM) enable to identify the contributing variables of the accident, analyze their cause links, and, subsequently, design solutions for accident prevention and mitigation," according to Dhalmahapatra, K., Das, S., & Maiti, J. (2020). Accidents are induced by mutually interacting factors in real-time contexts, according to complex non-linear models (Hollnagel, 2010). Understanding these various interacting elements, according to the HFACS model, can help prevent accidents.

HFACS was based on the Swiss cheese model developed by James T. Reason. Human systems were described as slices of cheese of the Swiss variety which has holes in it. According to its proponent, each slice or layer signifies a layer of defense against the risk of threat where each successive layer prevents any accident to materialize. In order to prevent a single point of failure, the holes or identified weaknesses must not align with other weak spots in the defenses. When it aligns in a straight, cumulative act, a catastrophic failure ultimately occurs. From the model displayed in Figure 3-1, there are four layers of protection before an accident can occur. It also displayed the top-down connection of human, organizational and technological elements.

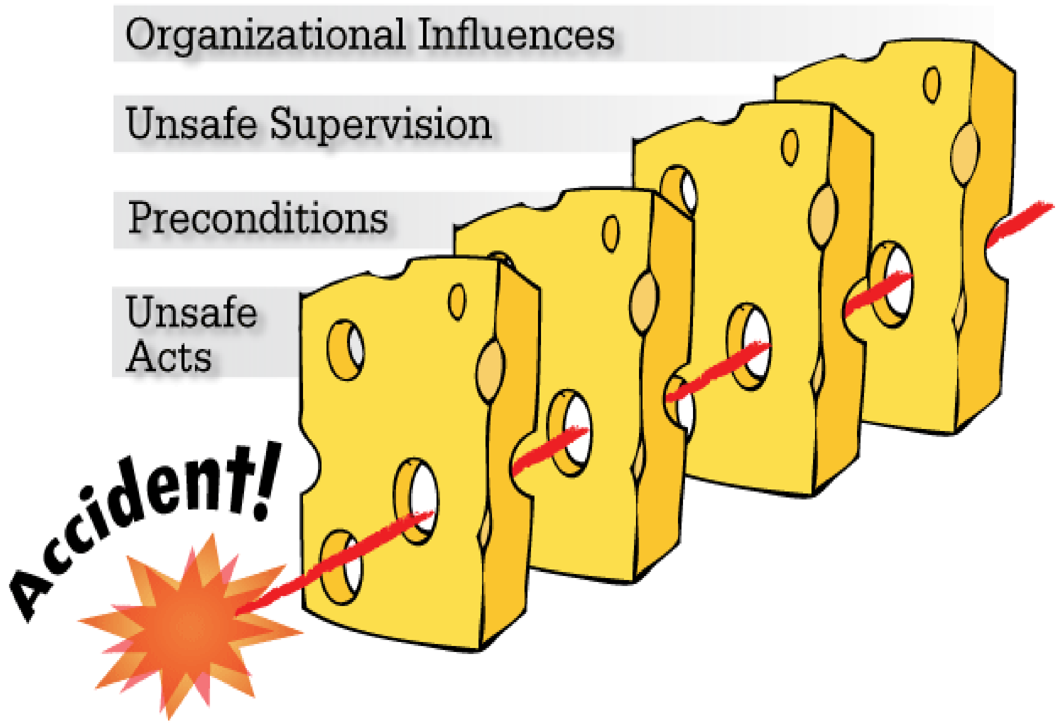

Figure 3-1 *Reason's Swiss Cheese Model* (HFACS, Inc | The HFACS Framework, 2014)

The model further expounds on active and latent failures where the active failure is attributed to immediate causes of an accident while the latent failure is attributed to organizational influences, unsafe supervision, and preconditions.

Drs. Wiegmann and Shappell used the Swiss Cheese Model to develop the Human Factors Analysis and Classification System (HFACS)(See Figure 2). The authors used the same four systems and outlined several indicators under each system. The framework allows accident investigators to directly pinpoint active failures and generate organizational and technological factors out of the different levels of inquiry. It can be used to analyze past failures and identify trends on the root causes of unsafe behaviors while revealing latent conditions inside the organization allowing these to happen. When causes are better determined, the organization can now engage in preventive measures to mitigate these hazards, which then can help improve human performance and lower accidents and fatalities for the industry.

The use of HFACS in the navy was profoundly beneficial for the organization. Many other industries utilized the simplistic approach of HFACS in their accident investigations. Its modification allowed for a more targeted approach to different organizational constructs and many studies decided to do just that.

Additionally, some notable researches regarding maritime accidents which utilized the HFACS model includes Human Factor Analysis Classification System - Passenger Vessel (HFACS-PV) (Uğurlu et al., 2018); Human Factor Analysis Classification

System - Machinery Spaces on Ships (HFACS-MSS) (Schröder-Hinrichs et al., 2011); Marine Human Factor Analysis Classification System Framework (Kang, 2017); and Human Factors Analysis and Classification System - Maritime Accidents (HFACS-MA) Model (Wang et al., 2020).

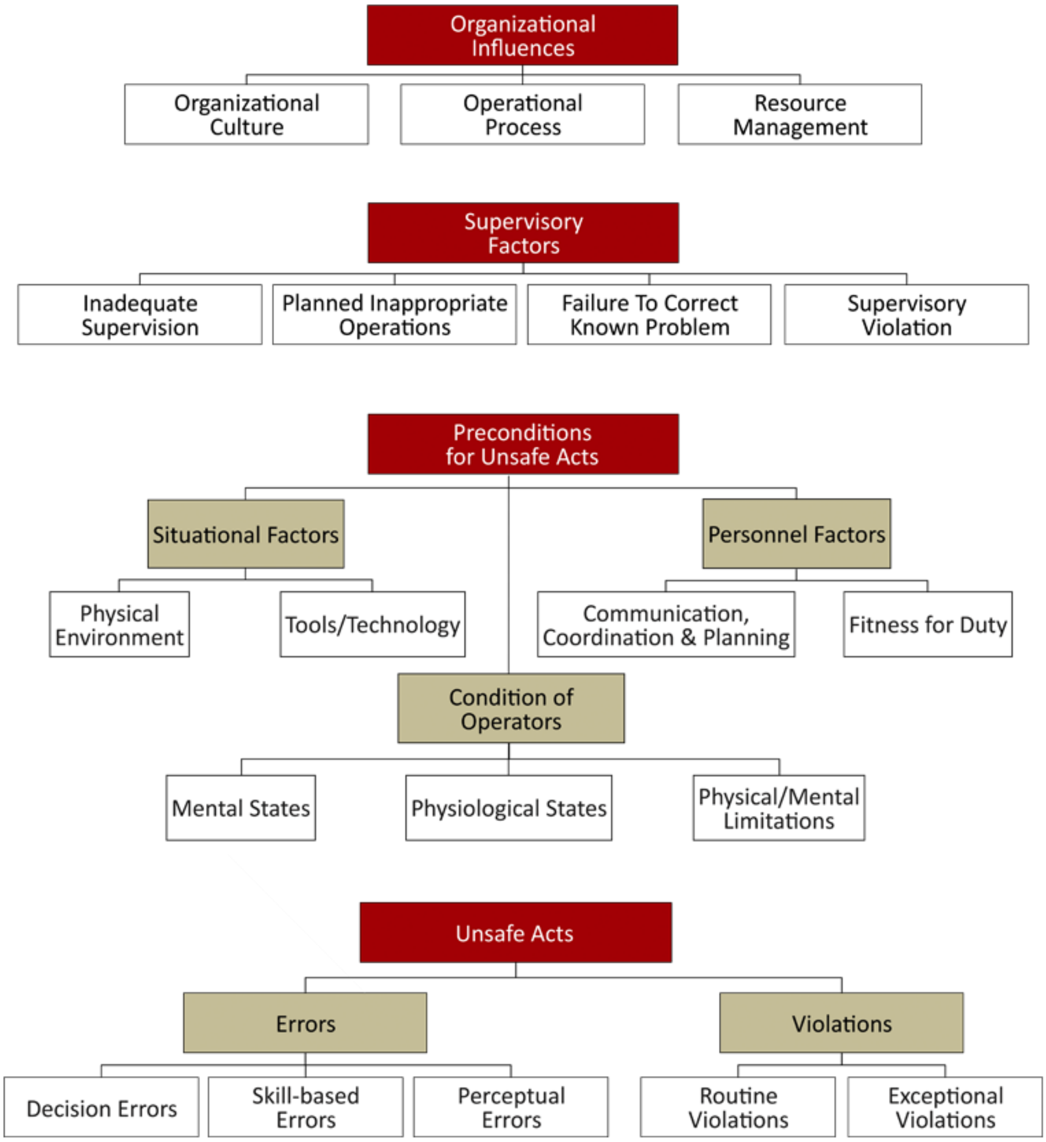

Figure 3-2 *Wiegmann and Shappell's Adoption of the Swiss Cheese Model for the Human Factors Analysis and Classification System* (HFACS) (HFACS, Inc | The HFACS Framework, 2014).

3.2 The HFACS-Machinery Spaces on Ships (HFACS-MSS)

For this paper, several accident causation models have been considered but the author decided to pattern this research from HFACS-MSS model. The improved HFACS-MSS is illustrated in Table 3-1 as adapted by Schroder-Hinrichs et al (2011). With this model, as highlighted below, outside factors were added to the HFACS as a fifth level above organizational influences, with the goal of focusing on the impact of shipping safety laws and their enforcement. (Schröder-Hinrichs et al., 2011 as cited in Onsongo, 2017).

Table 3-1 *HFACS-MSS Framework* (Schröder-Hinrichs et al., 2011).

Latent conditions ↕ *Active failures* | *Remote from the ship* ↕ *Within machinery space*

1st Tier	*2nd Tier*	*3rd Tier*
Outside factors	Statutory	• International standards • Flag State implementation
Organizational Influences	Resources	• Human resources • Technological resources • Equipment/facility resources
	Organizational climate	• Structure • Policies • Culture
	Organizational process	• Operations • Procedures • Oversight
Unsafe supervision/ workplace factors	Inadequate supervision	• Shipborne and shore supervision
	Planned inappropriate operations	• Shipborne operations
	Failed to correct known problems	• Shipborne related shortcomings
	Supervisory violations	• Shipborne violations
Preconditions for unsafe acts	Environmental factors	• Physical environment • Technological environment
	Crew condition	• Cognitive factors • Physiological state
	Personnel factors	• Crew interaction • Personal readiness
Unsafe acts	Errors	• Skill-based errors • Decision and judgement errors • Perceptual errors
	Violation	• Routine • Exceptional

Macro-perspective ⟷ *Micro-perspective*

3.3 The HFACS-Pre-Departure Inspection (HFACS-PDI)

From the HFACS-MSS ((Schröder-Hinrichs et al., 2011), the author made some minor changes to it and modified it into HFACS- Pre-departure inspection (HFACS-PDI) to specifically focus on PDI important elements which include the PDI and other related regulations and PDI enforcement related issues, as shown in Table 3-2.

Table 3-2 *HFACS-PDI 2^{nd} and 3^{RD} Tier Factors*

<table>
<tr><td rowspan="4">Outside Factors</td><td rowspan="4">Statutory</td><td>PDI and other related regulations</td><td>Rules and Regulations</td></tr>
<tr><td rowspan="3">PDI enforcement related issues</td><td>Absence of PDI</td></tr>
<tr><td>PDI Error</td></tr>
<tr><td>PDI Violation</td></tr>
</table>

The PDI and other related regulations simply pertain to the rules and regulations surrounding PDI. Meanwhile, PDI enforcement-related issues are divided into three sub-categories namely: absence of PDI, PDI Error, and PDI violation. Furthermore, Table 3-3 below describes each PDI factor.

Table 3-3 *HFACS-PDI Factors Description*

PDI Factors	Description
Rules and regulations	Factors in the PDI enforcement when related regulations are absent or not updated leading to unsafe situation.
Absence of PDI	Factors in the PDI enforcement when the safety inspector fails to perform PDI leading to unsafe situation.
PDI error	Factors in the PDI enforcement when the safety inspectors failed to achieve their goal as a result of perceptual, skill-based, or judgement and decision making errors which can lead to unsafe situation.
PDI violation	Factors in the PDI enforcement when the actions of the safety inspector represent willful disregard for regulations which can lead to unsafe situation.

Finally, the author adopts and utilizes the HFACS-PDI in this paper to achieve its objectives, as shown in Table 3-4.

Table 3-4 *HFACS-PDI*

1st Tier	2nd Tier	3rd Tier
Outside Factors (Statutory)	PDI and other related regulations	• Rules and regulations
	PDI enforcement related issues	• Absence of PDI
		• PDI Error
		• PDI violation
Organizational Influences	Resource Management	• Human resources
		• Technological resources
		• Equipment/Facility
	Organizational Climate	• Structure
		• Policies
		• Culture
	Organizational Process	• Structure
		• Policies
		• Culture
Unsafe supervision	Inadequate supervision	• Shipborne and shore supervision
	Planned inappropriate operations	• Shipborne operations
	Failed to correct known problems	• Shipborne related shortcomings
	Supervisory violations	• Shipborne violations
Preconditions for unsafe acts	Environmental factors	• Physical environment
		• Technological
	Crew condition	• Cognitive factors
		• Physiological state
	Personnel Factors	• Crew Interaction
		• Personal Readiness
Unsafe Acts	Errors	• Skill-based errors
		• Decisions and judgement errors
		• Perceptual errors
	Violations	• Routine violations
		• Exceptional

3.4 The AcciMap Model

In addition, Accimap is a graphical representation model that incorporates linked socio-technical variables into an integrated framework, according to Lee et al. (2017). Accimaps typically examine failures at six levels of analysis: government policy and budgeting; regulatory bodies and associations; local government planning and budgeting (including company management, technical, and operational management); physical processes and actor activities; and equipment and surroundings (Waterson et al., 2016).

AcciMap depicts the context in which an accident occurred as well as the relationships between multiple layers of the investigated system that led to that occurrence. In general, the patterns of dangers within an industrial sector can be defined by analysing prior accidents within the provided framework. This type of study can lead to the creation of safe-operations preconditions, which is a major goal of proactive risk management systems.

Salmon et al. (2012) argued that the systems-based accident analysis method Accimap was based off Rasmussen’s risk management framework. The framework shows how actors at various system levels contribute to production and safety management. All hazards are being controlled at each level and transferred down to the bottom levels. Rasmussen, through his 1997 work on risk management, proposed that same year the Accimap method which will be influential in the coming decades in representing system wide failures which lead to accidents, loss of property and fatalities. Figure 3-3 shows Accimap and the different system levels as conceptualized by Rasmussen.

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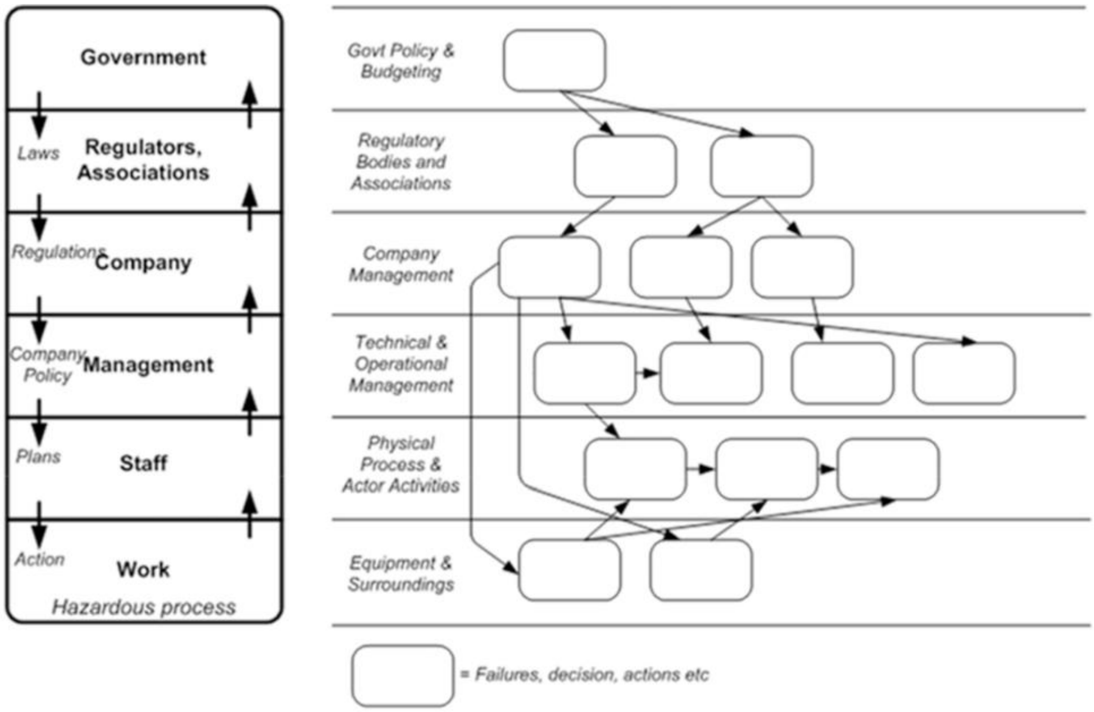

Figure 3-3 *Rasmussen's Accimap Method* (Salmon et al., 2012)

Also, important studies regarding maritime accidents which used Accimap Model includes the Sewol ferry tragedy in South Korea (Lee et al., 2017) and the capsizing of China's Eastern Star in 2015, and Korea's Sewol ferry in 2014 (Jiang, 2016)

Chapter 4

HFACS RESULTS AND DISCUSSION

In this chapter, the HFACS results (accident causal factors) using the twenty (20) PCG accident and incident investigation reports from 2008-2020 will be presented. Subsequently, all accident causal factors as per HFACS level will be individually laid down and fitted with the Safe ferry model elements, as applicable, to logically and thoroughly discuss them. Furthermore, the identified Philippines' domestic ferry industry inside accident causal factors and the PDI outside factors interrelationships will, also, be tackled.

4.1 Ferry Accidents and Incidents in the Philippines

This research utilized and analyzed twenty (20) official domestic ferry accidents and incidents in the Philippines (See Table 4-1). A more detailed information and accident summary can be found in **Appendix A**. The said investigation reports were all conducted by the PCG, while, three (3) accidents were jointly performed by the PCG with the MARINA. Also, out of the 20 maritime accident and incident investigation reports, six (6) were performed by the BMI and SBMI, while, the thirteen (14) were conducted by the MCIS and other Coast Guard Districts and Stations MCI Teams. The twenty (20) accidents and incidents were broken down into capsizing/ submerging, ramming/collision/allision, sinking, fire, and alleged overcrowding. Additionally, one (1) incident was initially involved in a collision which later on resulted in its sinking. The said investigation reports were requested from the Office of the MCI

Service and the Office of the Deputy Chief of Staff for Maritime Safety Services of the PCG.

Table 4-1 *Summary of uncoded Ferry Accidents and Incidents in the Philippines*

Selected Ferry Accidents and Incidents in the Philippines						
No	**Date**	**Vessel Name**	**Area**	**Nature of Incident**	**Severity**	**Remarks**
1	Jun-08	MV Princess Of The Star	Sibuyan, Romblon	Capsizing	Very Serious	Death-814
2	Nov-08	MBCA Don Dexter	Dimasalang Masbate	Capsizing	Very Serious	Death-42 Missing-10
3	Dec-09	MV Baleno 9	Verde Island Batangas	Sinking	Very Serious	Death-6 Missing-44
4	Jan-10	MV Cotabato Princess	Iloilo Arrastre Pier	Ramming/ Collision	Less Serious	Death-0
5	Aug-13	MV Thomas Aquinas	Cebu Channel	Collision/ Sinking	Very Serious	Death-55 Missing-65
6	Sep-14	MV Maharlika Ii	Southern Leyte	Sinking	Very Serious	Death-2
7	Jul-15	MBCA Kim Nirvana B	Ormoc Port	Capsizing	Very Serious	Death-62
8	Dec-16	MV Starlite Atlantic 2	Maricaban Island Batangas	Sinking	Very Serious	Death-1 Missing-18
9	Jan-17	LCT Poseidon 26	Allen Samar	Allision/ Collision	Serious	Death-0 Hull Damage
10	Jun-17	MBCA Alad Express 2	Romblon	Capsizing	Very Serious	Death-5
11	Sep-17	MV Ma Matilde	Tablas Rombon	Ramming/ Collision	Serious	Injured-51
12	Sep-17	MV Ocean Jet 12	Batangas Port	Ramming / Collision	Serious	Injured -6 W/ Vessel Damage
13	Dec-17	Mv Mercraft3	Infanta Quezon	Sinking	Very Serious	Death-4
14	Apr-18	MV Virgin De Penafrancia Vii	Port Of Banton, Romblon	Over-Crowding	Less Serious	Death-0
15	Aug-19	MV Lite Ferry 16	Dapitan City	Fire	Very Serious	Death-4 Missing-39
16	Aug-19	MBCA Chichi	Guimaras Strait	Capsizing	Very Serious	Death-31
17	Aug-19	MBCA Keziah	Guimaras Strait	Capsizing	Very Serious	

18	Aug-19	MBCA Jenny Vince	Guimaras Strait	Capsizing	Very Serious	
19	Dec-19	MV Island Roro	Camotes Port	Capsizing	Serious	Death-0
20	Nov-20	MBCA Gesu De Bambino	Atimonan Quezon	Submerging/ Capsizing	Very Serious	Death-1

The above table also indicated the nature of accidents and incidents included sinking, capsizing, ramming, collision, submerging, fire and alleged overcrowding. Furthermore, said accidents resulted to 1,026 deaths and 176 missing persons.

In addition, as per IMO (2008), MSC-MEPC.3/Circ.3 gave the guidance on the categorization of maritime accidents. The three (3) accident categorization are as follows:

- Very serious casualties are casualties to ships which involve total loss of the ship, loss of life, or severe pollution.
- Serious casualties are casualties to ships which do not qualify as very serious casualties and which involve a fire, explosion, collision, grounding, contact, heavy weather damage, ice damage, hull cracking, or suspected hull defect, etc., resulting in:
    1. immobilization of main engines, extensive accommodation damage, severe structural damage, such as penetration of the hull under water, etc., rendering the ship unfit to proceed,
    2. pollution (regardless of quantity); and/or
    3. a breakdown necessitating towage or shore assistance.

- Less serious casualties are casualties to ships which do not qualify as very serious casualties or serious casualties and for the purpose of recording useful information also include marine incidents which themselves includes hazardous incidents and near misses.

The accident severity category showed fourteen (14), four (4) and two (2) incidents were very serious, serious and less serious, respectively.(See Table 4-2) Likewise, half of the ferries age at the time of accidents were twenty (20) years old and below. Meanwhile, the other half were above twenty (20) years old. The oldest ferry was forty-seven (47) years old. Moreover, out of the twenty (20) ferries, five (5) sunk, eight (8) capsized, (1) submerged, four (4) rammed, one (1) caught fire and one (1) was alleged to be overcrowded.

Table 4-2 *Accident Category, Ship's Age and Nature of Incident*

ACCIDENT CATEGORY	NO.	SHIP'S AGE	NO.	NATURE OF INCIDENT	NO.
Very serious	14	1-10	6	Capsizing/Submerging	8/1
Serious	4	11-20	4	Ramming	4
Less serious	2	21-30	3	Sinking	5
		31-40	3	Fire	1
		41-50	4	Alleged Overcrowding	1
TOTAL	20		20		20

4.2 HFACS Results

After collecting and consolidating the twenty (20) maritime accidents and incidents investigation reports, they were processed one by one using HFACS Accident Causation Model. In the HFACS coding process, all causal factors per accident or incident were classified into the 5 different levels of the HFACS Model namely: unsafe acts, precondition to unsafe acts, unsafe supervision, organizational influences and outside factors.

Levels 1 to 4 of HFACS Model was adopted in this study except of the outside factors where the author made some changes and gave emphasis on the Pre-departure Inspection regulations and enforcement which is mandatory prior sailing and also, part of all maritime accident and incident investigation reports.

The HFACS coding process of the twenty (20) maritime accident and incident investigation reports resulted into the identification of two hundred twelve (212) 3rd tier causal factors (See Table 4-3). The detailed HFACS Coding results of the 3rd tier accident causal factors can be found in **Appendix B**.

Table 4-3 *Overview about 212 identified 3rd Tier HFACS Causal Factors in the investigation reports reviewed*

Reported HFACS Factors Philippines’ Ferry Industry Human and Organizational and PDI Regulation and Enforcement Factors			Figures	
			No	%
Outside Factors (PDI)			22	10
PDIR XXX	PDI and Other Related Regulations			
	PDIR 000	Rules and Regulations	1	0.5
PDIE XXX	PDI Enforcement Related Issues			
	PDIE 000	Absence of PDI	1	0.5
	PDIE100	PDI Error	2	1
	PDIE 200	PDI Violation	18	8
Organizational Influences			47	22
OR XXX	Resource Management			
	OR 000	Human resources	2	1
	OR 100	Technological resources	0	0
	OR 200	Equipment/Facility resources	5	2

OC XXX	Organizational Climate			
	OC 000	Structure	0	0
	OC 100	Policies	0	0
	OC 200	Culture	0	0
OP XXX	Organizational Process			
	OP 000	Operations	0	0
	OP 100	Procedures	9	4
	OP 200	Oversight	31	15
Unsafe supervision			46	22
SI XXX	Inadequate supervision			
	SI 000	Shipborne and shore supervision	14	7
SP XXX	Planned inappropriate operations			
	SP 000	Shipborne operations	0	0
SF XXX	Failed to correct known problems			
	SF 000	Shipborne related shortcomings	0	0
SV XXX	Supervisory violations			
	SV 000	Shipborne violations	32	15
Preconditions for unsafe acts			60	28
	Environmental factors			
		Physical environment	18	8
		Technological environment	38	18
	Crew condition			
		Cognitive factors	0	0
		Physiological state	0	0
	Personnel Factors			
		Crew Interaction	2	1
		Personal Readiness	2	1
Unsafe Acts			37	18
AE XXX	Errors			
	AE 000	Skill-based errors	12	6
	AE 100	Decisions and judgement errors	7	3
	AE 200	Perceptual errors	0	0
AV XXX	Violations			
	AV 000	Routine violations	17	8
	AV 100	Exceptional	1	0.5
Total			**212**	**100%**

As shown in Figure 4-1, the result percentages for the 1st tier causal factors were fairly distributed except for the preconditions for unsafe acts that got the highest percentage (28%, N=60) and the outside factors which had the least (10%, N=22). Meanwhile, the organizational influences (22%,N=47), unsafe supervision (22%,N=46) and unsafe acts (18%,N=37) got close scores.

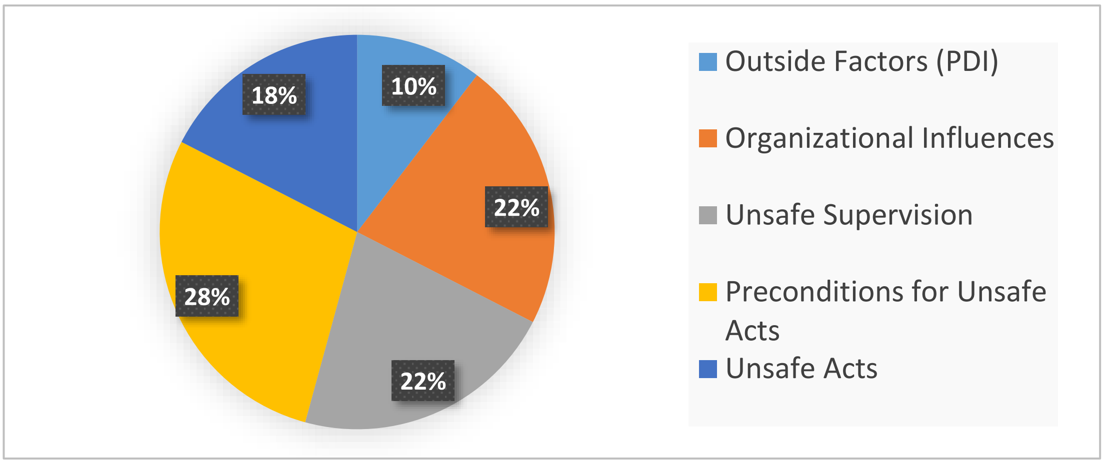

Figure 4-1 *1st Tier Contributory Factors*

Furthermore, Figure 4-2 below, shows that PDI causal factors count is only a ninth compared with the domestic ferry accident contributory factors (inside factors).

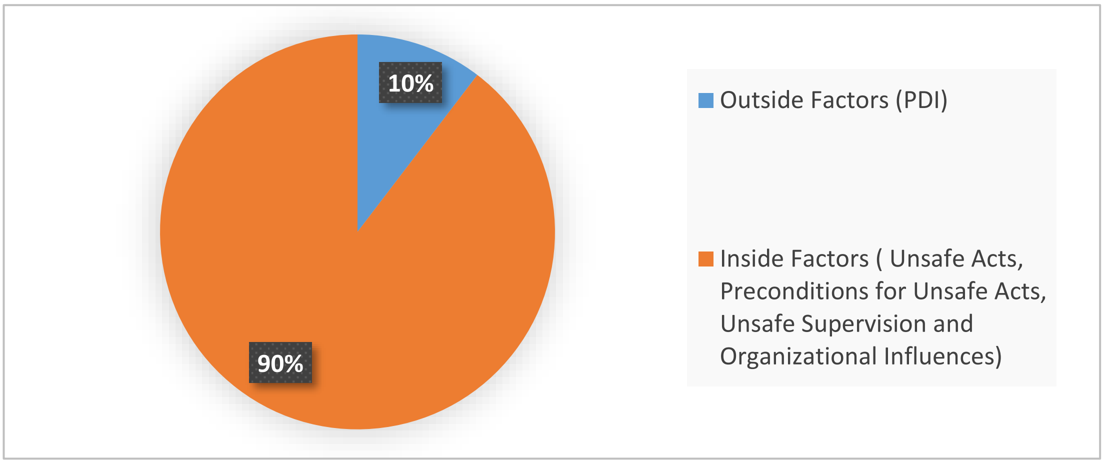

Figure 4-2 *1st Tier Inside and Outside Factors*

4.2.1 Unsafe acts

For the Unsafe acts, almost half of the accident causal factors were attributed to Routine violations.

For the 3rd tier of the first level of the HFACS coding process, the unsafe act level got 36 out of 212 accident causal factors. The unsafe act ranked second to the lowest, just above the outside factors (PDI). A large portion of the accident causal factors was attributed to routine violations (47%, N=17), skill-based error (31%, N=11), and decision and judgment error (19%, N=7). Meanwhile, the least percentage went to exceptional violation getting 3% (N=1) only (See Figure 4-3).

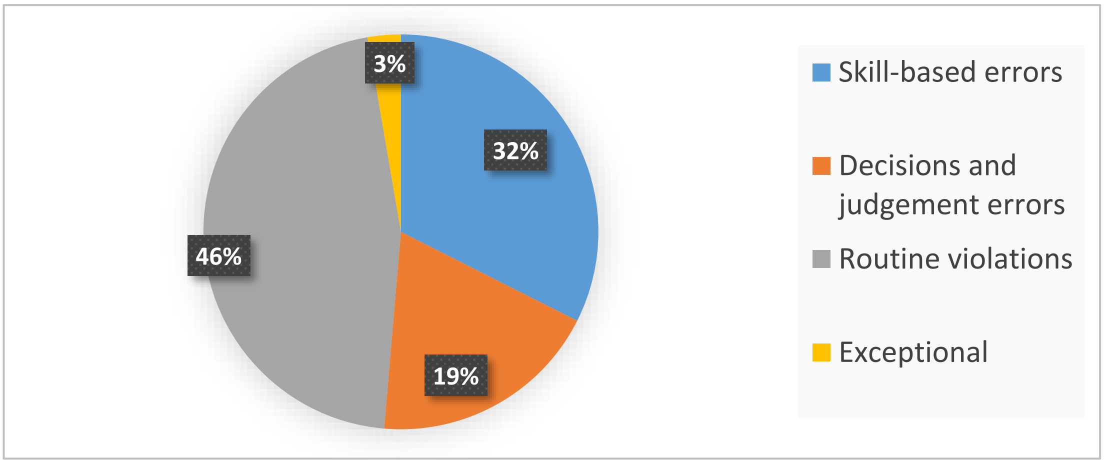

Figure 4-3 *Unsafe Acts*

Also, as shown in Table 4-4, the Routine Violations' 4th tier category was further narrowed down to violated standing orders and regulations (100%, N=17).

Table 4-4 *4th Tier in 3rd Tier Routine Violations*

1st Tier	2nd Tier	3rd Tier	4th Tier	No.	%
Unsafe acts	Violations	Routine Violations	Violated standing orders and regulations	17	100
Total=37	18	17		17	100

Additionally, inaccurate passenger manifest (35%, N=6), improper cargo lashing (18%, N=3), and overcrowding (18%, N=3) were the biggest contributors to routine violations (See Table 4-5).

Table 4-5 *Sub-factors in 4th tier Violated standing orders and regulations*

4th Tier	Sub-factor in 4th Tier	No.	%
Violated standing orders and regulations	Inaccurate passenger manifest	6	35
	Improper cargo lashing	3	18
	Overcrowding	3	18
	Overloading	1	6
	Inadequate manning	1	6
	Passenger staying inside the vehicle at the cargo deck	1	6
	Wrong TSS lane	1	6
	No PMS	1	6
Total=17		**17**	**100**

Passenger manifest, per se, does not contribute to maritime accidents. However, passenger manifest is very important in passenger accounting during search and rescue operations and for the passenger's insurance claims in case, anything bad happens. Also, overcrowding of passengers can be verified from the ferries' passenger manifest and authorized passenger capacity. Thus, the passenger manifest needs to be accurate.

Six (6) out of the twenty (20) ferries namely: MV Baleno 9, MBCA Alad Express 2, MV Mercraft 3, MBCA Jenny Vince, MBCA Chi-chi, and MBCA Gesu de Bambino had an inaccurate passenger manifest.

Knowing that the sea is a very unstable environment, proper cargo lashing is very crucial to maintain the ferry's stability in ro-ro passenger ferries and cargo-passenger boats. The ferry's instability endangers already the ferry itself and the lives of people on board. Meanwhile, three (3) out of the thirteen (13) ferries namely: MV Princess of the Stars, MV Baleno 9, and MV Maharlika 2 met accidents because of cargo shifting due to the improper lashing of cargoes that either resulted in their capsizing or sinking.

Similarly, overcrowding of passengers, specifically in a small ferry, also affects the boat's stability. Furthermore, the required lifesaving devices will not be sufficient if the people onboard will exceed the authorized passenger capacity.

Furthermore, three (3) out of the twenty (20) ferries namely: MBCA Don Dexter, MBCA Alad Express 2, and MBCA Kim Nirvana were overcrowded. However, MBCA Don Dexter was overloaded because there was no PDI was conducted before it departed due to the absence of a safety inspector in the area. Meanwhile, MBCA Alad Express 2 exceeded one (1) passenger only. But in the case of MBCA Kim Nirvana, PDI was conducted but the inspectors were remiss of their duty to prevent overcrowding.

Also, another five (5) ferries namely: MV Baleno 9, MV St. Thomas Aquinas, MBCA Kim Nirvana, MV Mercraft 3, and MV Lite Ferry 16 had routine violations such as passengers staying inside the vehicle at the cargo deck, inside the wrong lane at the TSS, overloading, inadequate manning and no main engine planned maintenance, respectively.

Also for the Unsafe acts, almost a third of the accident causal factors were attributed to Skill-based errors.

As demonstrated in Table 4-6, skill-based errors were mainly divided into three (3) sub-factors namely: Poor Seamanship (58%, N=7), procedures not used (25%, N=3) and failed to see and avoid (17%, N=2). Furthermore, poor seamanship was attributed to a master miscalculation (71%, N=5) and navigational failure (29%, N=2).

Table 4-6 *4th Tier in 3rd Tier Skill-based Errors*

1st Tier	2nd Tier	3rd Tier	4th Tier	No.	%
Unsafe acts	Errors	Skill-based Errors	Poor Seamanship	7	58
			Procedures not used	3	25
			Failed to see and avoid	2	17
Total=37	19	12		12	100

As shown in Table 4-7, five (5) out of the seven (7) ferries linked with poor seamanship category were MV Princess of the Stars, MV Cotabato Princess, MBCA Kim Nirvana, LCT Poseidon 26, and MV Ocean Jet 12 had an accident due to the Master's miscalculation. Meanwhile, the remaining two (2) ferries, namely: MV St. Thomas Aquinas and MV Maria Matilde met an accident because of navigational failure by not observing safe speed and the lack of situational awareness of the Officer on Watch (OOW)..

Table 34-7 *Sub-factors in 4th tier Poor seamanship*

4th Tier	Sub-factor in 4th Tier	No.	%
Poor seamanship	Master miscalculation	5	71
	Navigational failure	2	29
Total=7		**7**	**100**

In addition, as illustrated in Table 4-8, MV Mercraft 3 and MV Virgin de Penafrancia VII failed to execute crowd control and emergency procedures and failed to submit updated safety documents, respectively.

Table 4-8 *Sub-factors in 4th tier Procedures not used*

4th Tier	Sub-factor in 4th Tier	No.	%
Procedures not used	Crowd control failure	1	33
	Emergency procedure execution failure	1	33
	Failure to submit updated safety documents	1	33
Total=3		**3**	**100**

As shown in Table 4-9, MBCA Alad Express 2 and MV Island Roro-1 failed to see and avoid the overcrowding of one (1) passenger and the overloaded 10 wheeler truck loaded onboard, respectively.

Table 4-9 *Sub-factors in 4th tier Failed to see & avoid*

4th Tier	Sub-factor in 4th Tier	No.	%
Failed to see & avoid	Excess one (1) passenger	1	50
	Overloaded 10 wheeler truck	1	50
Total=2		**2**	**100**

Meanwhile, as demonstrated in Table 4-10, the decision and judgment errors is more or less a fifth of all Unsafe acts causal factors. Its sub-factor is wrong decision making during operation (100%, N=7) only.

Table 4-10 *4th Tier in 3rd Tier Decision and judgment Errors*

1st Tier	2nd Tier	3rd Tier	4th Tier	No.	%
Unsafe acts	Errors	Decision and judgment Errors	Wrong decision making during operation	7	100
Total=37	19	7		7	100

Six (6) out of twenty (20) ferries onboard operators committed seven (7) wrong decisions during operations, namely: MV Princess of the Stars, MV Baleno 9, MV St Thomas Aquinas, MV Starlite Atlantic 2, MV Maria Matilde, and MBCA Gesu de Bambino. Their respective violations were deciding to proceed en route even with typhoon signal, ballasting that caused the free surface effect, passing through uncharted area, failing to communicate, choosing a sheltering area, failing to inform the Master, and MBCA leaving one (1) crew in the water, respectively.

4.2.2 Preconditions for Unsafe acts

For the Preconditions for unsafe acts, more than half of the accident causal factors were attributed to Technological Environment. For the 3rd tier of the second level of the HFACS coding process, the preconditions to unsafe act level got 60 out of 212 accident causal factors. The preconditions to unsafe act garnered the most number of accident causal factors. Both physical and technological environments accounted for 30%(N=18) and 64%(N=38), respectively. Meanwhile, the least percentage was attributed to personal readiness and crew Interaction which both got 3%(N=2) only (See Figure 4-4).

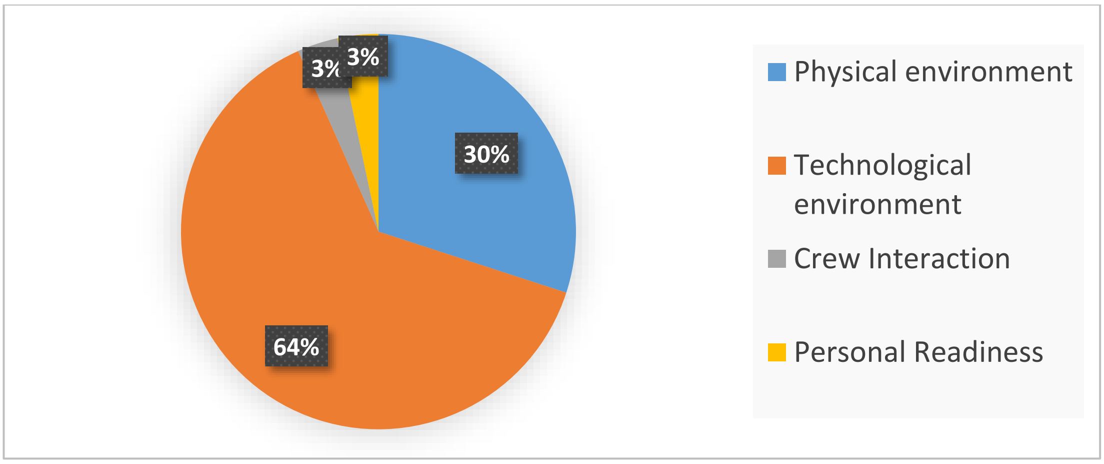

Figure 4-4 *Precondition for Unsafe Acts*

As illustrated in Table 4-11, ship design and construction failure (47%, N=18), equipment failure(21%, N=8), and procedural failure (11%, N=4) were the biggest contributors to Technological Environment.

Table 4-11 *4th Tier in 3rd Tier Technological Environment*

1st Tier	2nd Tier	3rd Tier	4th Tier	No.	%
Preconditions for unsafe acts	Environmental Factors	Technological Environ	Ship design and construction failure	18	47
			Equipment failure	8	21

		ment	Procedural failure	4	11
			Support Service failure	2	5
			Inadequate SAR Eqpt	3	8
			Legal Issue	3	8
Total=60	56	38		38	100

Furthermore, ship design and construction failure was divided into four (4) categories namely: Stability failure (56%, N=10), Hull failure(17%, N=3), Watertight integrity failure (11%, N=2), and Unsafe motorbanca roof design (17%, N=3). (See Table 4-12)

Table 4-12 *Sub-factors in 4th tier Ship design and construction failure*

4th Tier	Sub-factor in 4th Tier	No.	%
Ship design and construction failure	Stability failure	10	56
	Hull failure	3	17
	Watertight integrity failure	2	11
	Unsafe design	3	17
Total=18		**18**	**100**

Relatedly, ten (10) out of twenty (20) ferries, namely: MV Princess of the Stars, MBCA Don Dexter, MV Maharlika II, MV St. Thomas Aquinas, MBCA Kim Nirvana B, MBCA Alad Express 2, MBCA Chichi, MBCA Keziah 2 MBCA Jenny Vince and MV Island Roro-1 met an accident due to stability failure.

Meanwhile, MV Baleno 9, MV Mercraft 3, and MBCA Gesu De Bambino sustained hull damage after, allegedly, being hit and battered by floating object and by squall, respectively

Furthermore, MV Princess of the Stars, MV Maharlika II, and MV Starlite Atlantic 2 mishaps were attributed to the watertight integrity failure.

In addition, MBCA Chichi, MBCA Keziah 2, and MBCA Jenny Vince accidents were exacerbated by the MBCA's unsafe roofing that trapped the passengers and crew.

Also, as indicated in Table 4-13, seven (7) out of the twenty (20) ferries namely: MV Maharlika II, MV Starlite Atlantic 2, MV Lite Ferry 16, MBCA Chi-chi, MBCA Keziah 2, MBCA Jenny Vince and MBCA Gesu De Bambino had an equipment failure. One of the ferries had two (2) equipment failures making its total of eight (8).

Table 4-13 *Sub-factors in 4th tier Equipment failure*

4th Tier	Sub-factor in 4th Tier	No.	%
Equipment failure	Distress apparatus and radio communication equipment not readily available	4	50
	No fire dampers	1	12.5
	No maintenance of CO_2 fire extinguishing system	1	12.5
	No back-up power	1	12.5
	Steering Casualty	1	12.5
Total=8		**8**	100

On the other hand**,** almost a third of the Preconditions for unsafe acts accident causal factors were attributed to the physical environment. Bad Weather (3%, N=15) was the major accident contributor to the Physical environment. Meanwhile, hard floating objects (3%, N=2) and Night Navigation (3%, N=1) were the other contributors to the physical environment. (See Table 4-14)

Table 4-14 *4th Tier in 3rd Tier Physical Environment*

1st Tier	2nd Tier	3rd Tier	4th Tier	No.	%
Preconditions for unsafe acts	Environmental Factors	Physical Environment	Weather	15	83
			Floating Object	2	11
			Night Navigation	1	6
Total=60	56	18		18	100

Also, bad weather is divided into eight (8) categories namely: typhoon (13%, N=2), gale (13%, N=2), squall (33%, N=5), windy (13%, N=2), strong tornado (7%, N=1), change of current and strong wind (7%, N=1), strong waves (7%, N=1) and dark clouds with thunderstorms (7%, N=1). (See Table 4-15)

Table 4-15 *Sub-factors in 4th tier Weather*

4th Tier	Sub-factor in 4th Tier	No.	%
Weather	Typhoon	2	13
	Gale	2	13
	Squall	5	33
	Windy	2	13
	Strong tornado	1	7
	Strong waves	1	7
	Sudden change of current and strong wind	1	7
	Dark with thunderstorms	1	7
Total=15		**15**	100

Also, fifteen (15) out of the twenty (20) ferries namely: MV Princess of the Stars, MBCA Don Dexter, MV Baleno 9, MV Cotabato Princess, MV Maharlika II, MBCA Kim Nirvana B, MV Starlite Atlantic 2, LCT Poseidon 26, MBCA Alad Express 2, MV Ma Matilde, MV Ocean Jet 12, MV Mercraft 3, MBCA Chi-chi, MBCA Keziah 2, MBCA Jenny Vince and MBCA Gesu De Bambino were affected by a bad weather.

MV Princess of the Stars and MV Starlite Atlantic 2 were only ferries battered by a typhoon. MV Princess of the Stars was authorized to sail because policy allows it having a big gross tonnage. Meanwhile, MV Starlite Atlantic 2 sailed out without passengers just to take shelter.

On the other hand, MV Maharlika II and MV Mercraft 3 were faced with gale. Since their gross tonnage were above 35GT, authorities allowed them to sail.

Furthermore, MBCA Don Dexter, MBCA Chic-hi, MBCA Keziah 2, MBCA Jenny Vince and MBCA Gesu De Bambino capsized because of squall.

Lastly, MV Cotabato Princess, MBCA Kim Nirvana B, LCT Poseidon 26, MBCA Alad Express 2, MV Ma Matilde, MV Ocean Jet 12 were other weather elements such as wind, current, waves and tornado.

4.2.3 Unsafe supervision

For the Unsafe supervision, more than 2/3 of the accident causal factors were attributed to Supervisory violations or shipborne violations. For the 3rd tier of the third level of the HFACS coding process, the unsafe supervision level got 44 out of 212 accident causal factors. Also, it was ranked third out of the five HFACS levels. Figure 4-5, as shown below, reveals a 2:1 ratio with a supervisory violation and inadequate supervision having 70%(N=33) and 30%(N=14), respectively.

4.2.3 Unsafe supervision

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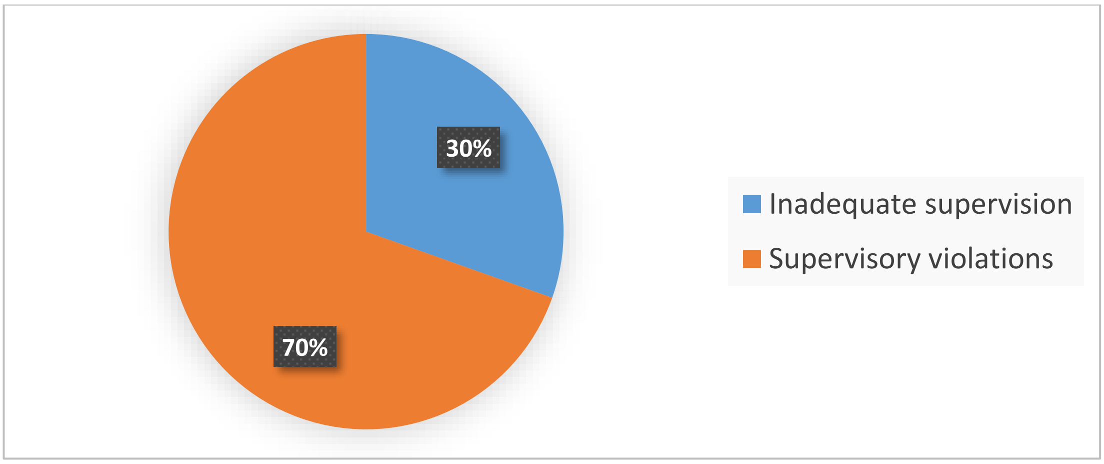

Figure 4-5 *Unsafe Supervision*

Additionally, shipborne violations is further broken down into failed to enforce rules and regulation (58%, N=18), authorized unnecessary hazard (33%, N=11), violated procedures (6%, N=2), and engaged unqualified crew (3%, N=1). (See Table 4-16)

Table 4-16 *4th Tier in 3rd Tier Shipborne violations*

1st Tier	2nd Tier	3rd Tier	4th Tier	No.	%
Unsafe supervision	Supervisory violations	Shipborne violations	Failed to enforce rules and regulation	18	58
			Authorized unnecessary hazard	11	33
			Violated procedures	2	6
			Engaged unqualified crew	1	3
Total=46	32	32		32	100

Furthermore, failed to enforce rules, and regulation was split into seven (7) smaller categories namely: inaccurate passenger manifest (32%, N=6), improper lashing of cargoes (16%, N=3), overcrowding (16%, N=2), inadequate support services (11%, N=2), overloading (5%, N=1), lack supply, and materials (5%, N=1), and inadequate manning(16%, N=2). (See Table 4-17)

Table 4-17 *Sub-factors in 4th tier Failed to enforce rules and regulation*

4th Tier	Sub-factor in 4th Tier	No.	%
Failed to enforce rules and regulation	Inaccurate passenger manifest	6	33
	Improper lashing of cargoes	3	17
	Overcrowding	3	17
	Inadequate support services	2	11
	Overloading	1	6
	Lack supply and materials	1	6
	Inadequate manning	2	11
Total=18		**18**	100

The officers or the ferries' leadership of the twelve (12) out of twenty (20) ferries namely: MV Princess of the Stars, MBCA Don Dexter, MV Baleno 9, MV Cotabato Princess, MV Maharlika II, MBCA Kim Nirvana B, MBCA Alad Express 2, MV Ma Matilde, MV Mercraft 3, MBCA Chi-chi, MBCA Keziah 2, MBCA Jenny Vince failed to enforce rules and regulations.

Meanwhile, MV Princess of the Stars, MV Baleno 9, MBCA Kim Nirvana B, MV Starlite Atlantic 2, MV Ma Matilde, MV Lite Ferry 16, and MBCA Gesu De Bambino's Masters deliberately authorized unnecessary hazards. Such unnecessary hazards include the decision to proceed even with typhoon signal; passing through an uncharted area; allowing passengers to stay inside the vehicle at the cargo deck and others.

Also, for the unsafe supervision, the remaining 1/3 of the accident causal factors were attributed to inadequate supervision or shipborne and shore supervision.

Moreover, shipborne and shore supervision is further narrowed down to leadership/ supervision/ oversight inadequate (100%, N=14) only. (See Table 4-18)

Table 4-18 *4th Tier in 3rd Tier Shipborne and shore supervision*

1st Tier	2nd Tier	3rd Tier	4th Tier	No.	%
Unsafe supervision	Inadequate Supervision	Shipborne and shore supervision	Leadership/ supervision/ oversight inadequate	14	100
Total=44	14	14		14	100

Also, leadership, supervision, and oversight inadequate was observed in the following ferries namely: MBCA Don Dexter, MV St Thomas Aquinas, MV Starlite Atlantic 2, MV Mercraft 3, MV Virgin De Penafrancia VII, MBCA Chi-chi, MBCA Keziah 2, MBCA Jenny Vince and MV Island Roro 1. Inadequate leadership, supervision, and oversight examples were passengers shifting to portside, failure to reduce speed, failure to communicate, failure to close engine room cover, and others.

4.2.4 Organizational Influence

Similarly, for the Organizational Influence, 2/3 of the accident causal factors were attributed to Oversight failures.

For the 3rd tier of the fourth level of the HFACS coding process, the organizational influence level got 47 out of 212 accident causal factors. The organizational influence ranked second with the most number of causal factors.

The majority of the causal factors were attributed to oversight 66%(N=31) and procedures 19%(N=9) which falls under organizational process. Meanwhile, equipment/facility resources and human resources under the resource management had 11%(N=5) and 4%(N=2), respectively. However, organizational climate with structure, policies, and culture sub-factors got zero. (See Figure 4-6)

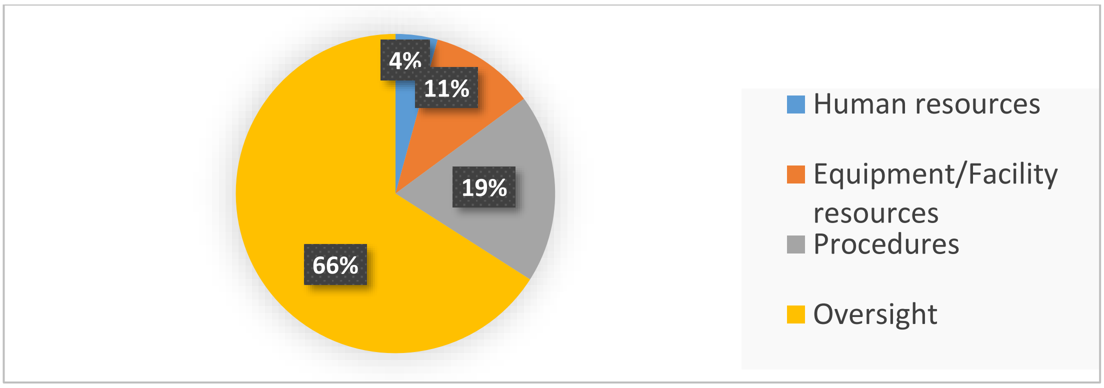

Figure 4-6 *Organizational Influences*

For the Organizational Influences, 2/3 of the accident causal factors were attributed to oversight. Relatedly, oversight was further narrowed down to monitoring and checking of resources, climate, and processes to ensure a safe work environment (100%, N=31) only. (See Table 4-19)

Table 4-19 *4th Tier in 3rd Tier Oversight*

1st Tier	2nd Tier	3rd Tier	4th Tier	No.	%
Organizational Influences	Organizational Process	Oversight	Monitoring and checking of resources, climate and processes to ensure a safe work	31	100
Total=47	40	31		31	100

As shown in Table 4-20, under the monitoring and checking of resources, climate, and processes to ensure a safe work environment, fifteen (15) out of twenty (20) ferries namely: MV Princess of the Stars, MBCA Don Dexter, MV Baleno 9, MV Starlite Atlantic 2, LCT Poseidon 26, MV Ma Matilde, MV Ocean Jet 12, MV Mercraft 3, MV Virgin De Penafrancia VII, MV Lite Ferry 16, MBCA Chi-chi, MBCA Keziah 2, MBCA Jenny Vince, MV Island Roro and MBCA Gesu De Bambino were found to generally had SMS failures. Some safety management failures included no planned maintenance of equipment, not observing safety policies, and others.

Additionally, under the monitoring and checking of resources, climate, and processes to ensure a safe work environment category, six (6) out of the twenty (20) ferries, as earlier mentioned, had an inaccurate passenger manifest. Meanwhile, three (3) out of the twenty (20) ferries met accidents because of cargo shifting due to the improper lashing of cargoes and three (3) out of the twenty (20) ferries were overcrowded. (See Table 4-20)

Table 4-20 *Sub-factors in 4th tier Monitoring and checking of resources, climate and processes to ensure a safe work environment*

4th Tier	Sub-factor in 4th Tier	No.	%
Monitoring and checking of resources, climate and processes to ensure a safe work environment	SMS Failure	17	55
	Inaccurate passenger manifest	6	19
	Improper lashing of cargoes	3	10
	Overloading	1	3
	Overcrowding	3	10
	Modification failure	1	3
Total=31		**31**	100

Also, under the Organizational Influences, almost 1/5 of the accident causal factors were attributed to Procedure. Similarly, the procedure was further narrowed down to Procedural guidance and publications (100%, N=9). (See Table 4-21)

Table 4-21 *4th Tier in 3rd Tier Procedure*

1st Tier	2nd Tier	3rd Tier	4th Tier	No.	%
Organizational Influences	Organizational Process	Procedure	Procedural guidance and publications	9	100
Total=47	40	9		9	100

MV St Thomas Aquinas, MBCA Kim Nirvana B, MV Starlite Atlantic 2, MV Mercraft 3, MV Lite Ferry 16, and MBCA Gesu De Bambino encountered procedural guidance and publications failures.

Similarly, the resource management under organizational influences was broken down into two (2) smaller 3rd tier factors namely: Human and Equipment resources. Furthermore, both the Human and Equipment resources have their own 3rd tier sub-factors namely: inadequate safe manning (N=2) and lack of equipment/supplies (N=5). (See Tables 4-22 & 4-23)

Table 4-22 *4th Tier in 3rd Tier Human resource*

1st Tier	2nd Tier	3rd Tier	4th Tier	No.	%
Organizational Influences	Resource management	Human resource	Inadequate safe manning	2	100
Total=47	7	2		2	100

Meanwhile, both the MV Cotabato Princess and MV Mercraft 3 were found to have inadequate safe manning.

Table 44-23 *4th Tier in 3rd Tier Equipment resource*

1st Tier	2nd Tier	3rd Tier	4th Tier	No.	%
Organizational Influences	Resource management	Equipment resource	Lack of equipment/supplies	5	100
Total=47	7	5		5	100

Furthermore, MV Cotabato Princess, MV Maharlika II, MV Starlite Atlantic 2, MV Ma Matilde, and MV Lite Ferry 16 exhibited a lack of supplies and equipment by having no tugboat assistance, cargo lashing equipment, back-up power, bell books, Quarter Masters logbook and fire dampers, respectively.

4.2.5 Pre-Departure Inspection

For the PDI, more than 4/5 of the accident causal factors were attributed to Routine violations. For the 3rd tier of the fifth level of the HFACS coding process, the PDI level got 22 out of 212 accident causal factors. For this level, almost a third of a quarter of the accident causal factors were attributed to the PDI Violation (82%, N=18). The remaining 3rd tier factors namely: Rules and regulation, PDI error, and Absence of PDI accounted for 4%(N=1), 9%(N=2), and 5%(N=1), respectively. (See Figure 4-7)

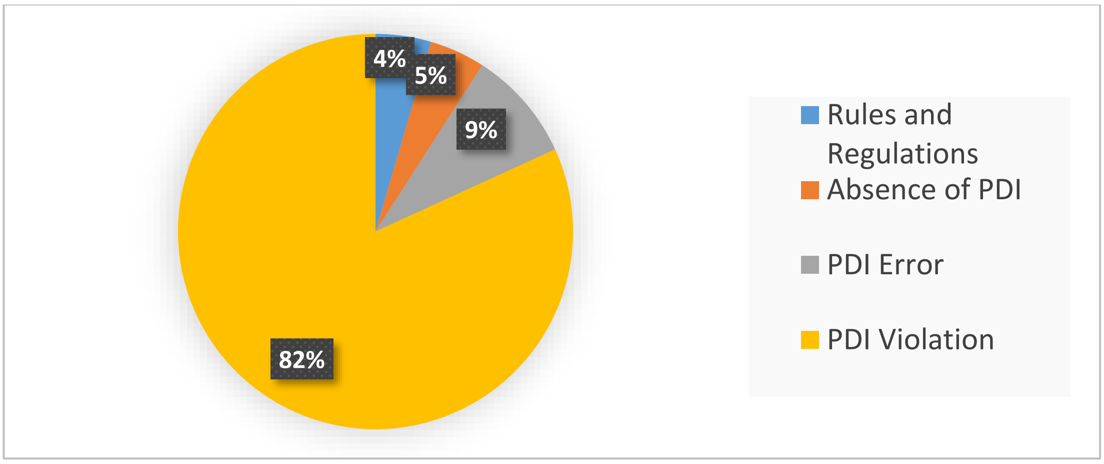

Figure 4-7 *PDI related factors*

Inaccurate passenger manifest (33%, N=6), emergency and communication equipment not readily available (22%, N=4), inadequate manning (11%, N=2), improper lashing of cargoes (17%, N=3), overcrowding (11%, N=2) and overloading (6%, N=1) were the contributors to PDI violations. (See Table 4-24)

Table 4-24 *4th Tier in 3rd Tier PDI Violations*

1st Tier	2nd Tier	3rd Tier	4th Tier	No.	%
Outside factors (PDI)	PDI Enforce ment Related Issues	PDI Violations	Inaccurate passenger manifest	6	33
			Emergency and radio communication equipment not readily available	4	22
			Inadequate manning	2	11
			Improper lashing of cargoes	3	17
			Overcrowding	2	11
			Overloading	1	6
Total=22	21	18		18	100

Under the PDI violations category, some inspectors violated regulations on safety documents, passenger manifest, equipment in good operating condition, proper lashing of cargoes, overcrowding, overloading, adequate and certificated manning. However, no PDI violation was made on the enforcement of the "No sail policy" during bad weather.

PDI Inspectors' safety regulation violations were noted on the following ferries, namely: MV Baleno 9, MV Cotabato Princess, MV Maharlika II, MBCA Kim Nirvana, MBCA Alad Express 2, MV Mercraft 3, MBCA ChichI, MBCA Keziah 2, MBCA Jenny Vince and MBCA Gesu De Bambino.

Additionally, PDI Error happened onboard MV Princess of the Star and MBCA Alad Express 2 wherein the inspector failed to verify the correctness of the Certificate of Stability and failed to prevent overcrowding of one (1) excess passenger, respectively. (See Table 4-25)

Table 4-25 *4th Tier in 3rd Tier PDI Error*

1st Tier	2nd Tier	3rd Tier	4th Tier	No.	%
Outside factors (PDI)	PDI Enforcement Related Issues	PDI Error	Certificate of stability entry	1	50
			Passenger manifest	1	50
Total=22	21	2		2	100

As shown in Table 4-26, the government regulators encountered one (1) regulatory challenge on the Sailing Policy during Bad weather that contributed to the capsizing of MV Princess of the Stars. Fortunately, the Sailing Policy during Bad weather was amended and refined to what it is now.

Table 4-26 *4th Tier in 3rd Tier Rules and regulations*

1st Tier	2nd Tier	3rd Tier	4th Tier	No.	%
Outside factors (PDI)	PDI and Other Related Regulations	Rules and regulations	Movement of vessels during heavy weather	1	100

Total=22	1	1		1	100

Also, the Absence of PDI happened only in the case of MBCA Don Dexter which resulted to its overcrowding.

4.3 Safe Ferry Model and HFACS Results Comparison

To logically present and discuss the identified accident causal factors of the Philippines ferry industry including the pre-departure inspection enforcement, the said causal factors were fitted, as applicable, to the Model of a Safe Ferry (Dalziel & Weisbrod, 2012)(See Table 4-27).

4.3.1 Ferry Operator Safety Culture

The HFACS coding results revealed that under the Ferry Operator Safety Culture, some of the ferries in this study were not suited in their intended service and were not well-maintained. A number of them have stability, hull Integrity, watertight integrity, and unsafe design issues. Also, improper lashing of cargoes and lack of supply and materials indicated that some of the ferries were not properly operated and maintained.

Furthermore, the SMS failure, inadequate leadership and oversight, procedure failure, inaccurate passenger manifest, overcrowding, overloading, navigational failure, and inadequate support services are indicative of the huge safety management challenges of some of the country's ferries. Also, the crew's number and crew competence gaps were highlighted by the Master's miscalculation and the inadequate manning, crew interaction, and personal readiness.

Table 4-27 *Model of Safe Ferry vs HFACS-PDI Accident Causal Factors*

	MODEL OF SAFE FERRY	ACCIDENT CAUSAL FACTORS	NO
1	**Ferry Operator Safety Culture:**		
	Ships suitable for intended service	Stability failure	10
		Hull failure	3
		Watertight integrity failure	2
		Unsafe motorbanca roof design	3
	Well-maintained ships	Lack supply and materials	5
		Improper cargo lashing	3
		SMS Failure	17
		Leadership/ oversight inadequate	14
		Procedure failure	9
		Inaccurate passenger manifest	6
		Overcrowding	2
		Overloading	1
	Properly operated, crewed ships	Navigational failure	2
		Inadequate support services	2
		Master miscalculation	4
		Inadequate manning	2
		Crew Interaction	2
		Personal readiness	2
2	**Regulatory regime:**		
	Appropriate regulations	Absent and outdated regulations	1
	Enforcement	Absence of PDI	1
		PDI Errors	2
		PDI Violations	18
3	**Hazardous Weather Notification**	Squall	5
		Typhoon	2
		Gale	2
		Windy	2
4	**Emergency Response**		
	Communication - Alerting /Location	Emergency and radio equipment not readily available	4
	Rescue / assistance resources		0
5	**Knowledgeable Passengers**	Alleged Overloading	0

Generally, safety violations were prevalent in majority of the ferries' different levels of echelon. (See Table 4-28) Such poor safety culture can be attributed to the regulators lapses in enforcement.

Table 4-28 *Domestic Ferry and PDI Violations*

	Ferry Organization				Safety Enforcement
	Violated orders	Equipment Failure	Failed to enforce rules and	Lapses in checking of resources, climate and processes to	PDI Violations
Inaccurate passenger manifest	6		6	6	6
Improper cargo lashing	3		3	3	3
Overcrowding	3		3	3	2
Overloading	1		1	1	1
Inadequate manning	2		2	2	2
Emergency and radio communication equipment not readily available		4			4
Total	**14**	**4**	**14**	**14**	**18**

4.3.2 Regulatory regime

Under the regulatory regime sub-topic particularly in the appropriate regulations and standards category, the absent and outdated regulations were also pinpointed to be contributory factors to ferry accidents. Mainly, the absent and outdated regulations were attributed to the absence of the safety inspector's centralized (ship risk profile, certification, and enforcement) information system and the safety inspector's performance oversight policies and infrastructure, and the outdated policy on the guidance on the movement of vessels during heavy weather. However, at present, the typhoon policy was already addressed by updating the old regulation.

As shown in Table 4-29, some of the accident causal factors were addressed by the PDI, while, others were not. Based on the HFACS results, PDI was only effective in implementing "No sailing policy" and proper cargo lashing, checking the ferries' safety documents, preventing overcrowding, and checking life-saving appliances only.

However, PDI inspectors have difficulties and were not so effective in ensuring ferry stability, verifying the actual operating condition of the ferry itself and its equipment, preventing overloading, and ensuring an accurate passenger manifest because such inspection concerns are more technical and require more than the capability of the naked eye. Furthermore, because of time constraints, thorough checking was quite a challenge.

Table 54-29 *PDI strengths and weaknesses*

Strengths	Weaknesses
• Enforcing "No sailing policy" during bad weather	• Ensuring ferry's stability
• Implementing the proper cargo lashing	• Verifying the actual operating condition of the ferry itself and its equipment
• Checking the completeness and credibility of ferry and crew safety documents	• Preventing overloading
• Preventing overcrowding	• Ensuring the passenger manifest accurateness
• Checking of lifesaving equipment	

Additionally, one (1) out of the twenty (20) of the maritime accidents did not undergo PDI due to the absence of a PDI inspector in the area. Relatedly, the said MBCA was found to be overcrowded and had an inaccurate passenger manifest. However, the direct cause of the accident was the unsafe design and instability of the MBCA which was triggered by the squall resulting in its capsizing. Also, PDI errors were committed by inspectors when one (1) passenger exceeded the authorized capacity and one (1) erroneous safety document was overlooked.

Meanwhile, PDI violations got the biggest number under the regulatory regime enforcement. This big number in the PDI violation is indicative that inspectors were either lax or overburdened with their duties. Although, safety regulations were communicated, yet, PDI violations were still committed.

4.3.3 Hazardous Weather Notification

Out of the twenty (20) ferry boats used in this study, fifteen (15) of them were affected by bad weather that resulted in accidents or incidents. However, only typhoon and gale warning advisories are being forecasted by the country's weather bureau. The remaining weather phenomenon such as squalls, wind, sea current, and waves have no forecast. As such, it can be concluded that the country's sea environment is very unstable and unpredictable, especially, twenty-two (22) typhoons on an average visit every year. The sea's instability, unpredictability, and harshness are a fact that every domestic ferry crew or a mariner should constantly master. Thus, ferry boat design and construction should be made or repaired within the highest safety design and construction standards.

4.3.4 Emergency Response

For this element, only emergency and radio communication equipment not readily available fell under the communication- alerting and location. The search and rescue party will not be alerted for any maritime distress if the communication equipment is not readily available aboard ferry boats. Based on the HFACS coding process, four (4) MBCA's were found to have shortcomings in the communication and emergency equipment requirement.

4.3.5 Knowledgeable Passengers

Although the knowledgeable passenger element of the Safe ferry model is not part of the HFACS coding, an example of this was demonstrated in one (1) of the twenty (20) investigation reports. One of the passengers aboard MV Virgin de Penafrancia VII complained and alleged that the said ferry vessel was overloaded after observing crowded passengers. After conducting a thorough investigation, it was found out that the safety certificates indicating the authorized capacity were not updated by the issuing agency. Updated safety certificate which was provided later on, proved that the allegation was incorrect. Nevertheless, the incident clarified the vessel authorized capacity for future inspections.

Although the passenger allegation was proven to be wrong, it was a good sign that passengers already have some knowledge about the ferry's safety regulations.

Moreover, the said passenger's vigilance and participation in the maritime safety checks and balance process by responsibly reporting his observation is another avenue in the cultivation of safety culture in the ferry industry.

4.4 Validation of the Study

This research HFACS results showed the many similarities with the MARINA (2019) MIDP particularly in its PTA. Accordingly, one of the challenges in the country's maritime sector is the poor quality of sea transport system which can be directly linked with the poor ferry operator's safety culture.

Furthermore, the said PTA elaborated that shortage of qualified of officers and crew and aging fleet were contributory factors, also. Similarly, the research found out that poor crew competence and poor ferry design and construction significantly contributed to mishaps. Although, aging fleet and poor ferry design and construction are two different factors, their link can be clarified later on.

Meanwhile, weak regulation and supervision factor identified in the problem tree analysis strengthens the research data results which illustrated the regulators lapses in its enforcement. Lastly, the fragmented maritime administration reported in the PTA is likewise glaring in the fragmented safety enforcement activities of different agencies and in the absence of safety inspector's centralized (ship risk profile, certification and enforcement) information system policy and infrastructure. Moreover, bad weather was not included in the above mentioned analysis.

On the one hand, the World Bank and IFC (2014) described the country's domestic shipping industry with high costs, low quality of service, and a poor safety record. The poor safety record is proven by the twenty (20) accidents and incidents from 2008-2020.

Similarly, according to PCG Report (2017), maritime accidents are largely attributable to three main factors: Ship Management (vessel maintenance, crew competence); Government Regulatory Enforcement (MARINA & PCG); and the Riding Public. The role of the riding public was recognized by the PCG in the process of improving ferry safety.

According to Golden and Weisbrod (2016), sea mishaps in developing countries are caused by the acquisition of outdated, substandard, and/or inappropriate vessels; overcrowding; insufficient training and sudden hazardous weather. This confirms that poor seamanship, poor design, construction, equipment and stability and bad weather are major contributory factors to maritime accidents.

Also, in research from Faturachman and Mustafa (2012) regarding Indonesian Sea Transportation Accidents, the three (3) major accident causative factors identified are: human, technical and natural factors. In comparison, the HFACS results in this publication are very similar to those in the above study.

Additionally, Interferry report (2019) confirmed the research result that the Philippines maritime safety improvements was substantially brought about by the stringent enforcement of "No sailing policy" during bad weather.

Similar to this papers' suggestions, Sigua and Aguilar (2003) proposed the below enumerated recommendations:

- Accurate sea state prediction with a system for warning/barring different vessel sizes from departing or undertaking voyages
- Standards for small crafts particularly the outrigger boats and old vessels including hull structural specifications, loading, engine, equipment and age limits.
- Safe harbors and anchorages
- Ensure crew competence and safety procedure capabilities
- Make sure the passengers are aware of emergency procedures in mandatory manner
- Institute rigid measures for inspecting second hand vessels.

Finally, Sigua and Aguilar (2003), recommended the usage of a comprehensive Geographic Information System (GIS) which has shown to be a valuable tool in integrating numerous functions such as mapping, modelling, querying, and analyzing vast amounts of data housed in a single database about maritime accidents and incidents.

Chapter 5

ACCIMAP RESULTS AND DISCUSSION

In this chapter, the HFACS accident causal factors from the previous chapter were utilized to illustrate a clearer and broader picture of the various accident scenarios and show their interrelationships with the help of the AcciMap Model. Furthermore, the twenty (20) accidents and incidents were narrowed down to four (4) accident maps, categorized per accident type such as capsizing, sinking/submerging, ramming/collision/allision, and fire.

5.1 Capsizing

As shown in Figure 5-1 below, a total of eight (8) capsizing accidents transpired out of the twenty (20) ferries which resulted in 964 deaths.

Under the physical, actor, and events processes and condition level, four (4) major causal factors were noted in capsizing accidents namely: poor safety management, poor seamanship, poor design and construction, and bad weather.

Out of the eight (8) capsizing accidents, MV Island Roro-1, alone and without weather disturbance, lost its stability solely because of cargo shifting of an overloaded truck that slipped to the side of the vessel during discharging operation in port. This accident was caused by the combination of poor safety management and poor seamanship only.

Similarly, MV Princess of the Stars capsized because of cargo shifting. However, cargo shifting was triggered and made worse by the unfavorable sea condition brought by a typhoon. Also, it has some design and construction issues. But most importantly, the Master’s poor seamanship itself brought the said vessel into harm’s way. In this accident, all of the four major causal factors contributed to the accident.

EXTERNAL	Not Updated Typhoon Policy (2008) Not updated MBCA design & construction Policy (2019) No policy for Inspector's Performance Oversight No policy and infrastructure for safety inspector's centralized (ship risk profile, certification and enforcement) information system **PDI enforcement lapses** - Improper lashing of cargoes - Overcrowding - Inaccurate Passenger manifest - Overloading **Other Safety Inspections lapses** - Ferries design, construction, equipment and stability inspection, survey and certification - Crew training, assessment and certification -Safety Management System Audit and Certification - Vessel Safety Enforcement Inspection (VSEI) -Emergency Readiness Evaluation (ERE)
ORGANIZATIONAL	Poor Organizational Safety Culture -Weak monitoring and checking of resources, climate and processes to ensure a safe work environment -Leadership/supervision/ oversight inadequate -Failed to enforce rules and regulation -Authorized unnecessary hazard -Violated procedures
PHYSICAL/ ACTOR EVENTS, PROCESSES AND CONDITIONS	Poor Safety Management - Improper lashing of cargo (1) - Overcrowding (3) - Inaccurate Passenger manifest (2) - Overloading (2) Poor Seamanship -Typhoon evasion failure (1) -Unsafe maneuvering(1) Poor Design and Construction -Stability Failure (6) - Unsafe roof design (3) Bad Weather -Typhoon (1) - Squall (1) -Tornado (1) - Strong waves (1)
OUTCOME	Capsizing (8) Death- 964

Figure 5-1 *Accimap Model for Capsizing*

Meanwhile, five (5) out of six (6) wooden boats namely, MBCA Don Dexter, MBCA Alad Express 2, MBCA Keziah, MBCA Chi-chi, and MBCA Jenny Vince with design and construction issues combined with bad weather resulted in their capsizing. Aside from the bad weather and its design and construction, MBCA Kim Nirvana's instability was further exacerbated by the Master's wrong maneuver by steering hard port and placing one of the throttles in full ahead and the other in a full-back.

As such, at the organization level, the Ferry Safety Culture was classified to be poor in general, partially, because of the PDI and other safety inspection enforcements shortcomings.

These lapses in enforcement were further rooted in the absence of rules and not updated policies.

The not updated typhoon policy can be traced back to 2008 during the capsizing of the ill-fated MV Princess of the Stars where the bigger vessel with larger gross tonnages was still allowed to sail. However, the said policy was already amended, thus, sea accidents were significantly reduced.

Also, MBCA design and construction still need to be revisited and revised, although, there is already a policy to phase out all passenger MBCA's.

Furthermore, there is also an absence of a safety inspector's centralized (ship risk profile, certification, and enforcement) information system and the safety inspector's performance oversight policies and infrastructure. The centralized information system is a very powerful tool for inspectors to control and target delinquent and substandard vessels. Also, inspector performance oversight aims to counter-check the safety inspection procedures and implementations. Without these mechanisms, safety enforcement will remain to be fragmented and very loose having very little control.

Additionally, for capsizing accidents, as shown in Table 5-1, it is very common for the 30 gross tonnage and below MBCA's to lose their stability once confronted with very strong winds such as squalls. The MBCA's design with non-aerodynamic roofing or superstructure was not fit with unfavorable weather conditions causing numerous casualties.

Out of the twenty (20) ferries included in this study, six (6) wooden ferries were involved in capsizing accidents. While four (4) of them were purely passenger ferries and the two (2) are pax-cargo ferries.

Table 65-1 *Summary of Capsizing Accidents*

DATE	VESSEL	GRT	AGE	HULL MATERIAL	FERRY TYPE	TRADING LICENSE	LOCATION	STABILITY FAILURE	CASUALTY
Jun-08	MV PRINCESS OF THE STARS	23,800	24	STEEL	ROPAX	COAST WISE	AT SEA (NEAR SHORE)	CARGO SHIFTING	814
Nov-08	MBCA DON DEXTER	13.7	6	WOODEN	PAX-CARGO	BAY & RIVER	AT SEA	MBCA DESIGN (NOT AERO DYNAMIC)	52
Jul-15	MBCA KIM NIRVANA B	33	4	WOODEN	PAX-CARGO	COAST WISE	IN PORT		62
Jun-17	MBCA ALAD EXPRESS 2	12.8	10	WOODEN	PAX	COAST WISE	AT SEA		5
Aug-19	MBCA CHICHI	19	4	WOODEN	PAX	BAY & RIVER	AT SEA		11
Aug-19	MBCA KEZIAH	5	47	WOODEN	PAX	BAY & RIVER	AT SEA		0
Aug-19	MBCA JENNY VINCE	10.6	15	WOODEN	PAX	BAY & RIVER	AT SEA		20
Dec-19	MV ISLAND RORO 1	196	41	STEEL	ROPAX	COAST WISE	IN PORT	CARGO SHIFTING	0

Meanwhile, out of the six (6) wooden ferries, five (5) of them met an accident at sea but just capsized and did not sink. This is another thought that contradicts the claim the MBCA's in themselves are unsafe. As long as MBCA's are not loaded with heavy cargoes, they will not sink because wooden materials float.

Arguably, then, why there were high fatalities for these MBCA's? In one of the investigation reports, it was also highlighted that the MBCA's roofing or superstructure traps the passengers causing deaths.

On the other hand, the other two (2) ferries, both steel-hulled, involved in the capsizing incident were affected by the cargo shifting. Out of the two (2), one (1) was additionally battered by a typhoon, while the other, happened during discharging operation. It can be noticed also that, luckily, both capsized because both were in shallow waters. If not, they would have sunk.

Additionally, ferries' stability condition was further affected by the cargoes it loads, posing danger to the lives of the passengers. As a result, the MARINA already issued a policy phasing out passenger MBCA's with corresponding conditions and exemptions. Nevertheless, MBCA's design needs to be revisited for the safety of other industries ' purposes. Also, boats can be classified purely either as passenger or cargo-only to mitigate the risk of cargo to passengers.

The casualty for capsizing accidents is relatively high because passengers are trapped inside the ferries attributable to the ferries' design. Also, the above case showed that poor MBCA design and construction and bad weather (squall) combination were already hazardous for the crew and the passengers.

5.2 Sinking/Submerging

Meanwhile, Figure 5-2 shows a total of five (5) sinking and one (1) submerging accident that occurred out of the twenty (20) ferries and resulted in 206 deaths as an outcome.

Similar to the capsizing accidents, under the physical, actor, and events processes and condition level, sinking accidents were caused by poor safety management, poor seamanship, poor design and construction, and bad weather, plus physical environment which refers to hard floating objects.

MV Baleno 9, MV Mercraft 3, and MBCA Gesu de Bambino had their hull raptured that caused the two formers to sink and the latter to submerge. Out of the three (3), MV Baleno 9 was the only ferry not affected by bad weather, while MV Mercraft 3 and MBCA Gesu de Bambino encountered bad weather at sea. Also, both MV Baleno 9 and MV Mercraft 3 alleged that they hit a hard floating object.

On the other hand, MV St. Thomas Aquinas, MV Maharlika 2, and MV Starlite Atlantic 2, all suffered watertight integrity failures. MV St. Thomas Aquinas's watertight integrity failure was caused by the collision with MV Sulpicio Express 7.

Meanwhile, MV Maharlika 2’s sinking was brought about by its cargo shifting triggered by the unfavorable weather that resulted in the flooding of the steering room. Lastly, MV Starlite Atlantic 2’s open car deck caused its watertight integrity breach which was also battered by a typhoon.

As explained above, the Poor Ferry Organizational Safety Culture was also prevalent in the said ferries because of some lapses in both the PDI and other Safety Inspection Enforcements. In like manner, the said enforcement lapses were rooted in the absence of policies and infrastructure on the safety

EXTERNAL	No policy for Inspector's Performance Oversight **PDI enforcement lapses** - Improper lashing of cargoes - Overcrowding - Inaccurate Passenger manifest - Overloading		No policy and infrastructure for safety inspector's centralized (ship risk profile, certification and enforcement) information system **Other Safety Inspections lapses** - Ferries design, construction, equipment and stability inspection, survey and certification - Crew training, assessment and certification -Safety Management System Audit and Certification - Vessel Safety Enforcement Inspection (VSEI) -Emergency Readiness Evaluation (ERE)	
ORGANIZATIONAL	**Poor Organizational Safety Culture** -Weak monitoring and checking of resources, climate and processes to ensure a safe work environment -Leadership/supervision/ oversight inadequate -Failed to enforce rules and regulation -Authorized unnecessary hazard -Violated procedures			
PHYSICAL/ ACTOR EVENTS, PROCESSES AND CONDITIONS	Poor Safety Management - Improper lashing of cargo (2) - Inaccurate Passenger manifest (2) - Inadequate manning (1) - Emergency procedure failure (2) - Communication failure (2) - Passengers staying inside the vehicle (1)	Poor Seamanship -Master miscalculation (1) -Navigational Failure (1)	Poor Design, Construction & Equipment -Hull Integrity Failure (4) -Stability Failure (1) -Equipment Failure (2)	Bad Weather & Physical environment --Typhoon (1) - Gale warning (2) -Floating Objects (2)
OUTCOME	Sinking (5) & Submerging (1) Death- 206			

Figure 5-2 *Accimap Model for Sinking and Submerging*

As shown in Table 5-2, four (4) out of five (5) were steel-hulled, while, the other one (1) was made of fiberglass.

Table 5-2. Summary of Sinking & Submerging Accidents

DATE	VESSEL	GRT	AGE	HULL MATERIAL	FERRY TYPE	TRADING LICENSE	LOCATION	HULL, STABILITY & WATERTIGHT INTEGRITY FAILURE	CASUALTY
Dec-09	MV BALENO 9	199	17	STEEL	RO PAX	COASTWISE	AT SEA	HULL RAPTURED	**50**
Aug-13	MV THOMAS AQUINAS (Collision)	1405	40	STEEL	RO PAX	COASTWISE	AT TSS	HULL COMPROMISED DUE TO COLLISION	**120**
Sep-14	MV MAHARLIKA II	1865	30	STEEL	RO PAX	COASTWISE	AT SEA	CARGO SHIFTING PLUS FLOODING AT STEERING ROOM	8
Dec-16	MV STARLITE ATLANTIC 2	1407	41	STEEL	RO PAX	COASTWISE	AT SEA	CAR DECK IS OPEN	**19**
Dec-17	MV MERCRAFT3	206	1	FIBER GLASS	PAX	COASTWISE	AT SEA	HULL RAPTURED	**14**
Nov-20	MBCA GESU DE BAMBINO (Submerging)	19	10	WOODEN	PAX	BAY & RIVER	AT SEA	HULL RAPTURED	1

In addition, another glaring point observed was the location of the accident which occurred in the open sea described with deep waters. Thus, once the hull integrity, the watertight integrity, and stability are compromised, if it is made of steel or fiberglass, surely, it will sink. The capsizing of the MV Princess of the Stars and the MV Island Roro-1 could have further resulted in sinking if it did not happen in shallow waters.

Regarding the four (4) steel-hulled and one (1) fiberglass-made ferries, their damage stability and compartmentalization features were likewise questionable. Arguably, ships should be designed and constructed with these features to ensure floating ability even they incurred damage. Similarly, the casualty for sinking accidents is also high because passengers are trapped inside the ferries attributable to the ferries' design.

5.3 Ramming/Collision/Allision

Furthermore, Figure 5-3 exhibited three (3) ramming, one (1) collision, and one (1) allision incident which resulted in zero deaths. Similar to the capsizing and sinking accidents, under the physical, actor, and events processes and condition level, ramming, collision, and allision incidents and accidents were caused by poor safety management, poor seamanship, and bad weather plus support service failure.

Both MV Cotabato Princess and MV Ocean Jet 12 rammed a pier during a docking maneuver. Likewise, Masters of both ferries claimed that their docking maneuver was affected by bad weather. Also, MV Cotabato Princess did not have a pilot onboard and tug assistance as required by the Port Authority.

Meanwhile, MV Maria Matilde rammed a wall of mountain rock in the island of Romblon due to the Officer of Watch (OOW) and the entire bridge team's lack of situational awareness during navigation. Also, LCT Poseidon, on the other hand, had an allision with another stationary vessel mainly due to the Master's poor seamanship and worsened by the bad weather also.

Lastly, MV Thomas Aquinas collided with MV Sulpicio Express 7 because of the lack of communication between the two vessels. Although, the latter was inside the wrong lane in the Traffic Separation Scheme (TSS). Available communication equipment was not utilized to its maximum to ensure collision avoidance and safety of navigation. Additionally, the absence of a lighted buoy in the TSS was an add-on factor to the accident.

In like manner, under the organizational level, the Poor Ferry Safety Culture was also prevalent in the said ferries solely because of other safety inspection enforcements shortcomings. On the map, PDI has no participation in safety enforcement except for checking the correctness of the ferries' manning requirement. Also, the said enforcement lapses were rooted in the absence of policies and infrastructure on the safety inspector's centralized (ship risk profile, certification, and enforcement) information system and the safety inspector's performance oversight.

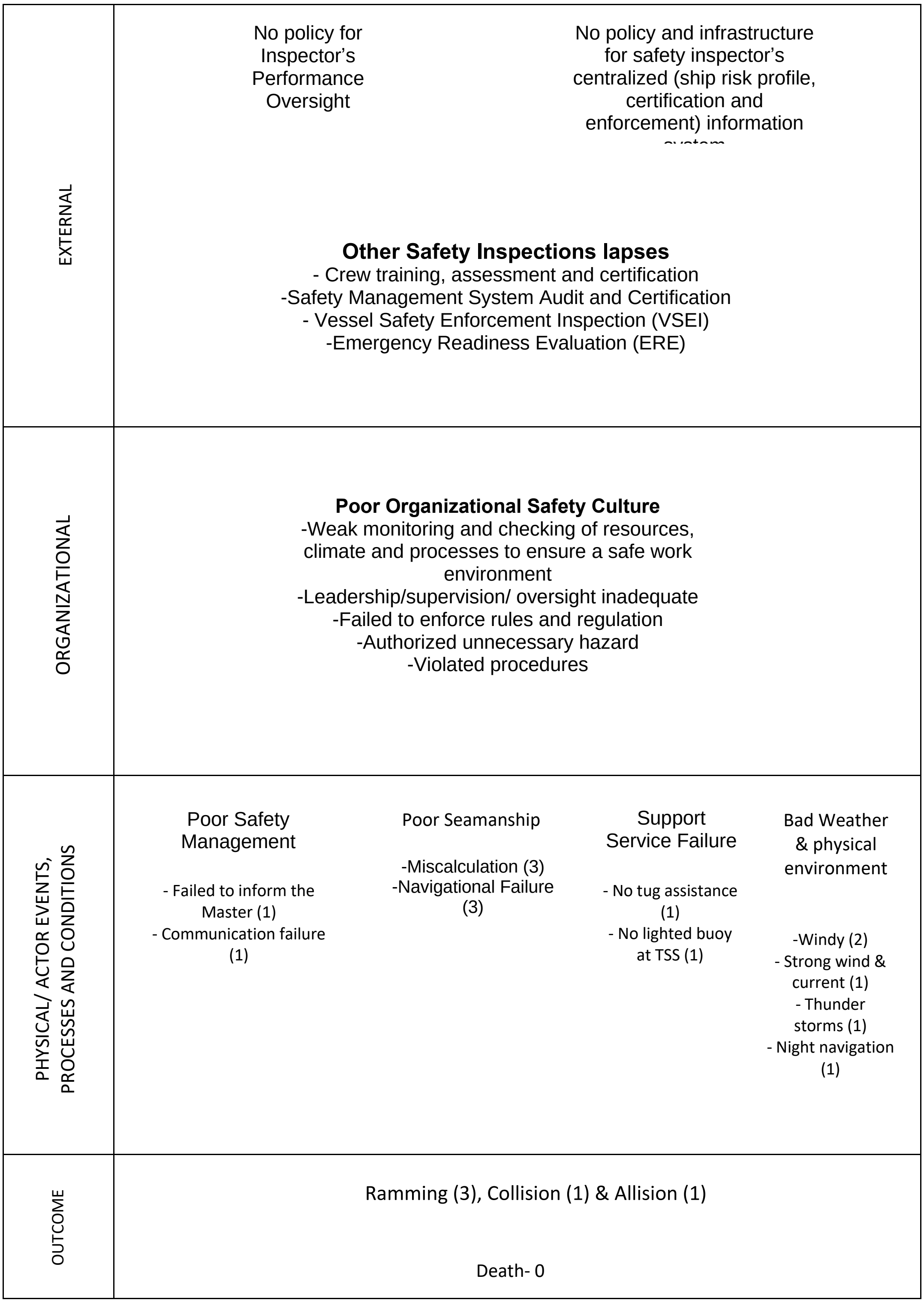

Figure 5-3 *Accimap Model for Ramming, Collision & Allision*

Generally, as shown in Table 5-3, the ramming, collision, and allision accidents were attributed to the master's miscalculation and the crew's lack of situational awareness. In these accidents, poor navigational skills particularly the no observance of the collision regulations (COLREGS) were highlighted that directly caused the accidents.

Table 5-3. Summary of Ramming, Collision and Allision

DATE	VESSEL	NATURE	GRT	AGE	HULL MATE RIAL	FER RY TYPE	TRADING LICENSE	LOCA TION	CAUSAL FACTOR	CASUA LTY
Jan-10	MV COTABA TO PRIN CESS	RAM MING	7,977	40	STEEL	ROPAX	COAST WISE	IN PORT	MASTER MISCALCUL ATION	0
Aug-13	MV THOMAS AQUINAS	COLLI SION/ SINKING	1,405	40	STEEL	ROPAX	COAST WISE	AT TSS	MASTER MISCALCUL ATION	120
Jan-17	LCT POSEI DON	ALLI SION	1,285	38	STEEL	ROPAX	COAST WISE	IN PORT	MASTER MISCALCUL ATION	0
Sep-17	MV MA MATILDE	RAM MING	1,266	46	STEEL	ROPAX	COAST WISE	AT SEA	LACK OF SITUATIO NAL AWARE NESS	0
Sep-17	MV OCEAN JET 12	RAM MING	242	19	ALUMI NUM	PAX	COAST WISE	IN PORT	MASTER MISCALCUL ATION	0

To prevent ramming of ports, these ferries should at least have line throwing devices and enough fenders as an aid to facilitate smooth docking maneuvers. Also, the majority of these ferries were affected by the wind and current conditions in the area. However, mariners were not excused from the unpredictable sea conditions and are expected to be adaptable to them.

Ironically, the casualty for collision accidents is none except for the MV St. Thomas Aquinas which subsequently sunk after the collision incident. In comparison to the capsizing and sinking accidents, ramming, collision, and allision accidents are not as fatal, as long as the ferry's hull and stability are not breached and they stay upright and floating.

Another evident contributory factor to these type of accidents was the absence of support services such as pilots, tug assistance and aids to navigation such as lighted buoys in the traffic separation scheme (TSS) lanes.

5.4 Fire

Lastly, Figure 5-4, as shown below, included one (1) fire accident which claimed forty-two (42) lives.

EXTERNAL	No policy for Inspector's Performance Oversight No policy and infrastructure for safety inspector's centralized (ship risk profile, certification and enforcement) information system **Other Safety Inspections lapses** - Ferries design, construction, equipment and stability inspection, survey and certification - Crew training, assessment and certification -Safety Management System Audit and Certification - Vessel Safety Enforcement Inspection (VSEI) -Emergency Readiness Evaluation (ERE)
ORGANIZATIONAL	**Poor Organizational Safety Culture** -Weak monitoring and checking of resources, climate and processes to ensure a safe work environment -Leadership/supervision/ oversight inadequate -Failed to enforce rules and regulation -Authorized unnecessary hazard -Violated procedures
PHYSICAL/ ACTOR EVENTS, PROCESSES AND CONDITIONS	Poor Safety Management - No Main Engine Planned maintenance (1) - No emergency procedure (1) - No maintenance of CO2 fixed extinguishing system Poor Seamanship - Maintenance Failure (2) Poor Design, Construction & Equipment -Equipment Failure (No fire dampers) (1) - Engine room is not airtight
OUTCOME	Fire (1) Death- 42

Figure 5-4 *Accimap Model for Fire*

Similar to the capsizing and sinking accidents, under the physical, actor, and events processes and condition level, the fire accident was characterized by the combination of poor safety management, poor seamanship, and poor design, construction, and equipment. But unlike the other type of accidents and incidents, it was not affected by any bad weather.

MV Lite Ferry 16 caught fire because of the absence of planned maintenance of its main engine. Furthermore, it was aggravated by the absence of fire dampers and the failure of the fixed fire extinguishing system to work properly.

Similar to the other accidents and incidents, the Poor Ferry Safety Culture was present in the said ferry partially because of other safety inspection enforcements lapses which did not include PDI, also. Moreover, planned maintenance is not practicable to be check during PDI.

Likewise, the said enforcement lapses were rooted in the absence of policies and infrastructure on the safety inspector's centralized (ship risk profile, certification, and enforcement) information system and the safety inspector's performance oversight.

On one hand, as shown in Table 5-4, the fire accident and the alleged overloading incident among the other ferries, had the least number.

Table 5-4 *Summary of Fire Accident and Alleged Overcrowding Incident*

DATE	VESSEL	NATURE	GRT	AGE	HULL MATE RIAL	FERRY TYPE	TRADIN G LICENSE	LOCA T ION	CAUSAL FACTOR	CASU ALTY
Aug-19	MV LITE FERRY 16 2019	FIRE	992	40	STEEL	ROPAX	COAST WISE	AT SEA	NO PLANNED MAINTENA NCE SYSTEM	42
Apr-18	MV VIRGIN DE PENAFRANCI A VII	ALLEGED OVER CROWD ING	678	12	STEEL	ROPAX	COAST WISE	AT SEA		0

MV Virgin de Penafrancia VII's alleged overloading incident was an example that passengers were already knowledgeable and had the safety awareness to participate in the process of improving the entire ferry safety culture. Also, passengers' safety awareness is another avenue to regulate the ferry industry and improve its safety.

5.5 Summary

In summary, as shown in Table 5-5, all major causal factors per accident and incident types were tabulated for a clearer understanding..

Table 5-5 *Summary of the AcciMaps' Four Accident and Incident Types*

	Capsizing	Sinking/ Submerging	Ramming/ Collision/ Allision	Fire
Poor safety management	●	●	●	●
Poor seamanship	●	●	●	●
Poor design, construction, stability and equipment	●	●		●
Bad Weather & physical environment	●	●	●	
Service Support Failure			●	
Poor Organization Safety Culture	●	●	●	●
PDI lapses	●	●		
Other safety Inspections lapses	●	●	●	●
Not updated Typhoon Policy	●			
Not updated MBCA design & construction	●			
No inspector performance oversight	●	●	●	●
No safety inspector computerized information system	●	●	●	●

Moreover, Table 5-6, as shown below, is the Summary of the Safe Ferry Model, HFACS and AcciMap Causal Factors.

Table 5-6 *Summary of the Safe Ferry Model, HFACS and AcciMap Causal Factors*

	MODEL OF SAFE FERRY	HFACS CAUSAL FACTORS	ACCIMAP CAUSAL FACTORS
1	**Ferry Operator Safety Culture:**		
	Ships suitable for intended service	Stability failure	Poor design, construction, equipment and stability
		Hull failure	
		Watertight integrity failure	
		Unsafe MBCA superstructure design	
	Well-maintained ships	Lack supply and materials	Poor safety management
		Improper cargo lashing	
		SMS Failure	
		Leadership/ oversight inadequate	
		Procedure failure	
		Inaccurate passenger manifest	
		Overcrowding	
		Overloading	
		Inadequate support services	
	Properly operated, crewed ships	Navigational failure	Poor crew competence/ seamanship
		Master miscalculation	
		Inadequate manning	
		Crew Interaction	
		Personal readiness	
2	**Regulatory regime:**		
	Appropriate regulations	Absent and outdated regulations	Absent and outdated regulations
	Enforcement	Absence of PDI	PDI and other safety enforcement lapses
		PDI Errors	
		PDI Violations	
3	**Hazardous Weather Notification**	Squall	Bad weather
		Typhoon	
		Gale	
		Windy	
4	**Emergency Response**		
	Communication - Alerting /Location	Emergency and radio equipment not readily available	Poor safety management and equipment
	Rescue / assistance resources		
5	**Knowledgeable Passengers**	Alleged Overloading	

Chapter 6

CONCLUSION AND RECOMMENDATIONS

In this chapter, relative conclusions will be drawn out from the HFACS and AcciMap results analysis. Further, corresponding recommendations will be forwarded to the concerned ferry industry actors for their further validation and final consideration.

6.1 Conclusion

6.1.1 Ferry Operator Safety Culture

Based on the above results and analysis derived from the HFACS coding and the AcciMap processes, one of the biggest challenges which confront the Philippines ferry industry is the poor ferry operator's safety culture. Primarily, it was exhibited by the poor quality of the design, construction, equipment, and stability of ferries itself. Particularly, the design, construction, equipment, and stability failures were identified that caused and/or contributed to the maritime accidents. Additionally, the absence of proper cargo lashing equipment and fittings, further, aggravated the instability of ferries. (See Table 6-1)

Table 76-1 *Summary of Major Causal Factors per Ferry Accident and Incident*

No	Date	Vessel Name	Poor Safety Management	Poor Seaman ship	Poor design, construction, stability and equipment	Service Support Failure	Bad Weather and/or floating object
1	Jun-08	MV Princess of the Stars	●	●	●		●
2	Nov-08	MBCA Don Dexter			●		●
3	Dec-09	MV Baleno 9	●	●	●		●
4	Jan-10	MV Cotabato Princess		●		●	●
5	Aug-13	MV St. Thomas Aquinas	●	●	●	●	
6	Sep-14	MV Maharlika II	●	●	●		●

7	Jul-15	MBCA Kim Nirvana B	●	●	●		●
8	Dec-16	MV Starlite Atlantic 2	●	●	●		●
9	Jan-17	LCT Poseidon 26		●			●
10	Jun-17	MBCA Alad Express 2			●		●
11	Sep-17	MV Ma Matilde	●	●			●
12	Sep-17	MV Ocean Jet 12		●			●
13	Dec-17	Mv Mercraft3	●	●	●		●
14	Apr-18	MV Virgin De Penafrancia VII					
15	Aug-19	MV Lite Ferry 16	●	●	●		
16	Aug-19	MBCA Chichi			●		●
17	Aug-19	MBCA Keziah			●		●
18	Aug-19	MBCA Jenny Vince			●		●
19	Dec-19	MV Island Roro	●	●	●		
20	Nov-20	MBCA Gesu De Bambino			●		●

Moreover, failures in the safety management system implementation from the different echelons of the ferry organization, greatly add to the occurrence of the mishaps.

Similarly, poor crew competence is another accident causal factor plaguing the country's domestic ferry industry. Although, poor crew competence is relatively lower compared to the poor quality of the design, construction, equipment, and stability and the SMS implementation failures of ferries.

Also, the poor crew competence, the poor quality of the design, construction, equipment, and stability of ferries, and the SMS implementation failure factors are quite contradictory to the valid safety certificates possessed by the ferries involved in the accidents and incidents. Almost all of the ferries out of the twenty (20) ferries have valid ship and crew safety certificates such as passenger ship safety certificates, minimum manning certificates, ship station licenses, safety management certificates, and the likes. However, there is a dilemma that the safety certificate's authenticity does not reflect the true condition of the ferry, the crew competence, and its safety management.

6.1.2 Pre-Departure Inspection

Generally, as shown in Table 6-2, the PDI enforcement is very effective in the areas of implementing "No sailing policy" and proper cargo lashing, checking the ferries' safety documents, preventing overcrowding, and checking of life-saving appliances only because such inspection items are tangible. However, PDI is not so effective in ensuring ferry stability, verifying the actual operating condition of the ferry itself and its equipment, preventing overloading, and ensuring an accurate passenger manifest because such inspection concerns are more technical and require more than the capability of the naked eye. Additionally, there is also time constraint during PDI. Moreover, visual scrutiny will not easily reveal the seaworthiness of the ferry, including its equipment, and the accuracy of passenger manifest.

Table 6-2 *PDI strengths and weaknesses*

Strengths	Weaknesses
• Enforcing "No sailing policy" during bad weather	• Ensuring ferry's stability
• Implementing the proper cargo lashing	• Verifying the actual operating condition of the ferry itself and its
• Checking the completeness and credibility of ferry and crew safety	• Preventing overloading
• Preventing overcrowding	• Ensuring the passenger manifest accurateness
• Checking of lifesaving equipment	

Also, verifying the level of crew competence and its safety management system during PDI, aside from the checking the crew and safety management certificates, poses a great challenge for inspectors because of PDI time constraints.

6.1.3 PDI and Other Domestic Ferry Safety Enforcement Activities

The Philippines' poor ferry operators' safety culture, in one way or another, is linked with the regulators' enforcement lapses. Aside from the fragmented regulatory and enforcement set up of the country's maritime agencies, its inspectors and safety supervisors are not properly equipped to particularly target and profile a single ferry, the crew, and the ferry company's safety management. This is due to the absence of the safety inspector's centralized (ship risk profile, certification, and enforcement) information system and the safety inspector's performance oversight policies and infrastructure, similar to APCIS of Tokyo MOU.

The ability to have an overall control by specifically profiling, targeting, and validating the crucial components of the ferry industry status including the ferries, its crew, and its safety management system is a very powerful tool for safety inspectors in discharging their functions.

In like manner, collecting and consolidating data about ferries, crew, and safety management inspections, certifications, surveys, deficiencies, detentions, near misses, incidents, accidents, search and rescue response, compensation, penalization, and others are equally vital in the enhancement of the Philippines domestic ferry safety. These data once consolidated and properly processed, will paint the complete and precise picture of the country's domestic ferry industry status. However, its absence will result in a loosely regulated ferry industry plagued with many safety regulations violations and accidents.

Overcrowding, overloading, improper lashing of cargoes, sailing during typhoon and gale and ferries design, construction, and stability related violations of both the operators, managers, and regulators need to be held accountable and given stiffer sanctions or even penalization.

Furthermore, a safety inspector's performance oversight body is likewise needed to counter-check their work procedures and implementation, once in a while. This mechanism is geared to have regulatory and enforcement transparency.

6.1.4 Hazardous Weather Notification

Presently, hazardous weather notification and "No sailing policy" about typhoon bulletin and gale warning have been enforced very effectively. As such, the "No sailing policy" during with typhoon and gale warning significantly reduced the number of maritime accidents in the country since 2013. However, results also revealed that other weather factors and phenomena such as strong wind, current, waves tornado, and squall still spells danger in the ferry industry especially to those ferries that have issues with design, construction, and stability. But since, these weather elements at sea are very unstable, unpredictable, and harsh, the ferries, their crew, and the management itself should adapt to such physical environment by ensuring that the ferries are seaworthy, the crew is competent mariners, and that they are religiously exercising the company's safety management.

6.1.5 Communication- Alerting/Location

Emergency and radio communication equipment not readily available factor was the only one identified with this category. Furthermore, its frequency was relatively low. Nevertheless, there is still a need to emphasize checking these items in future inspections.

6.1.6 Knowledgeable Passengers

The alleged overloading is one (1) incident which clearly illustrates the above sub-topic. The passengers or the riding public, as shown in Badajos (2020), plays a very crucial role in the process of improving domestic ferry safety. Most often, they are the victims of these sea mishaps, thus, the more they have to be concerned and vigilant.

6.2 Recommendations

Similar to the above chapters, these research recommendations are laid down using the Safe Ferry Model format to include Accimap's major causal factors for clearer presentation. As shown in Table 6-3, hereunder are the author's recommendations to further enhance the Philippines domestic ferry safety and other safety enforcement activities including PDI.

Table 6-3 *Recommendations*

	MODEL OF SAFE FERRY	ACCIMAP MAJOR CAUSAL FACTORS	RECOMMENDATIONS
1	**Ferry Operator Safety Culture:**		
	Ships suitable for intended service Well-maintained ships Properly operated, crewed ships	Poor design, construction, equipment and stability Poor safety management Poor crew competence/ seamanship	Intensify the campaign for the elimination of substandard ferries and incompetent crew -by conducting stringent ferry, crew and SMS inspections, trainings, assessments and certifications to ensure ferries seaworthiness, crew's competence and SMS compliance -by conducting stringent PDI and regular VSEI and ERE
2	**Regulatory regime:**		
	Appropriate regulations	Absent and outdated regulations	To continuously formulate, revisit and update maritime safety policies in the furtherance of ferry safety. To establish a safety inspector's centralized information system and a safety inspector's performance oversight policies and infrastructure To collect and consolidate data pertaining to ferries, crew and safety management inspections, certifications, surveys, deficiencies, detentions, near misses, incidents, accidents, investigations, search and rescue response, compensation, penalization and others for processing and analyzation
	Enforcement	PDI and other safety enforcement lapses	
3	**Hazardous Weather Notification**	Bad weather	To adopt and utilize "now casting" technology To formulate regulations on other weather phenomenon in coordination with the country's weather bureau
4	**Emergency Response**		
	Communication - Alerting /Location	Poor safety management and equipment	Intensify the campaign for the elimination of substandard ferries by conducting stringent ferry inspections and certifications, PDI and regular VSEI and ERE
	Rescue / assistance resources		
5	**Knowledgeable Passengers**		To launch an aggressive and continuous passengers' safety awareness program

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APPENDICES

Appendix A Detailed Information of 20 selected Domestic Ferry Accidents and Incidents

NO	DATE	VESSEL NAME	AREA	YEAR BUILT	GRT	NATURE OF INCIDENT	SEVE RITY	CASUA LTY	SYNOPSIS
1	Jun-08	MV PRINCESS OF THE STAR	SIBUYAN, ROMBLON	1984	23,800	CAPSIZING	VERY SERIOUS	DEATH-814	On 20 June 2008, the Princess of the Stars departed Port of Manila enroute to Cebu City. In accordance with the sailing policy, the said vessel was allowed to sail even when a Tropical Cyclone Warning Signal (TCWS) was already hoisted. Unfortunately, Typhoon Frank changed course and went directly to the path of the said vessel. At noon of 21 June 2008, MV Princess of the Stars was able to send a distress signal. At 1230H, radio contact was lost. On the very same day, MV Princess of the Stars capsized off the coast of San Fernando, Romblon at the height of Typhoon Frank.
2	Nov-08	MBCA DON DEXTER	DIMASALANG MASBATE	2002	13.7	CAPSIZING	VERY SERIOUS	DEATH-42 MISSING -10	MBCA Don Dexter, from the Zuniga Sea Line Pier or Dimasalang Pier, departed and was bound for Bulan, Sorsogon on November 4, 2008 at about 1:30 o'clock in the afternoon. At around 2 o'clock while at the vicinity of Macaraguit Island, Masbate, the said motorbanca listed on its port side and eventually overturned, trapping some of the passengers inside, resulting to the death of forty-two 42 passengers and damage of numerous goods.

NO	DATE	VESSEL NAME	AREA	YEAR BUILT	GRT	NATURE OF INCIDENT	SEVE RITY	CASUA LTY	SYNOPSIS
3	Dec-09	MV BALENO 9	VERDE ISLAND BATANGAS	1992	199	SINKING	VERY SERIOUS	DEATH-6 MISSING -44	On or about 262130H December 2009, MV Baleno (departed from Port of Calapan bound for Batangas Port. The said vessel was manned by 14 crew with 9 rolling cargoes. On or about 2146H of same date, CGS VTMS PPA Batangas observed an echo on the radar passing Baco Islands. On or about 2210H, the echo on the radar disappeared. On or about 2230H, CGS Calapan received a telephone call from CG Detachment Sta Clara of CGS Batangas that MV Baleno 9 was in distress at vicinity Verde Island and Baco Island. It was reported that MV Baleno 9 sunk on or about 262230H December 2009.

4	Jan-10	MV COTABATO PRINCESS	ILOILO ARRASTRE PIER	1970	7,977	RAMMING/ COLLISION	LESS SERIOUS	DEATH-0	On or about 1300H of 04 September 2008, MV Cotabato Princess allegedly rammed the Iloilo Arrastre Pier. According to the Captain Virgilio M Ylagan, the Master of the MV Cotabato Princess, that while the vessel was on docking maneuver at port of Iloilo City 1300H of 04 September 2008, both main engines stopped, vessel with enough distance from the wharf approaching the assigned berthing space. That while the docking maneuvering on progress, The Master noticed that the stern was drifting away from the wharf due to strong flood current and due to strong northeasterly winds. The Master controlled the vessel's momentum towards the wharf by using both main engine and bow thruster, but the vessel's port bow drifting towards the wharf that was under construction. At 1303H of same date, the vessel impacted the installed concrete piles.

NO	DATE	VESSEL NAME	AREA	YEAR BUILT	GRT	NATURE OF INCIDENT	SEVE RITY	CASUA LTY	SYNOPSIS
5	Aug-13	MV THOMAS AQUINAS	CEBU CHANNEL	1973	1,405	COLLISION/ SINKING	VERY SERIOUS	DEATH-55 MISSING -65	On 16 August 2013, MV St Thomas Aquinas, a passenger-cargo ship, collided with MV Sulpicio Express Siete at vicinity off Talisay, Cebu causing it to sink and resulted to 108 deaths and 29 missing. After leaving the port of Cebu, MV Sulpicio Express Siete traveled at a speed of 9 knots within a channel regulated by the TSS. Meanwhile, MV St Thomas Aquinas was sailing inbound when the two vessels collided. After the collision, MV St Thomas Aquinas was flooded and the Master announced “abandonship”. In a matter of minutes, MV St Thomas Aquinas sunk. Many perished because they were caught unaware and were trapped inside the vessel.

NO	DATE	VESSEL NAME	AREA	YEAR BUILT	GRT	NATURE OF INCIDENT	SEVE RITY	CASUA LTY	SYNOPSIS
6	Sep-14	MV MAHARLIKA II	SOUTHERN LEYTE	1984	1,865	SINKING	VERY SERIOUS	DEATH-2	MV Maharlika 2 departed Lipata Port, Surigao City on or about 131200H September 2014 with 13 rolling cargoes, 90 passengers and 31 crew members. Seven hours earlier on or about 0500H, PAGASA issued a Gale Warning No. 2 for the eastern seaboard of Mindanao. MV Maharlika 2 experienced favorable weather as it departed Lipata Port until it reached Bilaa Point, Surigao City. Thereafter, MV Maharlika 2 experienced strong winds and rough sea while navigating along Surigao Strait. While steadily traversing the Surigao Strait, the cargo securing devices progressively failed to maintain the respective stowage positions of the rolling cargoes. On or about 1415H, MV Maharlika 2 listed 3-4 degrees to starboard side. On or about 1430H MV Maharlika suffered steering casualty. On or about 1700H, the starboard list increased to 40-45 degrees. At 1730H, the Master announced “Abandonship”. At 1750H, MV Maharlika 2 sunk at vicinity of Binit Point.

NO	DATE	VESSEL NAME	AREA	YEAR BUILT	GRT	NATURE OF INCIDENT	SEVE RITY	CASUA LTY	SYNOPSIS
7	Jul-15	MBCA KIM NIRVANA B	ORMOC PORT	2015	33	CAPSIZING	VERY SERIOUS	DEATH-62	MV Kim Nirvana B is a wooden passenger motor banca authorized to load cargo for 60 days after being issued with special permit. On or about 02 July 2015 at 1215 o'clock in the afternoon, MBCA Kim Nirvana B departed and backed off the Port of Ormoc with passengers and cargoes onboard bound to Pilar, Camotes, Cebu. At around 12:20 o'clock, while MBCA Kim Nirvana B was approximately 200 meters from its origin at the Port of Ormoc, she moved forward making a hard turn to port. The said motorbanca did not complete the turn as she listed to starboard and subsequently capsized. This incident caused the death of sixty-two (62) passengers.

NO	DATE	VESSEL NAME	AREA	YEAR BUILT	GRT	NATURE OF INCIDENT	SEVE RITY	CASUA LTY	SYNOPSIS
8	Dec-16	MV STARLITE ATLANTIC 2	MARICABAN ISLAND BATANGAS	1975	1,407	SINKING	VERY SERIOUS	DEATH-1 MISSING -18	On 250300H December 2016, MV Starlite Atlantic was allowed to take shelter at Pinamucan Point Anchorage area, Batangas City with 33 crew onboard. PAGASA issued a weather bulletin at 0800H of same date hoisting TWCS No. 2 in Batangas. BY 1100H, PAGASA hoisted TWCS No. 3 over Batangas. The MV Starlite Atlantic went missing and believed to have sunk within the vicinity of Maricaban Island at the height of Typhoon Nina on 26 December 2016. Fourteen (14) crew were rescued, while, one (1) dead body was recovered.

NO	DATE	VESSEL NAME	AREA	YEAR BUILT	GRT	NATURE OF INCIDENT	SEVE RITY	CASUA LTY	SYNOPSIS
9	Jan-17	LCT POSEIDON 26 & MV REINA GENOVEVA	ALLEN SAMAR	1979	1,285	ALLISION/ COLLISION	SERIOUS	DEATH-0 HULL DAMAGE	On or about 060810H January 2017, LCT Poseidon 26, a roro passenger ship, while conducting maneuvering and docking operation at the vicinity seawater of Port of Balwarteco, Brgy Looc, Allen, Northern Samar, the portside of subject vessel's forward ramp accidentally hit the portside freeboard of MV Reina Genoveva of Montenegro Shipping Line which was already docked at the port, resulting to a hull puncture and damages to its hydraulic piping system.
10	Jun-17	MBCA ALAD EXPRESS 2	ROMBLON	2007	12.8	CAPSIZING	VERY SERIOUS	DEATH-5	On or about 091300H June 2017, a report from a concerned citizen was received by Coast Guard Station Romblon that MBCA Alad Express 2 capsized on or about 1200H at vicinity Agbudia, Romblon, Romblon. Based on the account of the crewmembers and some of the passengers during interrogation, a strong tornado accompanied with complete darkness suddenly appeared from the horizon directly hitting them, tossing them upward to sideward, making the motorbanca to suddenly capsized.

NO	DATE	VESSEL NAME	AREA	YEAR BUILT	GRT	NATURE OF INCIDENT	SEVE RITY	CASUA LTY	SYNOPSIS
11	Sep-17	MV MA MATILDE	TABLAS ROMBON	1971	1,266	RAMMING/ COLLISION	SERIOUS	INJURED-51	MV Maria Matilde's trip from Batangas City to Odiongan, Romblon was smooth. However, her voyage from Odiongan, Romblon to Romblon, Romblon turned mysterious as she directly bumped or hit a wall of mountain rock at the area of incident. The said vessel sustained major damage at the upper portion of the ship's bow but above the waterline. In command during the incident was the Second Officer with able body seaman, On the Job trainees (OJT's) and cadets. The ship's speed was 12-13 knots when it rammed the rock leaving fifty-one (51) injured passengers and crew.
12	Sep-17	MV OCEAN JET 12	BATANGAS PORT	1998	242	RAMMING / COLLISION	SERIOUS	INJURED - 6 W/ VESSEL DAMAGE	On or about 041800H September 2017, MV Ocean Jet 12 rammed the pier of berth 6 at the Asian Terminal Incorporated, Port of Batangas, Batangas City while on docking maneuver. The said incident injured one (1) crew and six (6) passengers. It also damaged the ship's starboard bow and anchor and portion of the pier.

NO	DATE	VESSEL NAME	AREA	YEAR BUILT	GRT	NATURE OF INCIDENT	SEVE RITY	CASUA LTY	SYNOPSIS
13	Dec-17	MV MERCRAFT3	INFANTA QUEZON	2016	206	SINKING	VERY SERIOUS	DEATH-4	On or about 210900H December 2017, MV Mercraft 3 with passengers onboard departed Port of Real, Quezon bound to Polilio Island, Quezon. While underway at the vicinity of Dinahican Point, Quezon, the said vessel encountered strong, big and successive waves. Accordingly, the Master heard a loud banging sound within the starboard bow and noticed that the vessel was listing to starboard. The Master made some precautionary maneuvers to compensate the listing and prevent the ingress of water brought by the waves but was in vain. The whole vessel was flooded, thus, the Master declared "abandonship". The vessel slowly sunk which resulted to 5 deaths and 7 missing.

NO	DATE	VESSEL NAME	AREA	YEAR BUILT	GRT	NATURE OF INCIDENT	SEVE RITY	CASUA LTY	SYNOPSIS
14	Apr-18	MV VIRGIN DE PENAFRANCI A VII	PORT OF BANTON, ROMBLON	2006	678	OVER-CROWDING	LESS SERIOUS	DEATH-0	On or about 011700H April 2018, MV Virgin de Penafrancia VII departed from Port of Banton bound to Port of Lucena City via Kawit, Marinduque. Based on the Master's Declaration of Safety Departure (MDSD) duly signed by the Master, the vessel's authorized passenger capacity excluding crewmembers indicated six hundred eight (608). On or about 092100H April 2018, Coast Guard Station Romblon received a forwarded complaint concerning the alleged excess passengers onboard the said vessel. Meanwhile, Coast Guard Station Southern Quezon was task to intercept the said vessel upon arrival at Lucena Port. Head counting revealed that five hundred ninety-five (595) passengers were on board. Later on, it was clarified that the ship's Passenger Ship Safety Certificate (PSSC) was really 608. Further, the said authorized passenger capacity was duly supported by an approved accommodation plan and passenger insurance coverage.

NO	DATE	VESSEL NAME	AREA	YEAR BUILT	GRT	NATURE OF INCIDENT	SEVE RITY	CASUA LTY	SYNOPSIS
15	Aug-19	MV LITE FERRY 16	DAPITAN CITY	1995	992	FIRE	VERY SERIOUS	DEATH-4 MISSING -39	On or about 280023H August 2019, MV Lite Ferry 16 with 10 crew, 28 ancillaries, 207 passengers and 28 rolling cargoes caught fire from its main engine at vicinity off Tagolo Point, Dapitan City while enroute from Bato, Cebu to Dapitan City. This resulted to 3 deaths and total loss of the ship.
16	Aug-19	MBCA CHICHI	GUIMARAS STRAIT	2015	19	CAPSIZING	VERY SERIOUS	DEATH-11	On or about 031132H August 2019, MBCA Chi-chi with two (2) crew, two (2) ancillaries and forty-five (45) passengers including one (1) child onboard, departed from Parola Wharf, Iloilo City to Jordan Wharf, Guimaras. According to the Boat Captain, said motorbanca, while underway, he noticed the sky turned dark and the wind became strong at the starboard side and the visibility became poor. The said boat cannot withstand the strong wind causing the MBCA to list to port. The passengers, likewise, shifted further to portside. As a result, she overturned and eventually capsized.

NO	DATE	VESSEL NAME	AREA	YEAR BUILT	GRT	NATURE OF INCIDENT	SEVE RITY	CASUA LTY	SYNOPSIS
17	Aug-19	MBCA KEZIAH	GUIMARAS STRAIT	1972	5	CAPSIZING	VERY SERIOUS	DEATH - 0	On or about 031138H August 2019, MBCA Keziah 2 with two (2) crew and three (3) ancilliaries, without passengers onboard, departed from Parola Wharf, Iloilo City to Jordan Wharf, Guimaras. According to the Boat Captain, said motorbanca, while underway, approximately halfway to her destination, they encountered a sudden strong wind. The strong wind tilted the motorbanca to portside. The crew and ancillaries attempted to stabilize and balance the MBCA but failed. Eventually, the boat capsized at 1205H of the same date.
18	Aug-19	MBCA JENNY VINCE	GUIMARAS STRAIT	2004	10.6	CAPSIZING	VERY SERIOUS	DEATH- 20	On or about 031138H August 2019, MBCA Keziah 2 with two (2) crew and three (3) ancilliaries, without passengers onboard, departed from Parola Wharf, Iloilo City to Jordan Wharf, Guimaras. According to the Boat Captain, said motorbanca, while underway, approximately halfway to her destination, they encountered a sudden strong wind. The strong wind tilted the motorbanca to portside. The crew and ancillaries attempted to stabilize and balance the MBCA but failed. Eventually, the boat capsized at 1205H of the same date.

NO	DATE	VESSEL NAME	AREA	YEAR BUILT	GRT	NATURE OF INCIDENT	SEVE RITY	CASUA LTY	SYNOPSIS
19	Dec-19	MV ISLAND RORO	CAMOTES PORT	1978	196	CAPSIZING	SERIOUS	DEATH-0	On or about 311145H August 2019, MV Island Roro-I, a passenger-cargo vessel departed Port pf Danao, Danao City with 8 crew, 11 ancillaries, 149 passengers and 10 rolling cargoes. At 1445H of same date, the said vessel, while disembarking a ten (10) wheeler truck upon her arrival at Consuelo Port, San Francisco, Camotes, capsized.
20	Nov-20	MBCA GESU DE BAMBINO	ATIMONAN QUEZON	2010	19	SUBMERGIN G/ CAPSIZING	VERY SERIOUS	DEATH-1	On or about 301140H November 2020, a crew named Jomel Del Moro pf passenger MBCA Gesu de Bambino was found lifeless at a location not far from Atimonan Port. On or about 1207H, the said motorbanca was flooded by seawater which resulted to the submerging of motorbanca with eighteen (18) passengers and four (4) crew on board.

Appendix B Results of HFACS Coding
MV Princess of the Stars, 2008

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	decided to proceed enroute even with typhoon
			shifting of cargo / improper lashing
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	erroneous entries in the cert of stability
	PDIE 200	PDI Violation	
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	
	OP 200	Oversight	decided to proceed enroute even with typhoon
			modification of c deck to pax accomodation
			shifting of cargo / improper lashing
			failure to implement safety management system
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore	
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	shifting of cargo / improper lashing
			decided to proceed enroute even with typhoon
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	typhoon
		Technological environment	modification of c deck to pax accomodation
			improper lashing
			erroneous entries in the cert of stability
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	typhoon evasion failure
	AE 100	Decisions and judgement	decided to proceed enroute even with typhoon
			ballasting caused free surface effect
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	shifting of cargo / improper lashing
	AV 100	Exceptional	

MBCA Don Dexter, 2008

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	overcrowding
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	overcrowding
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	
	OP 200	Oversight	Passengers shifting to portside
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	Passengers shifting to portside
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	overcrowding
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	squall
		Technological environment	mbca design/ outriggers cracking
			Passengers shifting to portside
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	
	AE 100	Decisions and judgement errors	
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	overcrowding
	AV 100	Exceptional	
Total			

MV Baleno 9, 2010

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	cargo shifting / improper lashing of cargoes
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	Passenger manifest inaccuracy
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	
	OP 200	Oversight	passed through uncharted area
			Passenger staying at the cargo deck
			Passenger manifest inaccuracy
			cargo shifting / improper lashing of cargoes
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	passed through uncharted area
			Passenger staying at the cargo deck
			Passenger manifest inaccuracy
			cargo shifting / improper lashing of cargoes
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	hit an unidentified object
		Technological environment	vessel design / hull integrity / hull raptured
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	
	AE 100	Decisions and judgement errors	passed through uncharted area
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	Passenger staying at the cargo deck
			cargo shifting / improper lashing of cargoes
			Passenger manifest inaccuracy
	AV 100	Exceptional	
Total			

MV Cotabato Princess, 2010

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	no medical practitioner/ c/m and 4/e with expired seamans book and prc license
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	no medical practitioner/ c/m and 4/e with expired seamans book and prc license
			no pilot
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	no tugboat assistance
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	
	OP 200	Oversight	
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervisiin	
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	no tugboat assistance
			no pilot
			no medical practitioner/ c/m and 4/e with expired seamans book and prc license
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	sudden change of current and strong ne wind
		Technological environment	no tugboat assistance
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	master miscalculation
	AE 100	Decisions and judgement errors	
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	
	AV 100	Exceptional	

MV St Thomas Aquinas, 2013

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	failure to reduce speed
			both vessels failed to communicate
			SE7 inside TSS inbound lane
	OP 200	Oversight	
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	failure to reduce speed
			both vessels failed to communicate
			SE7 inside TSS inbound lane
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	night navigation 9pm
		Technological environment	no lighted bouys at TSS (by CPA)
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	failure to reduce speed
	AE 100	Decisions and judgement errors	both vessels failed to communicate
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	SE7 inside TSS inbound lane
	AV 100	Exceptional	

MV Maharlika II, 2014

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	improper lashing of cargoes
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	improper lashing of cargoes
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	improper lashing of cargoes
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	
	OP 200	Oversight	improper lashing of cargoes
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	cargo shifting/ improper lashing of cargoes
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	gale warning
		Technological environment	steering casualty
			cargo shifting/ improper lashing of cargoes
			flooding at steering room
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	
	AE 100	Decisions and judgement errors	
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	improper lashing of cargoes
	AV 100	Exceptional	
Total			

MBCA Kim Nirvana, 2015

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	overcrowding
			overloading
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	hard port with stbd ahead and port astern
	OP 200	Oversight	overcrowding
			overloading
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	overcrowding
			overloading
			hard port with stbd ahead and port astern
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	strong waves
		Technological environment	mbca design with 2 decks
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	hard port with stbd ahead and port astern
	AE 100	Decisions and judgement errors	
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	overcrowding
			overloading
	AV 100	Exceptional	
Total			

MV Starlite Atlantic 2, 2017

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	no back-up power
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	communication from ship to VTMS and Coy
	OP 200	Oversight	choosing sheltering area
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	choosing sheltering area
			communication from ship to VTMS and Coy
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	no back-up power
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	typhoon
		Technological environment	car deck design is open
			no back-up power
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	
	AE 100	Decisions and judgement errors	choosing sheltering area
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	
	AV 100	Exceptional	communication from ship to VTMS and Coy
Total			

LCT Poseidon 26, 2017

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	no procedure on safe docking
	OP 200	Oversight	
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	no guidance on safe docking
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	windy
		Technological environment	
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	master miscalculation
	AE 100	Decisions and judgement errors	
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	
	AV 100	Exceptional	
Total			

MBCA Alad Express 2, 2017

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	overcrowding
	PDIE 200	PDI Violation	Passenger manifest inaccuracy
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	
	OP 200	Oversight	Passenger manifest inaccuracy
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	Passenger manifest inaccuracy
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	strong tornado
		Technological environment	mbca design
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
AE XXX	Errors		
	AE 000	Skill-based errors	overcrowding
	AE 100	Decisions and judgement errors	
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	inaccurate Passenger manifest
	AV 100	Exceptional	
Total			

MV Ma Matilde, 2017

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	no bell book / QM's logbook
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	SMS on navigational watchkeeping distance to nearest shoreline
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	
	OP 200	Oversight	
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	no captain night order book
			look outs not using binoculars
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	dark with thunderstorms
		Technological environment	
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	OJT Jabad noticed the unusual deviation of route but failed to inform 2nd Officer
		Personal Readiness	QM Fernandez stated that they are on the right track
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	second officer lack of situational awareness
	AE 100	Decisions and judgement errors	failed to inform the master
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	
	AV 100	Exceptional	
Total			

MV Ocean Jet 12, 2017

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	no procedure on safe docking and familiarization no safe speed regulation
	OP 200	Oversight	
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	no guidance on safe docking
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	windy
		Technological environment	
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	lack of familiarization
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	master miscalculation
	AE 100	Decisions and judgement errors	
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	
	AV 100	Exceptional	
Total			

MV Mercraft 3, 2017

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	inadequate manning
			inaccurate passenger manifest
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	inadequate manning
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	failure to control passenger during distress situation
			failure to close engine room cover
	OP 200	Oversight	
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	failure to control passenger during distress situation
			failure to close engine room cover
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	inadequate manning
			inaccurate passenger manifest
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	possibly hit by a hard submerged object
			gale warning
		Technological environment	vessel and structural design / seaworthiness / hull raptured
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	failure to control passenger during distress situation
			failure to close engine room cover
	AE 100	Decisions and judgement errors	
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	inadequate manning
			inaccurate passenger manifest
	AV 100	Exceptional	
Total			

MV Virgin de Penafrancia VII, 2018

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	
	OP 200	Oversight	amended passenger capacity in the PSSC
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	amended passenger capacity in the PSSC
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	
		Technological environment	amended passenger capacity in the PSSC
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	failure to submit updated safety docs
	AE 100	Decisions and judgement errors	
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	
	AV 100	Exceptional	
Total			

MV Lite Ferry 16, 2019

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	engine room is not airtight / no fire dampers
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	no main engine planned maintenance
			no maintenance co2 fixed extinguishing system
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	no emergency procedure
	OP 200	Oversight	
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	no maintenance co2 fixed extinguishing system
			no emergency procedure
			engine room is not airtight / no fire dampers
			no main engine planned maintenance
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	
		Technological environment	no maintenance co2 fixed extinguishing system
			no emergency procedure
			engine room is not airtight / no fire dampers
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	
	AE 100	Decisions and judgement errors	
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	no main engine planned maintenance
	AV 100	Exceptional	
Total			

MBCA Jenny Vince, MBCA Chi-Chi, MBCA Keziah 2, 2019

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	inaccurate passenger manifest
			distress apparatus and radio communication equipment not readily available
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	
	OP 200	Oversight	distress apparatus and radio communication equipment not readily available
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	distress apparatus and radio comm eqpt not readily available
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	squall
		Technological environment	mbca design unstable
			canvass awning traps pax
			wearing of lifejacket prohibited
			distress apparatus and radio communication equipment not readily available
			SAR teams has no rescue equipment
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	
	AE 100	Decisions and judgement errors	
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	inaccurate passenger manifest
	AV 100	Exceptional	

MV Island Roro-1, 2019

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	
	OP 200	Oversight	oily cargo decks
			cargo shifting
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	oily cargo decks
			cargo shifting
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	
		Technological environment	oily cargo decks
			cargo shifting
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	overloaded 10 wheeler truck
	AE 100	Decisions and judgement errors	
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	
	AV 100	Exceptional	
Total			

MBCA Gesu de Bambino, 2020

Reported HFACS Factors Philippines Ferry Industry Human and Org. Factors			Contributory Factors
Outside Factors (PCG PDI)			
PDIR XXX	PDI and Other Related Regulation		
	PDIR 000	Rules and Regulations	
PDIE XXX	PDI Enforcement Related Issues		
	PDIE 000	Absence of PDI	
	PDIE100	PDI Error	
	PDIE 200	PDI Violation	distress apparatus and radio communication equipment not readily available
			passenger manifest inaccuracy
Organizational Influences			
OR XXX	Resource Management		
	OR 000	Human resources	
	OR 100	Technological resources	
	OR 200	Equipment/Facility resources	
OC XXX	Organizational Climate		
	OC 000	Structure	
	OC 100	Policies	
	OC 200	Culture	
OP XXX	Organizational Process		
	OP 000	Operations	
	OP 100	Procedures	mbca left 1 crew on water after cutting the anchor rope entangled at the propeller
	OP 200	Oversight	
Unsafe supervision			
SI XXX	Inadequate supervision		
	SI 000	Shipborne and shore supervision	
SP XXX	Planned inappropriate operations		
	SP 000	Shipborne operations	
SF XXX	Failed to correct known problems		
	SF 000	Shipborne related shortcomings	
SV XXX	Supervisory violations		
	SV 000	Shipborne violations	mbca left 1 crew on water after cutting the anchor rope entangled at the propeller
Preconditions for unsafe acts			
	Environmental factors		
		Physical environment	squall
		Technological environment	mbca design flaw
			distress apparatus and radio communication equipment not readily available
	Crew condition		
		Cognitive factors	
		Physiological state	
	Personnel Factors		
		Crew Interaction	
		Personal Readiness	
Unsafe Acts			
AE XXX	Errors		
	AE 000	Skill-based errors	
	AE 100	Decisions and judgement errors	master miscalculation
	AE 200	Perceptual errors	
AV XXX	Violations		
	AV 000	Routine	passenger manifest inaccuracy
	AV 100	Exceptional	