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**WORLD MARITIME UNIVERSITY**

Malmö, Sweden

**IMPLEMENTATION OF THE SAFETY MANAGEMENT SYSTEM FOR DOMESTIC  
FLEET IN MYANMAR**

By

**KO KO ZIN  
UNION OF MYANMAR**

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

**MASTER OF SCIENCE**

IN

**MARITIME AFFAIRS**

(MARITIME SAFETY AND ENVIRONMENTAL ADMINISTRATION)

**2021**

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## DECLARATION

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

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

A handwritten signature in black ink, appearing to be 'M. Baig', written over a horizontal line.

(Signature):

(Date): 18<sup>th</sup> September 2021

Supervised by: Professor Jens-Uwe Schröder-Hinrichs  
Vice-President (Academic Affairs)

Co - Supervised by: Mirza Zeeshan Baig

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## **ABSTRACT**

Title of Dissertation: **Implementation of The Safety Management System for Domestic Fleet In Myanmar (DSM)**

Degree: **Master of Science**

This dissertation is a study of the analysis of the accident investigation and implementation process for domestic safety management in Myanmar. It analyzes previous accidents, including origins, consequences, and investigation, as well as any lessons learned. After analyzing with twenty investigation reports, interviewed with stakeholders who are those from administration, ship owner association, dockyards and insurance company. For getting the clear picture of hidden key points for the study, details discussion has been carried out about five times together with ship owner, supervisors and investigators. The prime focus remained at Myanmar's water transportation network's history and contemporary operating systems, including vessels, operators, supervisory bodies, and all other stakeholders. Myanmar has a 1300-mile Coastline and a 2000-mile network of inland navigable rivers. Ayeyarwady and Chindwin are the two main rivers. The Chindwin is navigable for around 730 kilometers when combined with the Ayeyarwady. Notably, number of domestic vessel accidents have occurred in the country because of contributing factors and, consequently, lead to massive loss of human life, environment and the property. The study has been conducted by using the Human Factor Analysis and Classification System (HFACS). This study identified 348 casualty factors moreover, the finding of the has been also validated by conducting the five interview of the stakeholders from the domestic shipping industry. The study presents all stakeholders a greater knowledge of domestic safety and how the human factor plays a role in unsafe conditions. Similarly, it is expected that this study will be helpful towards the improving the regular safety inspections and audits of Domestic Safety Management (DSM), eventually leading to the era of zero fatalities.

**KEYWORDS:** DSM, HFACS, Stakeholders.

## TABLE OF CONTENTS

Declaration.....	ii
Acknowledgement.....	iii
Abstract.....	iv
Table Of Content.....	v
List Of Tables .....	viii
List Of Figures .....	ix
List Of Abbreviations .....	xi
<b>Chapter One</b>	
1.1 Introduction .....	1
1.2 Background Information.....	2
1.3 Identifying what safety problems exist .....	4
1.4 History of maritime accidents in Myanmar.....	5
1.5 Aims and Objectives .....	7
<b>Chapter Two</b>	
2.1 Literature Review .....	8
2.2 Research Question .....	10
2.3 Research Methods .....	10
2.3.1 Data Collection Methods .....	10
2.3.2 Data Analysis Process .....	11
2.4 Expected Results .....	12
2.5 Limitations .....	12
<b>Chapter Three</b>	
3.1 Problem Definition .....	13
3.2 Description of the domestic shipping sector in Myanmar.....	15
3.3 Regulations for domestic ships .....	15
3.4 Accidents in Domestic Vessel-Between 2010 to 2020.....	17
3.5 Identification of root causes for domestic vessel accident .....	19

3.5.1 Outcomes of these accidents .....	22
3.5.2 Official accident investigation reports .....	22
3.6 Legal discussion how safety management is implemented in other countries .....	23

## **Chapter Four**

4.1 Human Factors Analysis Classification System (HFACS) and analyzing with the investigation reports.....	24
4.1.1 Unsafe acts .....	27
4.1.2 Preconditions for unsafe acts .....	28
4.1.3 Unsafe supervision .....	29
4.1.4 Organizational influences .....	30
4.2 Analyzing the data .....	31
4.3 Severity and the contributing factors from twenty investigation reports .....	37
4.4 Summary of HFACS analysis from twenty investigation reports .....	38
4.4.1 Comparison between Severity and contribution factors .....	40
4.4.2 Highlight of Contribution Factors .....	41
4.4.2.1 Unsafe Acts .....	42
4.4.2.2 Preconditions for unsafe acts .....	44
4.4.2.3 Unsafe supervision .....	46
4.4.2.4 Organizational Influences .....	48
4.4.2.5 Statutory .....	50

## **Chapter Five**

5.1 Interview with stakeholders .....	51
5.2 Discuss for the contribution factors of HFACS analysis and interview questions .....	51
5.3 Unsafe Acts .....	51
5.4 Preconditions .....	53
5.4.1 General and crew conditions .....	53
5.4.2 Coastal shipping .....	53

5.4.3 Inland waterway .....	54
5.4.4 Dockyards .....	55
5.5 Unsafe Supervision .....	55
5.6 Organizational Influences .....	56
5.6.1 Organization .....	56
5.6.2 Statutory .....	58
<b>Chapter Six</b>	
6.1 Implementation framework .....	59
6.1.1 Integration .....	59
6.1.2 Design Principle .....	60
6.1.3 Implementation .....	60
6.1.4 Evaluation .....	60
6.1.5 Improvement .....	60
6.1.6 Recommendation .....	60
6.2 Challenges for Implementation of DSM.....	62
<b>Chapter Seven</b>	
<b>Conclusion</b> .....	63
<b>Reference List</b> .....	64
<b>Appendices</b>	
Appendix 1 - WMU Research Ethics Committee Protocol .....	68
Appendix 2 - Consent to interview .....	69
Appendix 3 - Interview Questions .....	70
Appendix 4 - Google drive link for the lists of domestic vessel accident in Myanmar between 2010 to 2020 .....	71
Appendix 5 - Coding HFACS analysis retrieved from investigation reports .....	72



## LIST OF TABLES

<b>Table 1 - 1:</b> The trend of Maritime Accidents .....	5
<b>Table 3 - 1:</b> Safety Problems for Domestic Vessels in Myanmar .....	14
<b>Table 3 - 2:</b> Lists of Domestic vessels registered in DMA – 2020 .....	15
fleet between 2010 to 2020	
<b>Table 4 - 1:</b> Overview about the HFACS-MSS data structure .....	26
<b>Table 4 - 2:</b> Lists of uncoded accidents .....	31
<b>Table 4 - 3:</b> Severity and contributing factors .....	37
<b>Table 4 - 4:</b> Summary of HFACS analysis .....	38

## LIST OF FIGURES

<b>Figure 1 -1:</b> Location of Inland Waterway .....	3
<b>Figure 1- 2:</b> Comparison for Number of Death and Injury between ESCAP Countries .....	4
<b>Figure 1 - 3:</b> Photos of domestic vessel accident in Myanmar .....	6
<b>Figure 2- 1:</b> Process of data analysis .....	11
<b>Figure 3- 1:</b> Trend of Myanmar Domestic vessel accidents between 2010 to 2020 .....	17
<b>Figure 3- 2:</b> Type of domestic vessel accidents in Myanmar between 2010 to 2020 .....	18
<b>Figure 3- 3:</b> Accidents classification for the domestic fleet in Myanmar .....	19
<b>Figure 3- 4:</b> Comparing between Coastal and Inland Water Way for accident cases from 2010 to 2020 .....	20
<b>Figure 3- 5:</b> Accidents rate in a different type of vessels in Myanmar Domestic fleet between 2010 to 2020 .....	21
<b>Figure 3- 6:</b> Rate of casualties for different type of vessels in Myanmar Domestic fleet 2010- 2020 .....	22
<b>Figure 4- 1:</b> Classification of Unsafe acts .....	27
<b>Figure 4- 2:</b> Classification of preconditions for unsafe acts .....	28
<b>Figure 4-3:</b> Illustration of unsafe supervision .....	29
<b>Figure 4-4:</b> Categorization of organizational influences .....	30
<b>Figure 4-5:</b> Comparison between Severity and contribution factors .....	40
<b>Figure 4-6:</b> Highlight of Contribution Factors .....	41
<b>Figure 4-7:</b> Contribution of unsafe acts.....	42
<b>Figure 4- 8:</b> Contribution of preconditions for unsafe acts .....	44
<b>Figure 4- 9:</b> Contribution of unsafe Supervision .....	46
<b>Figure 4- 10:</b> Contribution of organizational influences .....	48

<b>Figure 4-11: Contribution of statutory</b> .....	50
<b>Figure 6- 1: Implementation Framework for Domestic Safety Management System</b> .....	59

## LIST OF ABBREVIATIONS

<b>ADB</b>	Asian Development Bank
<b>AMSA</b>	Australian Maritime Safety Authority
<b>ASEAN</b>	Association of Southeast Asia Nations
<b>COLREG</b>	International Regulations for Preventing Collisions at Sea
<b>DMA</b>	Department of Marine Administration
<b>DOC</b>	Document of Compliance
<b>DSM</b>	Domestic Safety Management
<b>DWIR</b>	Directorate of Water Resources and Improvement of River System
<b>DWT</b>	Deadweight Tonnage
<b>EMCIP</b>	European Marine Casualty Information Platform
<b>EMSA</b>	European Maritime Safety Agency
<b>E.U.</b>	European Union
<b>FSA</b>	Formal Safety Assessment
<b>GBS</b>	Goal-Based Standards
<b>GISIS</b>	Global Integrated Shipping Information System
<b>HFACS</b>	Human Factors Analysis and Classification System
<b>IMO</b>	International Maritime Organization
<b>IMSAS</b>	IMO Member state Audit Scheme
<b>ISM</b>	International Safety Management
<b>ISO</b>	International Organization for Standardization
<b>MAIB</b>	Marine Accident Investigation Branch

<b>MARPOL</b>	International Convention for the Prevention of Pollution from Ships
<b>MCA</b>	Maritime Environment Protection Committee
<b>MMSL</b>	Myanmar Merchant Shipping Law
<b>MEPC</b>	Marine Environment Protection Committee
<b>MOTC</b>	Ministry of Transport and Communications
<b>MPA</b>	Myanmar Port Authority
<b>MSC</b>	Maritime Safety Committee
<b>NC</b>	Non-Conformities
<b>NDC</b>	Nationally Determined Contributions
<b>NGO</b>	Non-Governmental Organization
<b>PIDSS</b>	Pacific Islands Domestic Ship Safety
<b>ROs</b>	Recognized Organizations
<b>SMC</b>	Safety Management Certificate
<b>SMS</b>	Safety Management System
<b>SOLAS</b>	International Convention for the Safety of Life at Sea
<b>STCW</b>	Standards of Training, Certification, and Watchkeeping
<b>UNCLOS</b>	United Nations Convention on Law of the Sea
<b>UNESCAP</b>	United Nations Economic and Social Commission for Asia and The Pacific
<b>WFA</b>	Worldwide Ferry Safety Association

## Chapter One

### 1.1 Introduction

Maritime transport is a critical component of all of the countries' economic and social growth. Sea transport carries about 80% of global trade volume and over 70% of global trade value (UNCTAD,2018). In most developing countries, these percentages are much higher. Maritime transport in the Economic and Social Commission for Asia and the Pacific (ESCAP) region proliferated in the 2000s and is expected to expand even further in the future, as the rapid growth in maritime transport is linked to the region's economic growth (UNESCAP,2016). However, the shipping industry faces various challenges that characterize safety and maritime incidents because a ship causes harm to its environment. Accidents are caused by a sequence of interactions rather than a single act or occurrence. However, human factors account over 58% of maritime claims, while mechanical failures (machines) and natural hazards account for the remaining percent (MCA,2010). Human factors significantly affect all processes, and although human errors cannot be avoided, their impact can be mitigated by introducing additional mitigation techniques. Because, ships are designed, built, owned, crewed, maintained, repaired, and salvaged by people.

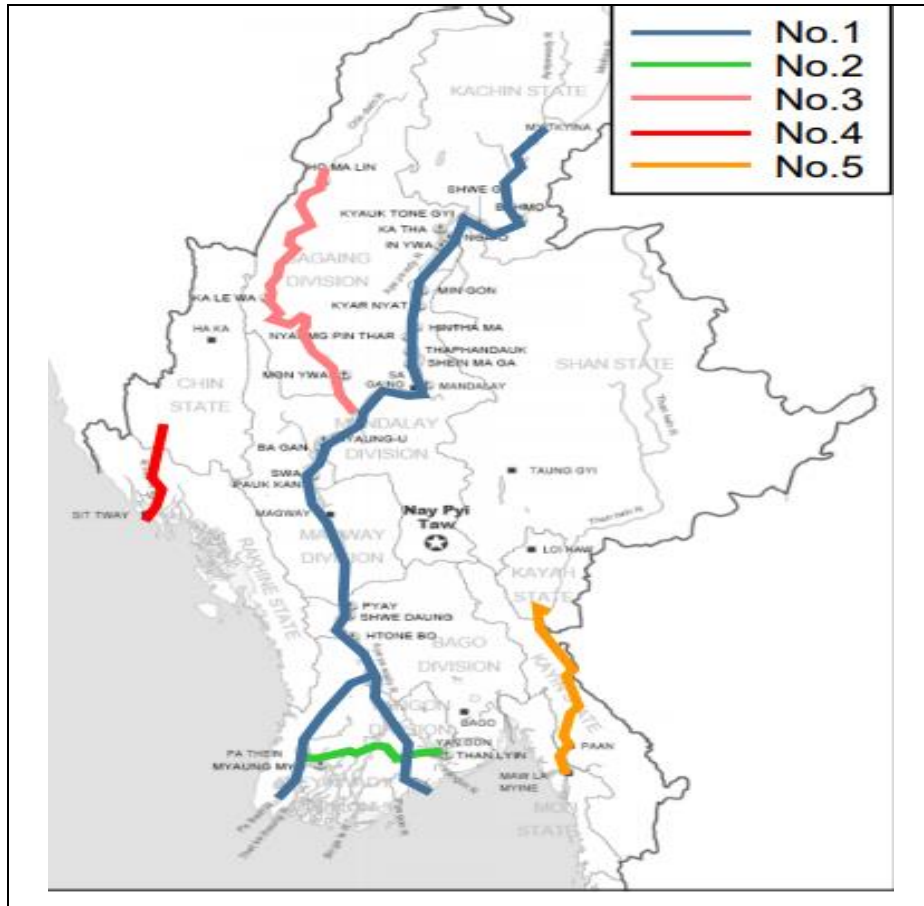
When things go wrong, People regulate them, survey them, underwrite them and investigate them (MCA,2010). As a result, most international safety regulations focused on people systems aim to minimize human error and harmonize emerging technologies known as "human-machine interfaces" to improve safety and harmonize new technologies. The human factor will help identify gaps and vulnerabilities in the interaction between shipboard crew and equipment in the maritime industry. The International Maritime Organization (IMO) states that "humans are non-programmable; as a result, considerations to be studied are what elements are, what will be created, and the limits of humankind". To reduce human-related incidents in the shipping industry, the IMO adopted the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers (STCW) and the International Safety Management Code (ISM). Presently, IMO is in process for drafting the model regulation for the domestic ferry safety (MSC-103/8).

Furthermore, incident investigation reports and data collection for casualties from member states within their sovereign is not transparent due to national interest. Small boats and non-convention vessels operating on domestic voyages fall outside the sphere of IMO's activities. Additionally, domestic vessels in Myanmar were aged, and most passenger-cum-cargo barges were below 100 tons. The fleet was poorly maintained and repaired, had limited-service capacity, and had a weak safety record by most standards. Per year, on average, ten boats sunk in the 1980s (ESCAP,2016).

## **1.2 Background Information**

Myanmar, a developing country, will need to continue reforms and structural transformations to realize its high growth potential, especially in terms of major infrastructure projects, developing relevant capacities and skills, and improving the business situation. Myanmar will be able to enter the upper-middle-income economies by 2030 as a result of this (National Logistics Master Plan, 2018). However, Myanmar infrastructure lags behind its Association of Southeast Asia Nations (ASEAN) neighbors, making it complex to access markets and social services. Moreover, poverty and geographic deprivation are heightened by high transportation costs and restricted access to markets and services (Baird, N.W, 2018). To serve the country's major transportation corridors, Myanmar has a comprehensive domestic vessel transport network that is well configured, including the Yangon-Mandalay route.

**Figure 1- 1:** Location of Inland Waterway.



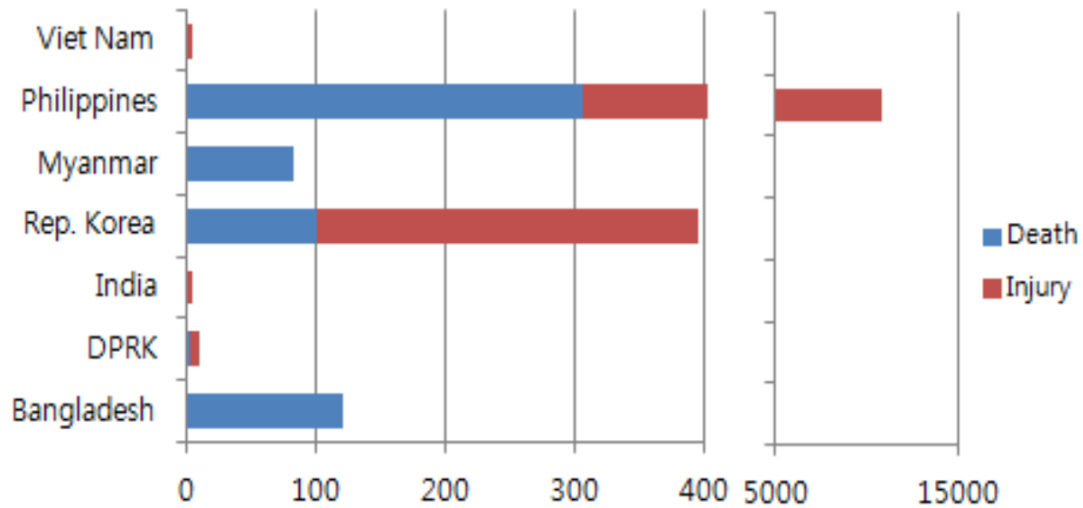
**Source:** National Logistic Master Plan 2018- 2030.

Myanmar has a coastline of 1300 miles and inland navigational waterways that is 2000 miles long (NDC, 2020). There are two main rivers illustrates in the figure 1-1 , Ayeyarwady (No.1) and Chindwin (No.3), sailing restriction during Summer due to C (DWIR,2020). The Ayeyarwady is navigable all year up to Bhamo and during the dry season up to Myitkyina. However, rapids on the distance of the channel between Bhamo and Myitkyina make navigation dangerous during the rainy season. From its combination with the Ayeyarwady, the Chindwin is navigable for around 730 kilometers. Many streams in the Ayeyarwady Delta are navigable and interconnect with a network of canals. Twenty million of the population in villages and limited access to all-season roads (ADB, 2016).



### 1.3 Identifying What Safety Problems Exist

Figure 1- 2: Comparison for Number of Death and Injury between ESCAP Countries.



Source: UNESCAP 2016.

There is a significant difference in the number of casualties reported by countries responding. Figure 1-2 reveals that the Philippines, Bangladesh, the Republic of Korea, and Myanmar have more losses than others. On the other hand, other countries lack sufficient mechanisms to collect and manage casualty statistics (UNESCAP,2016). According to Dr Hebbert's (2020), the main problems which threaten the maritime safety of the domestic fleet are "overloading and overcrowding, pre-departure safety education, crew training for emergency scenarios and effective search & rescue efforts to alleviate fatal consequences". In addition, human factors are complex systems and errors affected by incompetence, overconfidence, carelessness, negligence, drinking, drowsiness, and fatigue.

## 1.4 History of Maritime Accidents in Myanmar

**Table 1- 1:** The trend of Maritime Accidents.

	Bangladesh	Cambodia	DPRK	India	Republic of Korea	Myanmar	Philippines	Viet Nam
2011	22	0	12	26	566	24	531	61
2012	16	0	24	22	539	15	558	34
2013	10	0	23	27	467	17	716	30
2014	16	0	12	18	536	17	428	16
2015	22	3	15	17	741	5	578	23
Total	86	3	86	110	2,849	78	2,811	164
Average	17.2	0.6	17.2	22.0	569.8	15.6	562.2	32.8

**Source:** The Study on Improving Maritime Transport Safety in the ESCAP Region – 2016.

According to UNESCAP, 2016 publication, “The analysis on ship accident rate based on the number of ships that were in accidents and the total number of ships operated for the past five years based on the data submitted by eight countries showed that the rate is 3.2 percent on average”. Accidents happened in Myanmar may seem to be nose down from 2011 to 2015 by the submitted result. However, apart of the ESCAP report , rate of casualty rose again after 2015 and this study will highlight in chapter 3.5. In Myanmar, where many people depend on overcrowded and dilapidated boats for transportation, marine accidents are frequent. For example, seventy-seven people died due to *Aung Ta Gun (3)*, a government-owned Passenger vessel sunk in March 2015 near Naung Taw Gyi island, Rakhine state; consequently, 77 people died. Moreover, the Domestic ferry, *Aung Soe Moe Kyaw*, which has been carrying around 300 passengers and sank due to overloaded and overcrowded during the lighting festival, a prominent Buddhist religious event in 2016 near Sagaing in Chindwin River; as a result, 72 people died (The Maritime Executive). After the accident investigation process, Myanmar Authorities decided to establish Chindwin standards, especially for the ferry, which vessels are operating in the Chindwin River (Upper Myanmar). The

third major maritime accident in Myanmar happened in 2017; a wooden boat carrying about 60 wedding guests collided with a container ship and sunk in Patheingyi, southwestern Myanmar, killing 20 people and leaving another dozen missing (Reuters,2017).

**Figure 1- 3:** Photos of domestic vessel accident in Myanmar.



**Source:** News and Journal

## **1.5 Aims and Objectives**

The study aims to effectively implement the DSM system and minimize human-related accidents for all domestic vessels. The DSM framework's efficient outcome protects and prevents poor, un-educated ship drivers and passengers from such casualties. The objectives of this research are to ensure a cost-effective and straightforward means of:

- (a) Ensuring safety for all domestic vessels;
- (b) Preventing human injury and loss of life;
- (c) Prevention of pollution along the river and coastal area;
- (d) Complying with applicable regulations, rules, standards, and procedures; and
- (e) Smooth operation for all governing bodies.

## Chapter Two

### 2.1 Literature Review

There are two main rivers, Ayarwaddy and Chindwin, sailing restriction during Summer due to limited draft about one to two meters (DWIR,2020). As a result, oil and cargo barges frequently ground, threatening along river banks due to severe pollution. Additionally, the other challenges are strength and stability criteria to reduce light ship weight related to upper Myanmar's draft limit, which negatively impacts ferry safety. Fishing and ferry are the majority fleet of accidents within ten years in Myanmar, which relate to Collision, Flooding, Capsizing, and Fire. The highlights of most accident cases are related to human factors, which rely on stakeholders' knowledge and participation in marine safety awareness training programs and information sharing activities. Myanmar society has been dominated by a culture of pursuit of economic expansion. Safety has been ignored too much for too long. Therefore, promoting a "culture of safety first" mentality is critical to avoid future marine disasters.

Implementation of international and national maritime safety standards and regulations through national law and maritime policies is a vital role of maritime administration to improve maritime activity safety and efficiency. This study uses the IMO Goal Base Standards safety level approach method (MSC.1/ Circ.1596). Implementation framework aligns with the outcome of accident investigation reports and which analyzed with HFACS method. There are five layers that correspond to the main principles of HFACS, Reason's Swiss Cheese Model, and Hawkins' SHEL model (Chen et al., 2013). According to Chen et al., 2013, "The suggested technique is demonstrated through a case study of the Herald of Free Enterprise catastrophe, which illustrates how the integration of analysis findings as a supplement to the HFACS analytical data may provide a full understanding of the event". However, much of accident reports shall be taken to achieving more strengthening of paradigm. Before taking place the implementation process, analyze the gaps between system requirements and performance limitations of stakeholders by collecting data and analyzing this data with qualitative for HFACS methodology and interview questions and quantitative methods for summarizing accident records between 2010 to

2020. Then, the implementation of requirements is given to the competent authority, DMA, supporting, among other things, indigenous solutions that are low-cost but fit for purpose (MSC 103/8 draft). Moreover, DMA ensures that suitable occupational health and safety procedures are onshore and onboard, focusing on newly emerging health and safety problems. The administration shall conduct inspections, testing, and surveys, with the person acting the functional title and contact information clearly and legibly indicated on the certificate. The DSM manual clearly defines the policy for safety and environmental protection and documentation process. Moreover, effectively implement by setting with specific principles, establish framework and processing recording and reporting system. According to Maritime Coast Guard Agency (MCA, 2015), the following chapters are to include within domestic safety management system: General; Objectives; Policy; Vessel safety standards; Area of trading zones; Monitoring system; Duties and Responsibilities; Designated Person; Knowledge sharing and Training; Procedure for safe operation; Procedure for reporting Accidents; Procedure for responding and preparation for Emergencies; Equipment; Review; Certification; Exemption. However, the implementation process shall meet with the actual situation and harmonized with Myanmar safety culture for effective outcomes. Therefore, chapter six of this study may provide with implementation framework by modification of the International Organization for Standardization (ISO 31000, 2018).

According to UNCLOS, article 91, "Every State shall fix the conditions for the grant of its nationality to ships, for the registration of ships in its territory, and for the right to fly its flag. Ships have the nationality of the State whose flag they are entitled to fly". Myanmar is an IMO member state since 1945 and party to different IMO instruments. Therefore, this research shall provide with contributing factors of accidents which taken from HFACS method and interview questions to establish policy and procedure by emphasizing the safety standards for the Domestic fleet to prevent any loss of life and pollution from Myanmar flagged ships. To reduce and minimize accidents, all stakeholders involved in Domestic shipping may take steps to maintain, preserve, and promote traditional craft and transportation development and construction in domestic waterways (MSC 103/8).

## **2.2 Research Questions**

To achieve the objectives, the following research questions guided the study:

- (1) How to apply the HFACS Taxonomy for accident investigation of Myanmar domestic vessels?
- (2) How to reduce or eliminate the significant contributing factors of accidents?
- (3) How to solve problem statements regarding legal and economic sector?
- (4) What could be the initiatives of relevant stakeholders to ensure and maintain Myanmar domestic vessel safety?

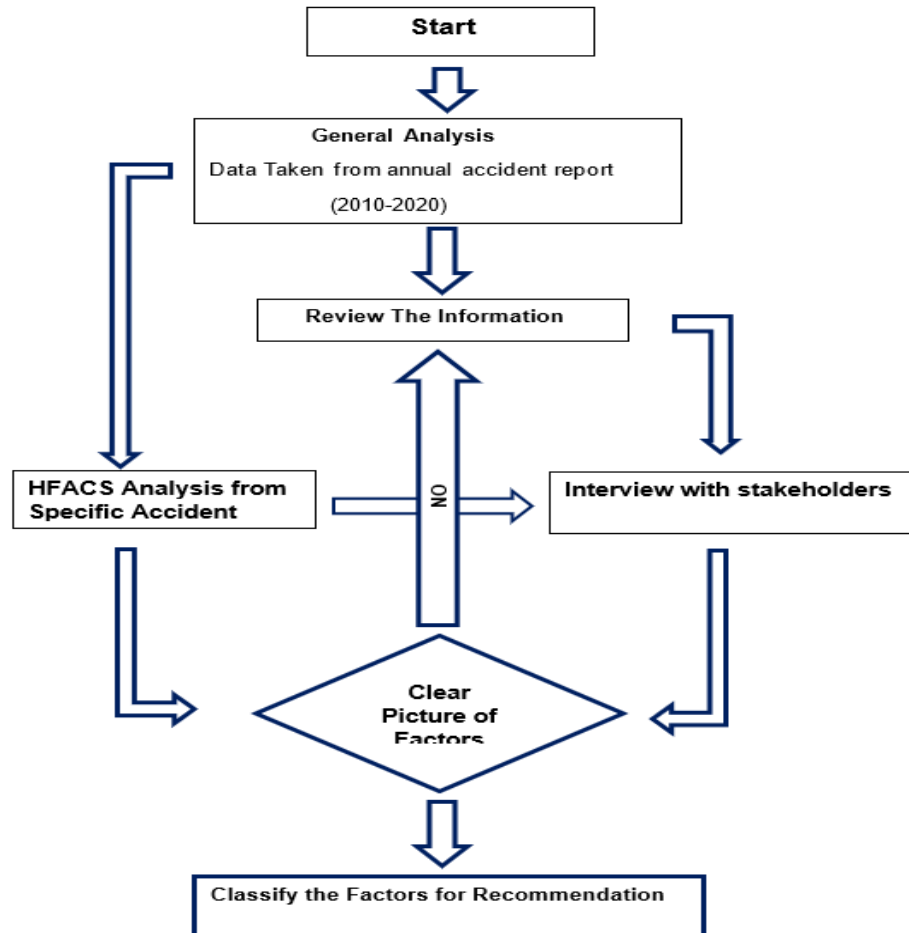
## **2.3 Research Methods**

### **2.3.1 Data Collection Methods**

Data collection for this study will be based on primary and secondary data sources. The preliminary data taken from internal administrative documents, accident investigation reports and survey records, stakeholders` Interview records, and secondary data will be achieved from relevant websites, reports, training materials, dissertations of previous students. Furthermore, lectures by both visiting experts and WMU professors certainly contribute to this work.

### 2.3.2 Data Analysis Process

Figure 2- 1: Process of data analysis.



Source: Author

The analysis procedure is divided into two stages: (a) general analysis from annual records and (b) details analysis for specific investigation reports by human factors classification system. These stages align with interview questions to get a clear picture of contributing factors for domestic vessel accidents, as shown in the above diagram. For analyzing data, apply with HFACS taxonomy for primary data is taken from administrative accidents records and interviews with stakeholders related to the



quantitative and qualitative (mixed) method. For general analysis, extraction of data from annual accident records between 2010 to 2020 which control by legal department of DMA. For detail analysis, apply with HFACS to investigation reports and factors extracts from it. Finally, supported the implementation section which part of implementation process by mixing with general records, details (HFACS) and key points from interviewing the stakeholders.

## **2.4 Expected Results**

This dissertation aims to examine accidents that happened between 2010 to 2020 for general analysis and some selected typical accidents that have occurred in Myanmar using the HFACS – MSS framework and taxonomy, as well as to implement an effective safety management system for the domestic fleet. The purpose of this dissertation is to examine with the HFACS – MSS framework for some selected typical incidents that have occurred in Myanmar in the past and to minimize accidents and casualties in Myanmar Domestic shipping. The expectation for this study is to achieve an applicable safety management system for domestic fleets which aligns with Myanmar cultural, economic, and educational background. Additionally, the practical outcomes may achieve from theoretical basics to initiate effective frameworks. The finality of research is enhancing the safety culture for all concerning those who perform in the Domestic fleet and changing their mindset by providing DSM system with a less documented control system.

## **2.5 Limitations**

This research is aimed at enlargement focusing the ferry safety and other domestic vessel safety standards and procedures. However, conflict of interest and poor co-operation challenges the capacity building for all stakeholders and data collection from other sources due to poor co-operation. The majority of the challenge for this study is political instability during research which reflects in data collection and interviews due to restriction of social network application.

## **Chapter Three**

### **3.1 Problem definition**

In recent years, analysis of shipping incidents has increased concerns about the critical role of the human factor. The loss of life, the effect on company income and reputation, and the significant environmental damage that a shipwreck can cause are all clear and present risks. There is a clear link between human issues, and the commercial success of work in the shipping industry and all concerned must recognize that they are the human factor (MCA,2010). Although most of the vessels operating on domestic voyages fall outside the sphere of IMO's activities, the Organization highlights extreme importance on the domestic vessel safety and requests member states to implement the best safety culture to standardize with applicable. According to MSC103/8," model regulations (a) provide framework provisions on domestic ferry safety for incorporation into national law; (b) do not promulgate provisions on facilitation, security, and pollution; (c) are drafted in a way to enable easy translation and incorporation into national law; and (d) may serve as a basis for intergovernmental agreements, whether multilateral, bilateral or regional".

**Table 3- 1:** Safety Problems for Domestic Vessels in Myanmar.

Vessel Type	Problem	Root Cause	Remark (reactive control )
Fishing	Personal Injury, Capsizing,	Poor education, low living & working condition, time pressure	Safety Awareness training (pre monsoon)
Coastal	Grounding, Flooding, Overloaded , Inadequate Stability	Careless, Poor maintenance, Owner interest	Safety Awareness training (pre monsoon)
Inland	Collision, Grounding	Poor communication , lack of knowledge	-
Ferry / Passenger	Capsizing, Collision, Communication error, Stability	Overcrowded, Economic pressure Lack of monitoring	Introduction of Chindwin standard Domestic ferry safety management system

**Source:** Author.

Most vessels in Myanmar are operating along the coastline and inland waterway, including fishing vessels and ferries. Therefore, the majority of the accidents are Collision, Flooding, Capsizing, and Fire happened in cargo, fishing, and ferry ships/boats. Moreover, most casualties and loss of life in the Domestic fleet are fishing and ferry sector due to human-related errors. Additionally, the lack of stakeholders' involvement in maritime safety awareness training programs and knowledge sharing events is the primary root cause of accidents in domestic shipping. However, there is no standard procedure for the safety management system to minimize human-related casualties for all types of vessels in the Domestic fleet; consequently, the number of accidents does not significantly decline.

### 3.2 Description of the Domestic Shipping Sector in Myanmar

As of 2020, 3,800 vessels registered with the Department of Marine Administration (DMA) for the Domestic fleet and transport approximately 93,400 passengers and 68,600 tons of freight; although the ownership structure has changed dramatically over the years, the fleet has grown steadily. Total Gross tonnage 723300 operates along the coastline, river, and islands of Myeik, Thanintharyi, and Rakhine archipelagoes (DMA,2020). In addition, smaller vessels, below 20 horsepower, and small barges registered at the local level are small and low-cost and typically made of wood.

**Table 3- 2:** Lists of Domestic vessels registered in DMA – 2020.

	<b>Cargo</b>	<b>Passenger</b>	<b>Fishing</b>	<b>Ferry</b>	<b>Tug</b>	<b>Cruise</b>	<b>Barge</b>	
Coastal	404	25	347	-	-	-	-	776
Inland	1064	-	-	542	511	39	872	3028
Total	1963	25	347	542	511	39	872	<b>3804</b>

**Source:** DMA Internal documents.

### 3.3 Regulations for Domestic Ships

Myanmar Registration of Ships Act and Inland Vessels law set out the requirements for registering under Myanmar flag also shipbuilding and survey of inland vessels. DMA completes draft of Inland vessels registration law.

Myanmar Merchant Shipping Act includes a chapter exclusively for flagged ships' and some of the articles are life-saving appliances, load lines, and unseaworthy ships. Similarly, a chapter of Inland Vessels Law details the safety measures of vessels, passengers, and shipped cargoes.

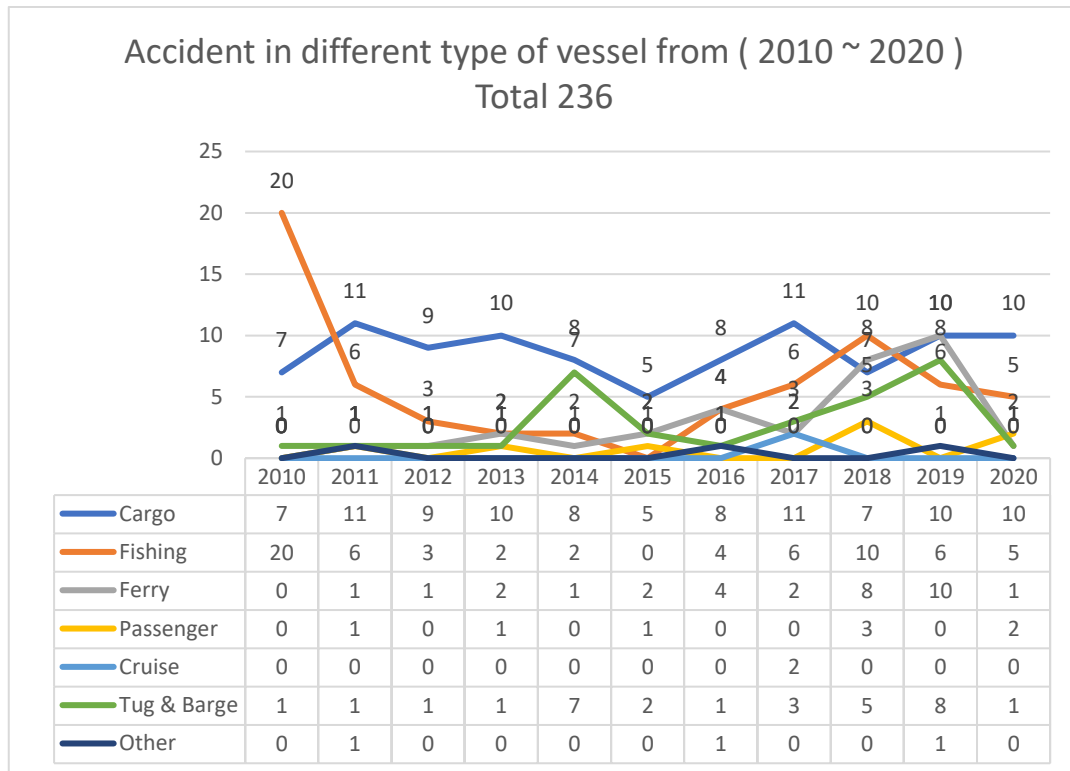
National Requirements of Construction, Equipment, and Maintenance standards for Non-convention cargo ships of more than 12 m in length are provided by directive 13/2015.

DMA provides training and certification programs for Domestic vessels as below:

1. MOTC Notification 91/2019 Minimum Requirements for Myanmar Coastal Master and Chief Mate Certificate of Competency.
2. MOTC Notification 228/2018 Minimum Requirements for Myanmar Coastal Engine Driver Certificate of Competency.
3. MOTC Notification 229/2018 Minimum Requirements for Myanmar Coastal Engineer Certificate of Competency.
4. MOTC Notification 230/2018 Minimum Requirements for Myanmar Inland Engine Driver Certificate of Competency.
5. MOTC Notification 231/2018 Minimum Requirements for Myanmar Inland Engineer Certificate of Competency.

### 3.4 Accidents in Domestic Vessel Between 2010 to 2020

Figure 3- 1: Trend of Myanmar Domestic vessel accidents between 2010 to 2020.

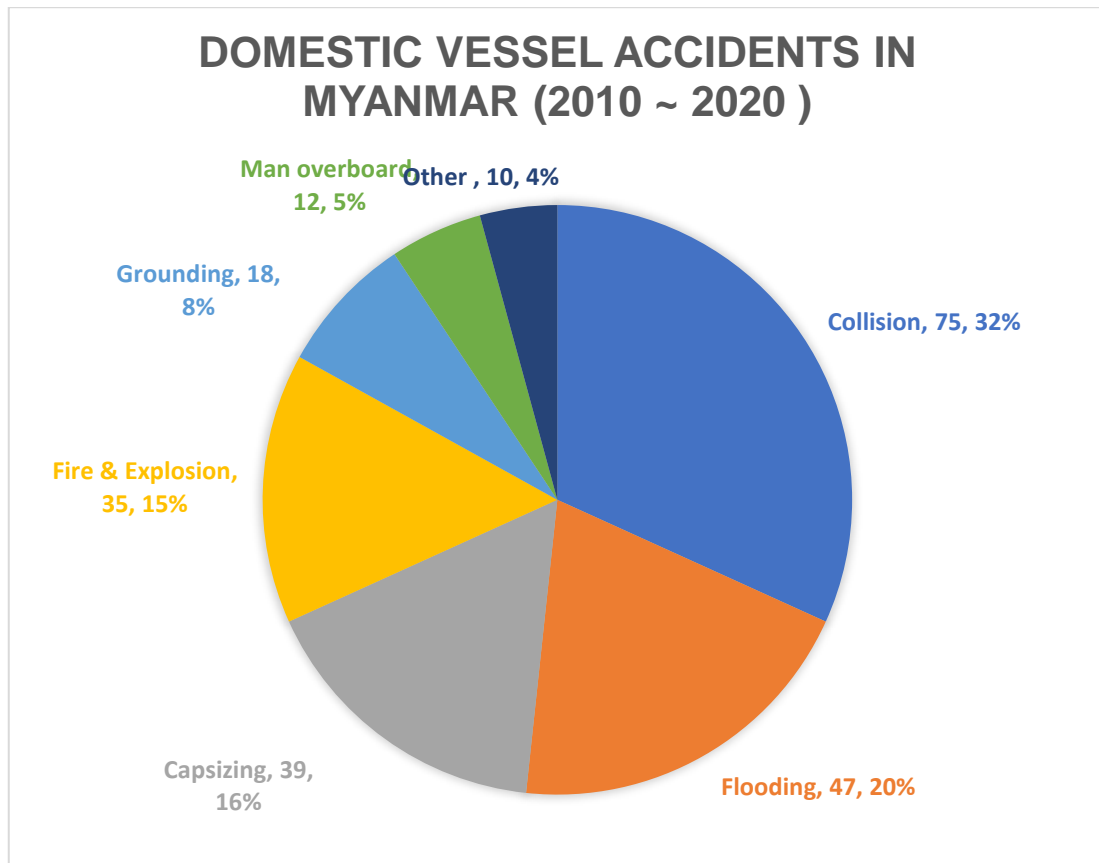


**Source:** Author as adopted from DMA records.

The Domestic vessels are classified by Cargo, Fishing, Ferry, Passenger, Cruise, Tug and Barge, and other types based on design structure and nature of performing duty. The Cargo ships are about 1,0500 to 100 gross tonnage trading near Myanmar coastal and navigable river passage. Cargo ships : Trend highest number about 96 accidents while remaining stable during ten years cycle. Fishing vessels can be categorized by carrier, trawlers, and non-trawler which were the second number of the accident in Myanmar about 64 times in ten years cycle. However, the accident rate of fishing vessels was unstable due to a sharp decline from 2011 to 2015 and then significantly rose after 2015. Ferries, vital role of the transport sector in a rural area, third major accident in Myanmar about 32 cases between 2010 to the 2020

calendar year and accident trend peak up during 2019. Furthermore, Tug and Barge are the backbone of inland waterway transport and the largest fleet in Myanmar, nearly the same as the rate of Ferry accidents, about 31 cases during a decade.

**Figure 3- 2:** Type of domestic vessel accidents in Myanmar between 2010 to 2020.

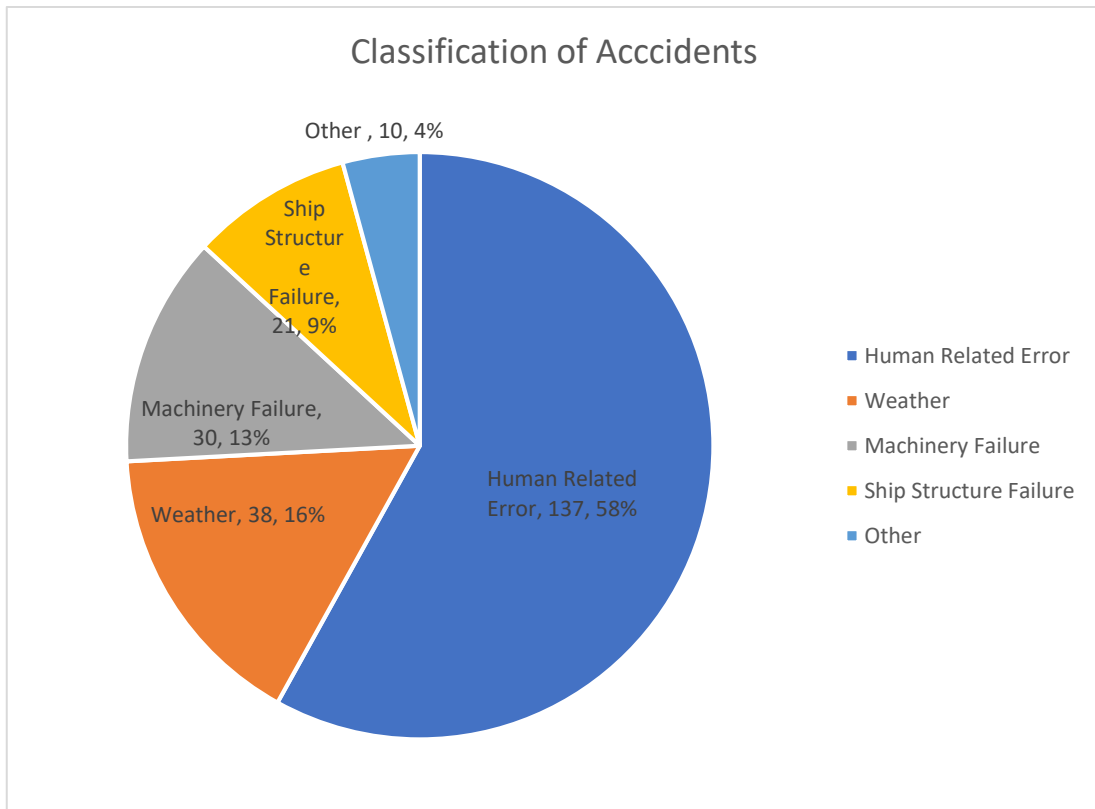


**Source:** Author as adopted from DMA records.

According to the Classification of Domestic vessel accidents in Myanmar, Collision is the highest and thirty-two percentage of total cases in Domestic fleet. Flooding is the second-highest number of accidents in Myanmar domestic fleet, about twenty percent. Capsizing and Fire are the second and third significant cases, about sixteen and fifteen percent of all total. Finally, grounding, man-overboard, and other unspecified accidents are least number of instances in Domestic vessels below ten percent.

### 3.5 Identification of Root Causes for Domestic Vessel Accident

**Figure 3- 3:** Accidents classification for the domestic fleet in Myanmar.

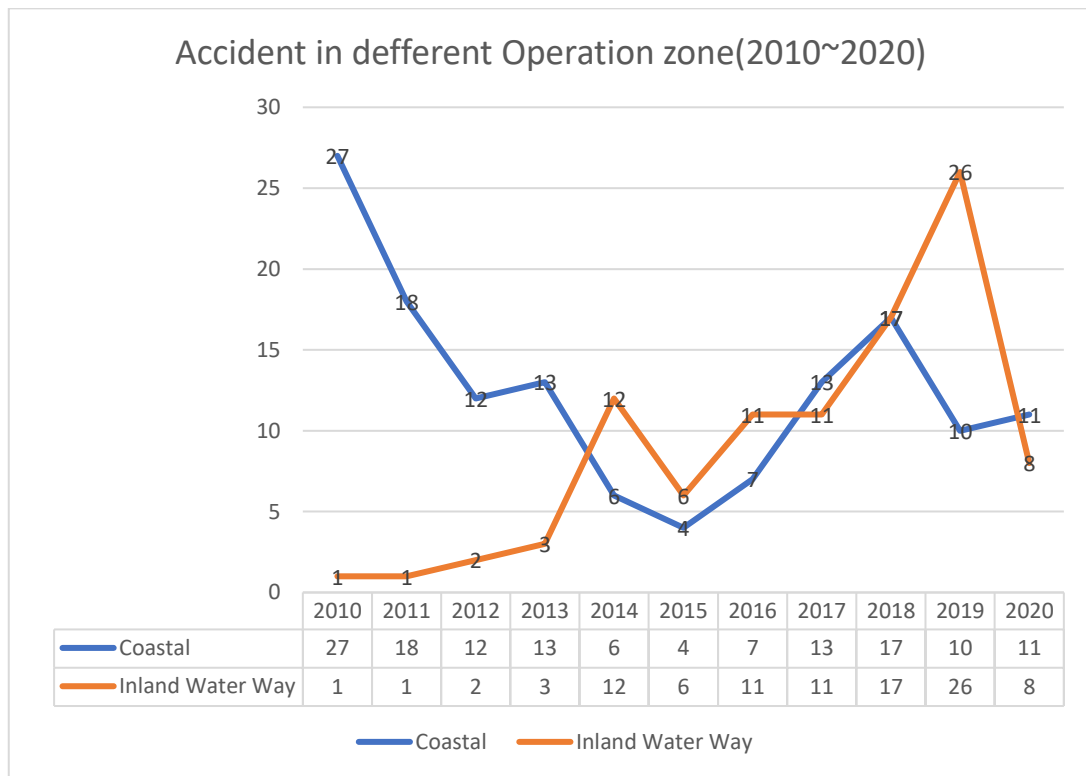


**Source:** Author as analysed from DMA records.

According to accident records, about 236 cases were reported to authorities within eleven years, and 137 cases were based on human-related errors in the coastal and inland waterways. By comparison, the fatalities rate in domestic shipping is significantly higher than in international voyages. However, there is an incredible finding that the major root causes of all accidents in domestic and international voyages are nearly the same percent, with human-related error over 50 percent.



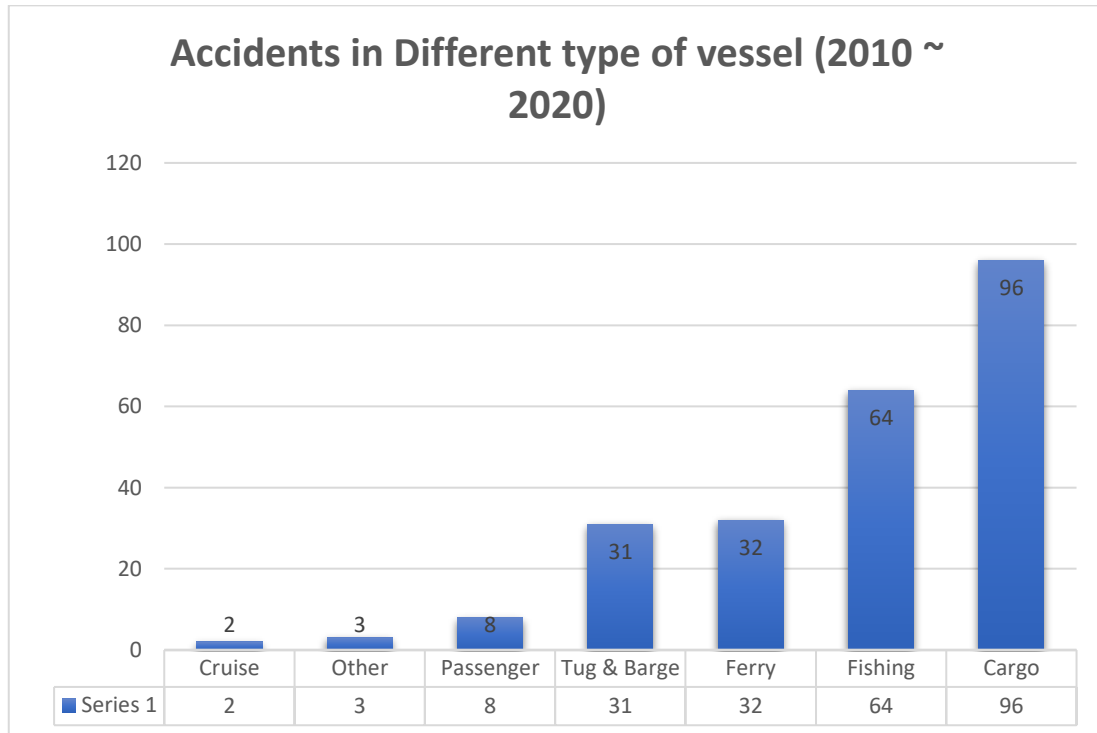
**Figure 3- 4:** Comparing between Coastal and Inland Water Way for accident cases from 2000 to 2020.



**Source:** Author as analysed from DMA records.

The above graph showed that total accidents cases for eleven years in inland and coastal areas were nearly the same. Therefore, trading areas are less influence by the implementation of a safety management system within Myanmar water. Within four years, from 2014 to 2018, insignificant trend of domestic vessel accident between inland and coastal vessel, while found the highest different rate between two area for the year of 2010 and 2019.

**Figure 3- 5:** Accidents rate in different types of vessels in Myanmar Domestic fleet between 2010 to 2020.

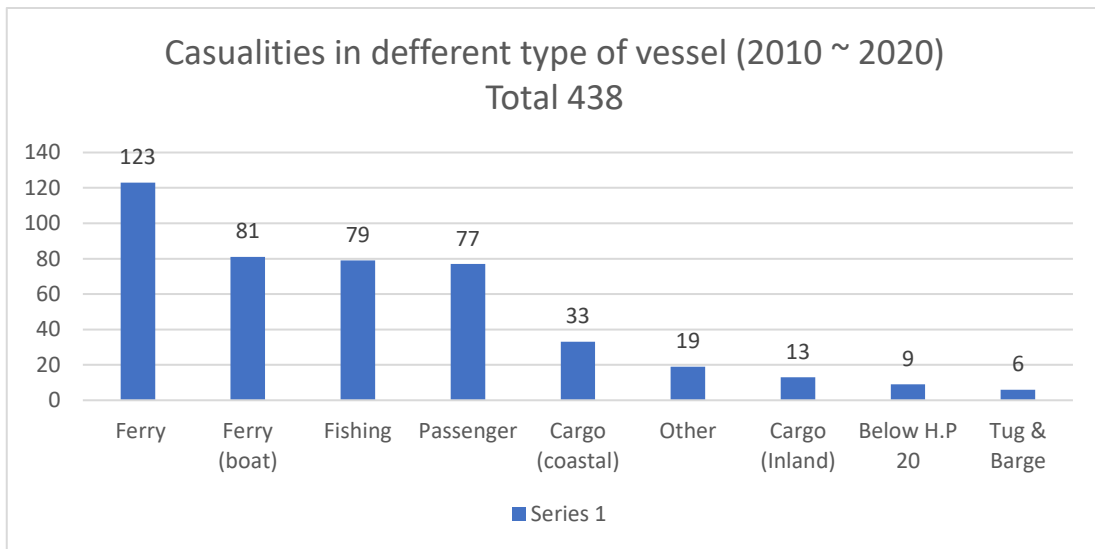


**Source:** Author as analysed from DMA records.

The highest number of accidents happened in cargo, fishing, ferry, and tug between 2010 to 2020. After comparing the total vessel and total accident rates, fishing, passenger, ferry, and cargo vessel are the highest in order. However, some accident cases happened in unregistered vessels and small boats that DMA did not control. The fishing sector is the highest rate for unregistered ships in Myanmar.

### 3.5.1 Outcomes of the accidents

**Figure 3- 6:** Rate of casualties for a different type of vessels in Myanmar Domestic fleet 2010- 2020.



**Source:** Author as adopted from DMA records.

In Myanmar, significantly high casualties rates in the ferry sector and small boat, fishing, and passenger vessels are the second-highest fatalities rates in Domestic shipping. Very few fatalities rate in other sectors from 2010 to 2020, such as cargo, tug, barge, and other types of vessels.

### 3.5.2 Official Accident Investigation Reports

There is only one investigation report was uploaded to IMO, Global Integrated Shipping Information System (GISIS), and other accident investigation reports for the domestic fleet are written in Myanmar language and kept in the Legal department and Director General office of DMA. There is no specific board for maritime investigation, and DMA handles it. Follow-up of these accidents in terms of new regulations by Vessel Standardization for the upper Myanmar area is in progress, namely Chindwin standards.

### **3.6 Legal Discussion How Safety Management is Implemented in Other Countries**

The United States Coast Guard has released a draft advance notice of proposed rulemaking on safety management systems for domestic passenger vessels, including small passenger vessels. (Subchapter K vessels). The Coast Guard is gathering public input on the scope, content, cost, and benefits of such a requirement by doing so. According to Source: 336/ 2006 to cover Community ships operating either internationally or domestically, "extends the application of the ISM Code, regardless of the flag and compliance with regulation requires owners of domestically trading vessels to implement a Domestic Safety Management system (DSM) which based on the ISM Code Parts A & B". India, DG shipping provided the standards and guidelines for Coastal and inland vessels regarding with audit and verification for safety and environmental protection. Additionally, Asia and Pacific region countries initiate domestic ferry safety with the support of The Economic and Social Commission for Asia and the Pacific (ESCAP).

## Chapter Four

### 4.1 Human Factors Analysis Classification System (HFACS) and Analyzing of Investigation Reports

This dissertation aims to examine accidents that happened between 2010 to 2020 for general analysis and some selected typical accidents that have occurred in Myanmar using the HFACS – MSS framework and taxonomy, as well as to implement an effective safety management system for the domestic fleet. Thus, the purpose of this dissertation is to examine with the HFACS – MSS framework for some selected typical incidents that occurred in Myanmar in the past and to minimize accidents and casualties in Myanmar Domestic shipping. Furthermore, lectures by both visiting experts and WMU professors certainly contribute to this work.

As the technology has advanced over the years, machinery cause to the accident has been reduced over time. However, there is more and more accident caused by human factor. Additionally, the figure 3- 3 in chapter 3.5 shows that human error contributes to 58% of Domestic vessel accidents, including the majority of navigation accidents and Fire and explosions. Therefore, the study needs to analyze with HFACS taxonomy to understand and prevent human error, which will be the key to improving safety.

The concept itself has been discussed since the 1900s, while the proper research of it had not begun until the 1970s before the two major accidents that happened by human error, the ground collision of two air crafts in Tenerife (1977) and the Three Mile Island accident in 1979 (Chen et al., 2013). Three Mile Island accident was one of the most significant accidents in the United States and commercial nuclear power plant history. It was a nuclear accident and released radioactive gases into the environment and stoked the public fears about nuclear power. Investigation into this accident has found several minor mechanical failures, which were made worse by human errors. Therefore, after this accident, many academic conferences have been gathered to discuss the problem of human error precisely two schools of thought. The cognitive psychological school is best represented by Professor James Reason, a

psychologist who studied how people make mistakes in daily life together is a joint Cognitive system that emerged regarding the human and machine interface (Kim, 2021).

The Human Factor Classification and Analysis System (HFACS) was utilized to review the casualty investigation reports. HFACS is based on James Reason's "Swiss Cheese" model, which Douglas Wiegmann and Scott Shappell created for aviation accidents in the U.S. Navy. However, James Reason's approach was never intended to be used as a casualty inquiry framework. Several improvements to the original framework have been made in subsequent years, allowing it to be used in a variety of other scenarios, as well as those unrelated to transportation. HFACS has been observed in aviation, health care, military forces, railroads, and even the mining industry.

**Table 4- 1:** Overview of the HFACS-MSS data structure

	<i>1<sup>st</sup> Tier</i>	<i>2<sup>nd</sup> Tier</i>	<i>3<sup>rd</sup> Tier</i>		
<i>Latent conditions</i>	<b>Outside factors</b>	Statutory	<ul style="list-style-type: none"> <li>• International standards</li> <li>• Flag State implementation</li> </ul>	<i>Remote from the ship</i>	
	<b>Organizational Influences</b>	Resources	<ul style="list-style-type: none"> <li>• Human resources</li> <li>• Technological resources</li> <li>• Equipment/facility resources</li> </ul>		
		Organizational climate	<ul style="list-style-type: none"> <li>• Structure</li> <li>• Policies</li> <li>• Culture</li> </ul>		
		Organizational process	<ul style="list-style-type: none"> <li>• Operations</li> <li>• Procedures</li> <li>• Oversight</li> </ul>		
	<b>Unsafe supervision/ workplace factors</b>	Inadequate supervision	<ul style="list-style-type: none"> <li>• Shipborne and shore supervision</li> </ul>		
		Planned inappropriate operations	<ul style="list-style-type: none"> <li>• Shipborne operations</li> </ul>		
		Failed to correct known problems	<ul style="list-style-type: none"> <li>• Shipborne related shortcomings</li> </ul>		
		Supervisory violations	<ul style="list-style-type: none"> <li>• Shipborne violations</li> </ul>		
	<b>Preconditions for unsafe acts</b>	Environmental factors	<ul style="list-style-type: none"> <li>• Physical environment</li> <li>• Technological environment</li> </ul>		<i>Within machinery space</i>
		Crew condition	<ul style="list-style-type: none"> <li>• Cognitive factors</li> <li>• Physiological state</li> </ul>		
Personnel factors		<ul style="list-style-type: none"> <li>• Crew interaction</li> <li>• Personal readiness</li> </ul>			
<i>Active failures</i>	<b>Unsafe acts</b>	Errors	<ul style="list-style-type: none"> <li>• Skill-based errors</li> <li>• Decision and judgement errors</li> <li>• Perceptual errors</li> </ul>		
		Violation	<ul style="list-style-type: none"> <li>• Routine</li> <li>• Exceptional</li> </ul>		
	<i>Macro-perspective</i> ← → <i>Micro-perspective</i>				

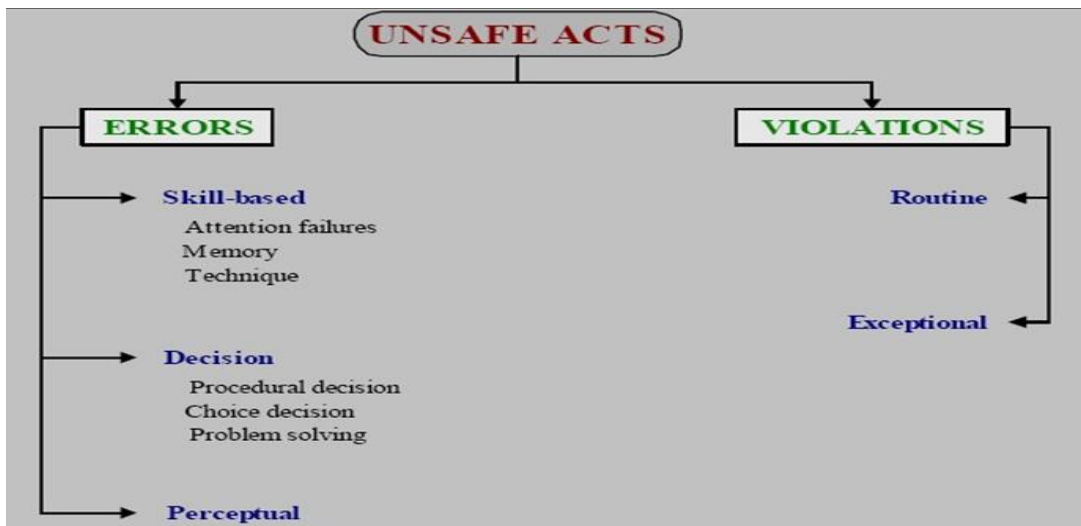
**Source:** IMO document, FSI 19/ INF.15.

Many of researcher applied with various accident causation hypothesis to achieve depth of contribution factors. The above model, the improved HFACS for machinery space is developed by Schroder-Hinrichs et al (2011), with an addition fifth level called outside factors. According to the above hierarchy, factors go up from unsafe acts to organizational influences. Each level is hooked on to the former by taking place with activities to the latent form. According to IMO document, FSI19/ INF.15,

"HFACS is seeking for causal components involved in fatality developments on five different organizational levels: 1. Unsafe acts; 2. Preconditions for unsafe acts; 3. Unsafe Supervision; 4. Organizational influences; and 5. Statutory. Even though the fourth level may be considered a subset of Organizational impacts".

#### 4.1.1 Unsafe Acts

**Figure 4- 1:** Classification of Unsafe acts.



**Source:** IMO document, FSI 19/ INF.15.

Unsafe acts are active failures, which are high-risk actions done by system operators on the front line that directly and immediately impact the system's safety. Alternatively, latent states can exist in a system for a long time without causing harm (Guevara Hero, 2020)

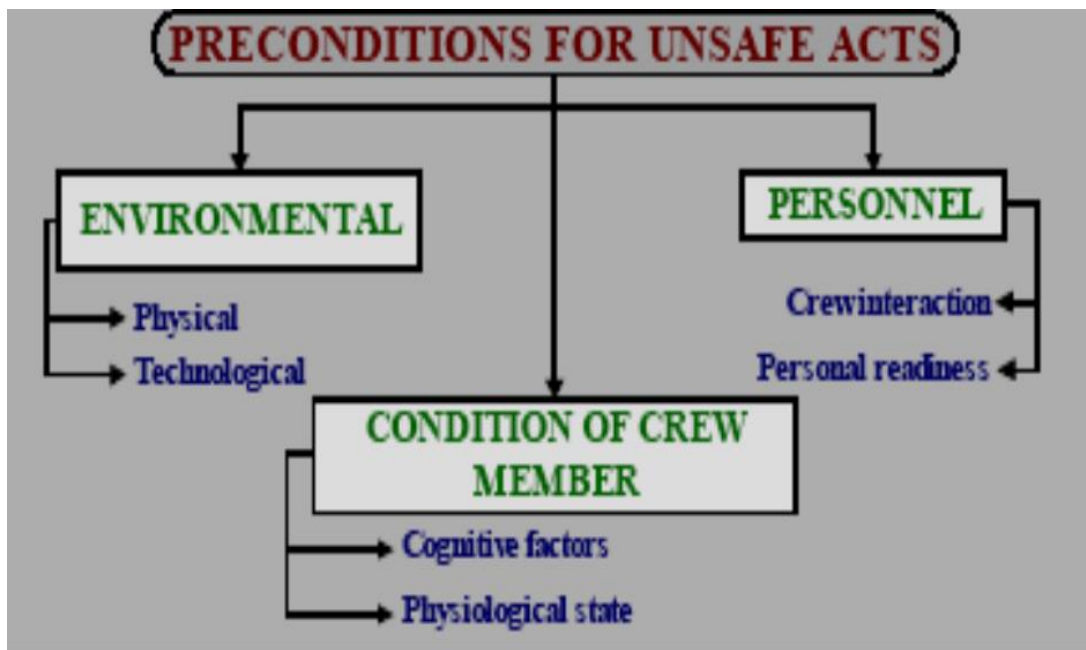
Unsafe acts may clarify into two parts: errors and violation. Error is an untended failure and forget to do something or performing an action or late response of any action, whether alone or as part of a planned sequence of actions either singly or as part of a planned sequence of action (Whittingham, 2004). The subcategories of human errors are skill-based, decision and perceptual may lead to accidents and



incidents. The Knowledge and skill description of human performance provides three main human error categories: the failure of attention (slip), memory failure (lapse), and technique, where errors are unintentional action and a mistake is an intended action deliberately doing the wrong thing. However, there is no explicit decision to act against it (Chen et al., 2013). Mistakes can be further divided into rule-based and skill-based. Not all violations are adverse because sometimes violation could be no choice and have to violate to be safe, and for intentional violation, they do not care about the consequences(Kim, 2021). Violations are deviations from safe operating practices, procedures, standards, or rules and are divided into routine and; exceptional (situational or optimizing) violations.

#### 4.1.2 Precondition for Unsafe Acts

**Figure 4- 2:** Classification of preconditions for unsafe acts.



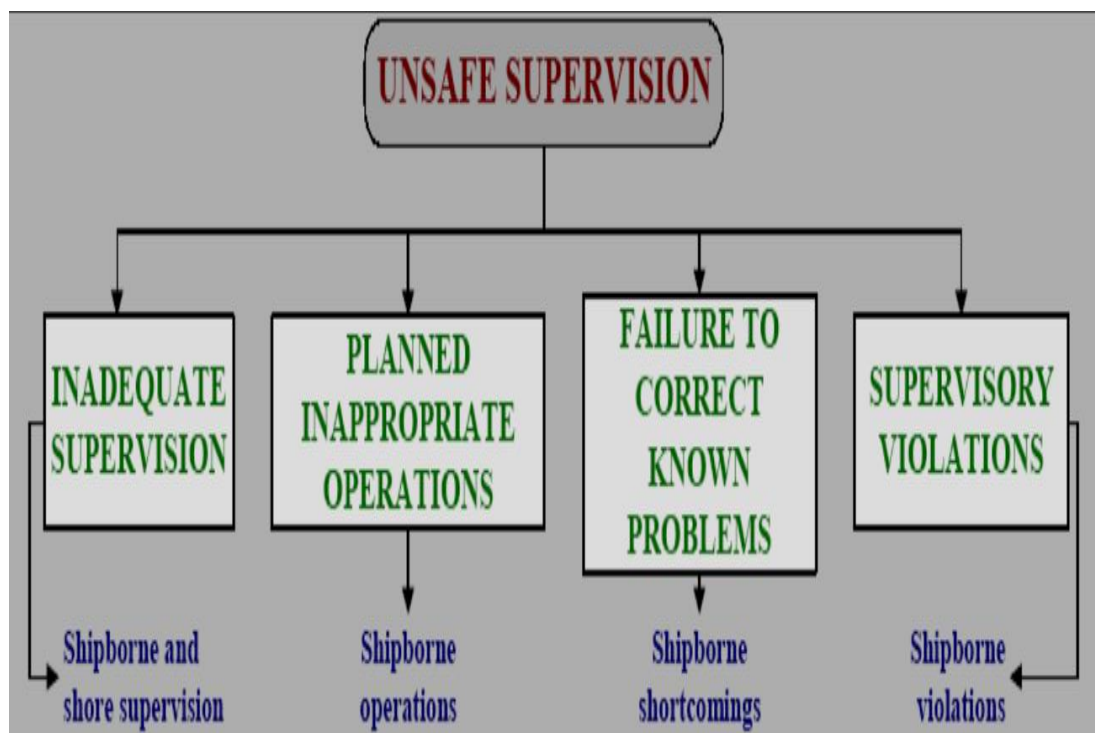
**Source:** IMO document, FSI 19/ INF.15.

Active or latent preconditions for unsafe acts are essential factors in an accident. For example, environmental factors, operators, and employees influence individuals'

behaviours, resulting in an unsafe condition or operator error, resulting in an unsafe condition or operator error (Onsongo. E.K, 2017). The above figure exhibiting Individual elements and environmental factors embrace both physical condition and human-environment interactions (cognitive) that include all kinds of conditions. Cognitive factors that contribute to an error in cognitive or individual perceptions and performance are influenced by environmental factors, which might lead to human error or an undesirable condition and Improper body functioning, comprising the physical and chemical processes of cells, tissues, organs, and systems. Their complex interactions can cause an individual to make an error or engage in unsafe behaviour.

#### 4.1.3 Unsafe Supervision

**Figure 4- 3:** Illustration of unsafe supervision.

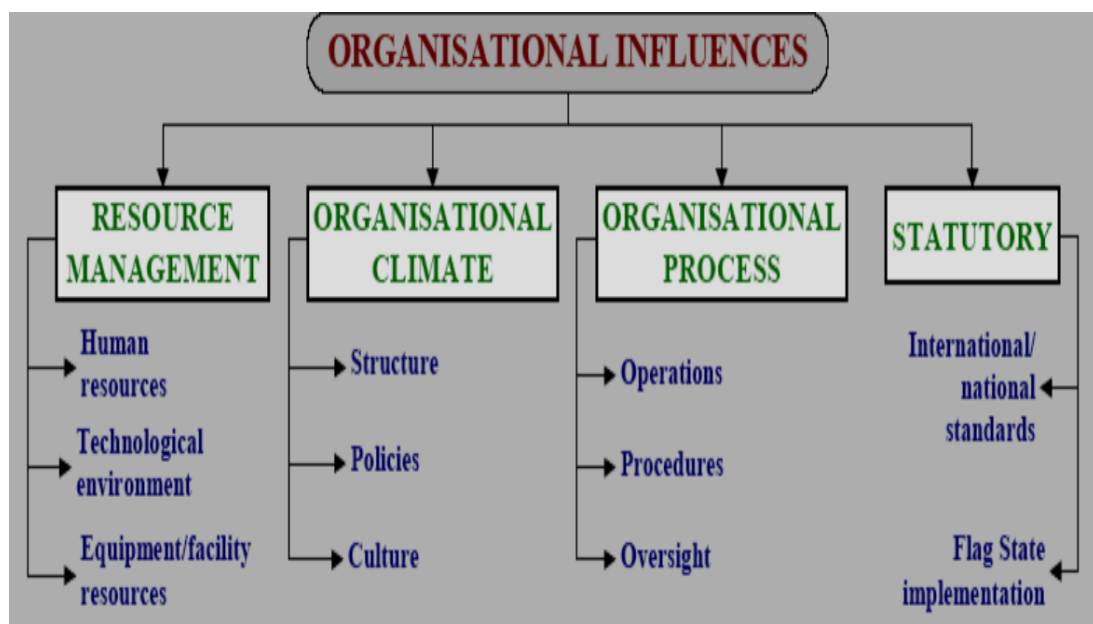


**Source:** IMO document, FSI 19/ INF.15.

Inadequate Supervision, planned improper operations, supervisory violations, and failure to rectify recognized problems are the four different factors of unsafe Supervision. The factors are directly affected by practices, conditions, or actions from management level decisions, procedures, or policies resulting in human error or a dangerous environment at the managerial level to technical or support level (Onsongo. E.K,2017).

#### 4.1.4 Organizational Influences

Figure 4- 4: Categorization of organizational influences.



Source: IMO document, FSI 19/ INF.15.

Four groups are listed. According to the above figure, four categories are resource management, organizational climate, organizational process, and statutory. Factors in the above categories that contribute to an accident if high-level management's statements, actions errors, or policies directly or indirectly impact managerial procedures, settings, or crew member activity, resulting in malfunction, human error, or an unsafe situation.

## 4.2 Analyzing the data

Total 348 accidents have been documented in the internal file of DMA and general data analysis from 2010 to 2020. However, the study with HFACS Taxonomy for twenty accident reports is shown below and Appendix I.

**Table 4- 2:** Lists of uncoded accidents.

	<b>Date Location</b>	<b>Name/ Type of Vessel</b>	<b>Type of Accident Severity</b>	<b>Summary</b>
1	28/04/20 13  Yangon River	M.V "MALACCA HIGHWAY" (Container) & M.T "MYAN AUNG" (Coastal Tanker)	Collision  Total loss (Tanker)	The pilot from Container tried to contact Tanker sailed with the tide, but no replied. The captain raised the whistle tried to announce the Tanker vessel at a distance of about 0.3 N-miles. About 14: 45 hours, the pilot ordered to master of the Tanker vessel to change course via VHF radio. Tanker vessel responded that he had been ordered to alter starboard and refused to alter again to port. The pilot ordered to stop the engine and full astern; however, two vessels collided.
2	26/04/20 15  Yangon River	MV Panja Bhum (Container) , Zwe Myint Myat Tun 3 (Tug)	Collision  Barge sinking	Panja Phum collided with an inland tug, Zwe Myint Myat Tun 3, due to bad weather. There was no proper lookout duty on both vessels and no VHF radio provided on the Inland tug. Master and pilot from container ship ignore the safe speed, and inland tug master violated the inland vessel rule ( sail to the right side as far as possible ).

3	31/10/20 15 Long Grate Swirl, Kalaywa, Sagaing Division	Yazar Tun Ferry	Capsizing Total loss 14 dead and 25 missing	The vessel controlled by an uncertified driver deviated from the regular lane and proceeded to swirl at 05:30 hr.
4	15/10/20 16 Monywa, Sagaing Division	Aung Soe Moe Kyaw 2 Ferry	Capsizing Total loss 73 dead and 41 missing	At (04: 45) hr., near Michaungtwin village, the western bank of Chindwin River, the vessel capsized due to overturning the steering because the driver tried to return to regular waterway from the wrong direction which directed to the river bank.
5	19/12/20 16 Toe River (Kye Htaw )	Pathein Thu 15 , Chan Myae Tun 2 Ferry & Wooden cargo boat	Collision Small boat sinking	Inland ferry, Pathein Thu 15 collided with a wooden boat, Chan Myae Tun 2, at the Wae Gyi curve, Toe River. The ferry sailed against the tide and proceeding from starboard lane with reduce speed. However, the wooden boat suddenly turned and crossing over the ferry; consequently, the wooden boat entered into the twin-hull of the ferry then sunk.
6	01/03/20 17 Yangon River	MV Anan Bhum (Container) and MV Htet Aung Lin 1(Coastal cargo)	Collision Hull damage on both vessels	At 04:20, the master from the Cargo ship called the Container ship twice via the VHF channel. There was no reply from the Container ship controlled by the Myanmar pilot and Thailand captain, and Htet Aung Lin been handled with the coastal master who holds the pilot exemption permit. All navigation and manoeuvring equipment was satisfactory and at about 05:00 hour collided the two vessels during the port to port passing
7	07/04/20 17 Ngawon River, Pathein	Nadi Shwe Sin (Tug), Ngwe Kyal Pwint (Under 20 H.P Ferry)	Collision 31 loss of life	A small ferry departed from Pathein jetty with 59 persons onboard, which was twice the allowable limit and some passengers seated on the roof. There was no navigational or signal light and life-saving appliance onboard. A few minutes

				after departure, a small ferry boat collided with a tug and barge when passing through the curve of Ngawon River.
8	01/08/2017 Gawine jetty, Mandalay	RV Poukan River Cruise	Fire diminished one cabin	During under repairing process, the cruise dock at Gawain jetty, Mandalay power supply from shoreside. On the evening of 1 <sup>st</sup> August 2018, about 09:30 hours, the fire broke out from repaired room due to surge voltage and shortcircuited. There was no fire petrol arrangement and switch off the power of sprinkler and fire main system due to voltage variation (220 ~ 440 v). Fire has been killed by portable extinguisher after the 60 minutes.
9	29/08/2017 Yangon River	MV Bangpakaew (Container) , MFV Phyo Pwint Maung / Lin Yaung Thit 4 (Fishing)	Collision sunk the fishing vessel ( Lin Yaung Thit 4 )	container vessel, Bangpakaew departed from Yangon against the tide and fishing vessels, Phyo Pwint Maung towed with Lin Yaung Thit due to engine damage. Both fishing vessels proceed to Yangon with the. About 19:07, the Pilot from the Container ship informed that "Port-to-Port crossing" via VHF radio. Meanwhile, the Fishing vessel did not reply due to VHF malfunction. After eight minutes, Fishing vessels altered the course to port immediately due to steering malfunction consequently collided with the starboard bow of the container ship.
10	25/02/2018 Indawgyi Lake, Kachin State	Under 20 Horse Power Boat Ferry	Capsizing Nine loss of life	The unregistered small ferry capsized near Iwaemon village in Indawgyi Lake during bad weather. The small boat was designed for fishing and operated by fishermen without a driver license and carried passengers for island pagoda during festival season. According to the design feature, the boat can carry six persons only. However, 18 passengers were carried before

				the accident happened and remaining the freeboard six inches consequently, ingress water and sinking after the strong wind.
11	26/03/20 18 Daw Nyein village, Pyarpone , Ayarwady Division	Aung Chan Thar 3 Fishing	Fire Total loss	During under repairing process, the vessel dock at Daw Nyein village. The shipowner and crew brought the old engine to the shore and left the vessel without a crew or any watchkeeper. Before leaving the ship, one of the crew charged the mobile phone with a power bank and lit a candle on the shrine in the engine room. After the fire occurred, all crew fought with a portable fire pump. However, the fire was an uncontrollable condition and led to exploding fuel oil storage tank. Consequently, it burned out some houses from shore and the whole vessel. Major root causes were: usage of naked light in the engine room, fuel oil service tanks were made with plastic, there was not ready to fire extinguisher and sand box.
12	13/06/20 18 Kawyar village, Homemal in	Shwe Sin Oo  Under 20 horse power boat	Capsizing One missing	Shwe Sin Oo, under 20H.P cargo boat, departed from the jetty with cargoes and 25 passengers. Vessel out of control due to jammed with floating dunnage between propeller and rudder after 15 minutes departure. After that, the vessel collided with another ship and sunk.
13	24/03/20 19 Maw Tin Soon (Lat. 16' 03.5' (N) & Long 094' 11.8"	(CBR 0740) Cargo Barge	Flooding Total loss One missing and one severe injury	The Inland tug towed the cargo barge, which carried ship breaking parts and fuel oil from the wreck removing project. Barge bottom part bumped with seabed twice per day due to tidal condition and barge operated over three months, Barge has been flooded from bottom hull where temporary repaired and inclined to the port side, and water ingress from opened- manholes then difficult to handle. After that, the cargo barge

				bumps with rock and sinking. Tug and barge were only permitted for an inland waterway, and accidents happened in the coastal area
14	25/07/2019 26 Nautical miles from Pathein lighthouse	MV. HtarwaraAh Arman Cargo (Coastal)	Capsizing  Total loss Five dead and two missing	About 14:13, sea water ingresses to the main deck passed over 7 feet of bulwark due to heavy waves with a strong wind from the port bow. Consequently, two-third of the cement pack from the forecastle moved to the port side alleyway, then all cargo collapsed to the port side then capsized.
15	17/10/2020 Tamalo village, Nyaungtone, Hlaing river	Regency 1(Tug) with OB 404 & Yokohama 4(Tug) with CBR 351, CBR 510	Collision  Hull damage and oil pollution	Regency 1 vessel towed with full speed and communicated to Yokohama 4 via VHF radio before passing the tringle; however, loss of connection after replied from Yokohama vessel, which was manned with an uncertified master and engine driver. Both vessels passed the tringle without continuous communication via radio and collided with an oil barge and two cargo barges.
16	19/10/2020 Layan island, Myeik, Tanintharyi Division	Aung Mingalar 5 (ON 4702) Fishing	Capsizing Total loss Two missing and two injuries	The vessel returned from the fishing zone, and all fishing nets were stored on the starboard side for sheltering due to storm warnings. About (07:30), the vessel capsized to starboard were kept in the fishing net due to strong wind, then sunk two nautical away from the island.



17	24/10/20 20 Myungmya, Ayarwady Division	Win Thiri Aung ( Ya Nya Na / Ayar - 1376 ) Dredging and sand carry boat	Flooding Total loss and one loss of life	The vessel carried sand with the overloaded condition and docked at the river bank for waiting for the low tide. However, during low tide, it flooded from the stern part and then sunk.
18	11/11/20 20  Five miles away from Monywa, Sagaing Division	Win Win Htet (15284)  Cargo (Shallow water)	Fire  Two injuries	The initial source of the Fire was an overheated socket of battery charging unit in the engine room, and then the Fire spread out to the fuel oil level gauge, which was provided with plastic. There was no watchkeeper in the engine room and consequently did not fight in time, leading to vessel fire.
19	27/02/20 21 Myebon, Rakhine State	MV Kumudra 1 Cargo (coastal )	Grounded and Capsizing Total loss	<i>Kumudra 1</i> departed from Kantaung Gyi jetty, Myebon and loaded with 600 tones of construction rock. About 12:00 hour, Commenced heavy waves and strong wind from starboard beam together with high tide due to full moon day. The vessel proceeds voyage with difficult steering control and poor visibility. At about 13:30 hour, the vessel collided with black rock and ran aground, consequently flooded due to tank damage. Ship crew pumping out with three water pumps and informed to ship owner and other vessels. On the 18:00 hour, the vessel cleared from black rock and capsized to the starboard side. Master and crew were safely rescued by <i>Yadanarwin</i> , a coastal vessel.
20	28/04/20 21 Lat 17' 57 (N), Long 94' 00(E)	Toe Myat Annawar Fishing	Fire Total loss	Fishing vessel Caught fire from engine room due to electric shock. There was no certified engine driver onboard and operated with an assistance driver before the accident happened. Electric shock immersed from loosening socket, plug and poor wiring system then the fire spread out to fuel and finally

				the whole vessel has been destroyed although all crew has been safe.
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**Source:** Author

### 4.3 Severity and the contributing factors from twenty investigation reports

**Table 4- 3:** Severity and Contributing factors.

Factors	Severity				Total
	Very high (Total loss and high causality) 5 cases	High (Total loss and less causality) 4 cases	Moderate (Total loss or Dead ) 8 cases	Less serious (Damage part) 3 cases	
<b>Unsafe Acts</b>	19	11	32	15	77
<b>Precondition for unsafe acts</b>	22	15	40	17	94
<b>Unsafe supervision</b>	32	18	35	14	99
<b>Organizational Influences</b>	26	11	29	12	78
<b>Total</b>	99	55	136	58	348

**Source:** Author

The analysis has been taken from the internal document of DMA and retrieved from twenty accident investigation reports for the Domestic shipping sector. Evaluation or highlight any deviations in the study, the coding was examined by a flag state surveyor and expert in domestic vessel accident investigation. By modifying the IMO's guidelines for casualty report analysis, severity was summarized in several seriousness categories as indicated in the above table and the cause elements classified after evaluating the collection data of domestic vessel accidents around

Myanmar. The severity of accidents is classified into four categories: very high to less severe cases depending on the rate of causality and properties loss.

#### 4.4 Summary of HFACS analysis from twenty investigation reports

**Table 4- 4:** Summary of HFACS analysis.

Reported HFACS Causal Factors			Figures	
			No.	%
<b>Statutory</b>			<b>8</b>	<b>2.29 %</b>
<i>FS xxx</i>	<i>Statutory</i>		8	2.29 %
	FS 000	International standards	2	0.57 %
	FS 100	Flag state implementation	6	1.72 %
<b>Organizational Influences</b>			<b>70</b>	<b>20.11 %</b>
<i>OR xxx</i>	<i>Resource management</i>		20	5.75 %
	OR 000	Human resources	11	3.16 %
	OR 100	Technological Resources	4	1.15 %
	OR 200	Equipment/facility resources	5	1.44 %
<i>OC xxx</i>	<i>Organizational climate</i>		23	6.61 %
	OC 000	Structure	9	2.58 %
	OC 100	Policies	1	0.28 %
	OC 200	Culture	13	3.73 %
<i>OP xxx</i>	<i>Organizational Process</i>		27	7.78 %
	OP 000	Operations	5	1.44 %
	OP 100	Procedures	7	2.01 %
	OP 200	Oversight	15	4.31 %
<b>Unsafe supervision/work place factors</b>			<b>99</b>	<b>28.45 %</b>
<i>SI xxx</i>	<i>Inadequate supervision</i>		32	9.19 %
	SI 000	Shipborne and shore supervision	32	9.19%
<i>SP xxx</i>	<i>Planned inappropriate operations</i>		22	6.32 %
	SP 000	Shipborne operations	22	6.32 %

<i>SF xxx</i>	<i>Failed to correct known problems</i>		12	3.45 %
	SF 000	Shipborne shortcomings related	12	3.45 %
<i>SV xxx</i>	<i>Supervisory violations</i>		33	9.48 %
	SV 000	Shipborne violations	33	9.48 %
<b>Preconditions for unsafe acts</b>			<b>94</b>	<b>27.01 %</b>
<i>PE xxx</i>	<i>Environmental factors</i>		38	10.92 %
	PE 100	Physical environment	24	6.89 %
	PE 200	Technological environment	14	4.03 %
<i>PC xxx</i>	<i>Crew Condition</i>		27	7.75 %
	PC 100	Cognitive factors	19	5.46 %
	PC 200	Physiological state	8	2.29 %
<i>PP xxx</i>	<i>Personnel factors</i>		29	8.33 %
	PP 100	Crew interaction	12	3.45 %
	PP 200	Personnel readiness	17	4.88 %
<b>Unsafe acts</b>			<b>77</b>	<b>22.13 %</b>
<i>AE xxx</i>	<i>Errors</i>		48	13.79%
	AE 000	Skill-based errors	28	8.04 %
	AE 100	Decision and judgement errors	15	4.31 %
	AE 200	Perceptual errors	5	1.44 %
<i>AV xxx</i>	<i>Violations</i>		29	8.33 %
	AV 000	Routine violations	17	4.88%
	AV 100	Exceptional violations	12	3.45 %
<b>Total</b>			<b>348</b>	<b>100%</b>

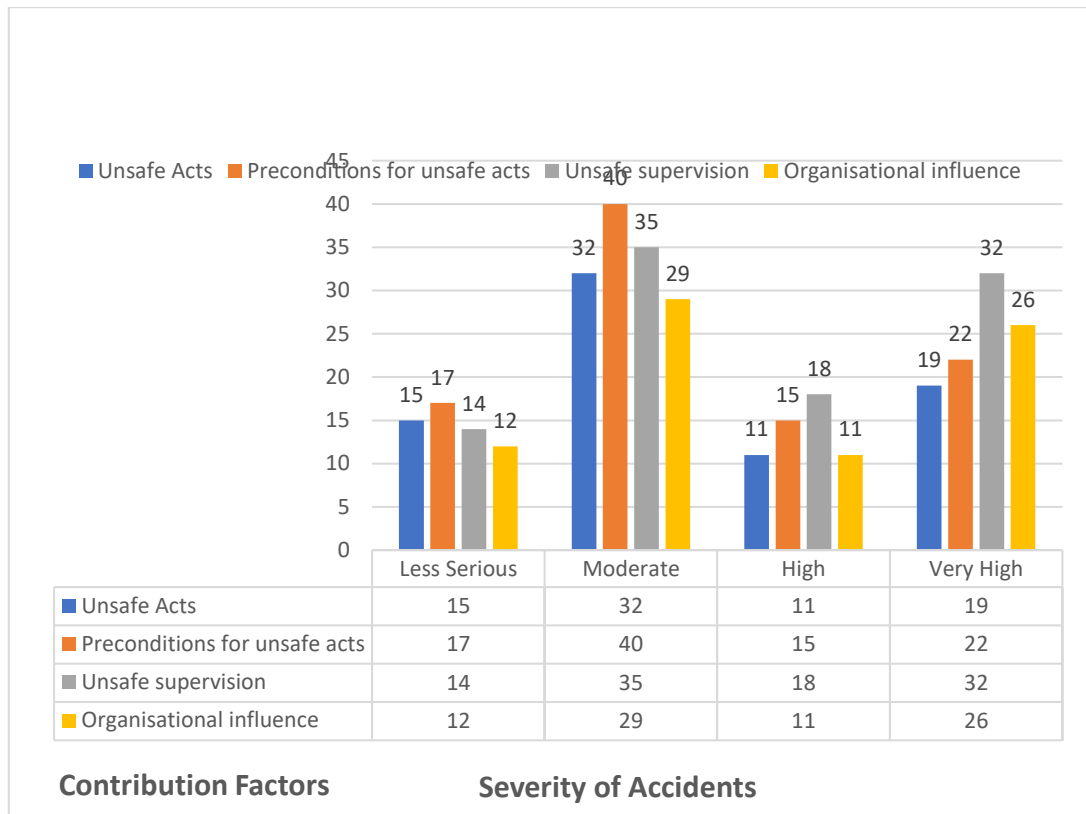
**Source:** Author as adopted from Schröder-Hinrichs et al., 2011.

There are three hundred, and forty-eight factors were identified for twenty accident cases, and unsafe supervision had the highest ranking among all factors, about 28.45 percent. In addition, the subcategory " *Supervisory violations* " within the major category " *Unsafe supervision* " had the most prominent values among all components, accounting for 9.48 percent of all causal factors.

As a result, the statistics imply that the causes of marine casualties are still primarily attributable to shipborne violations due to lack of supervision. In contrast, Organizational contributing factors were not attributed to the specific case of accidents.

#### 4.4.1 Comparison between Severity and contribution factors

**Figure 4- 5:** Comparison between Severity and contribution factors.



**Source:** Author

According to HFCS analysis results from twenty investigation reports, the above chart illustrates how the severity of accidents is related to the contributing factors, i.e., unsafe acts, preconditions for unsafe acts, unsafe Supervision, and organizational influence.

The bar chart mentioned in figure 4-5 provides 32 casual factors of unsafe Supervision that are the leading cause of the very high severe accidents (resulting in total loss and high causality). Twenty- six organizational influences take the second and 22 causal factors of precondition for unsafe acts the third. The least contributing factor in the most severe accidents is unsafe acts, which constitute only 19 factors.

In second-most severe accidents (resulting in total loss and less causality), 18 factors of unsafe Supervision also take the leading role, followed by 15 factors of precondition

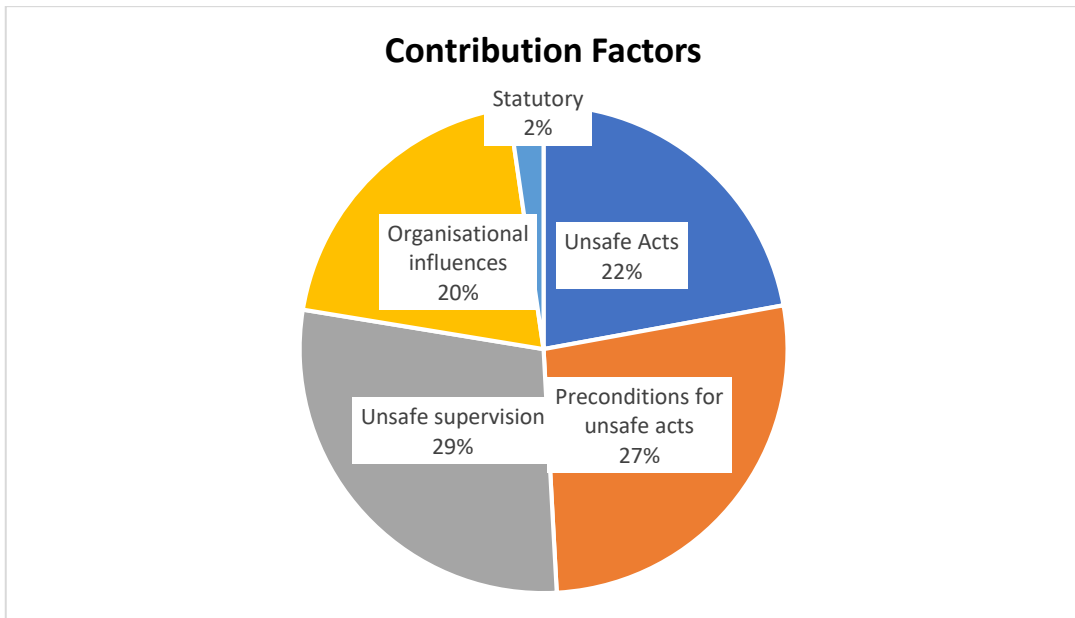
for unsafe acts. The unsafe acts and the organizational influences are the least found, which constitute 11 factors evenly.

In moderate-severe accidents (resulting in total loss and injury), 40 factors of precondition for unsafe acts take the leading role, and 35 elements of unsafe Supervision take the second leading role, followed by 32 aspects of unsafe acts and 29 the organization influences.

In the least severe accidents (resulting in only damaged parts), 17 factors of the precondition for unsafe acts take the leading role, and 15 unsafe acts take the second. Fourteen factors of unsafe supervision the third and 12 factors of organizational influences the fourth. In summary, unsafe Supervision is the main related factor to the most severe accidents, while the precondition for unsafe acts is mainly found in the moderate and least severe accidents.

#### 4.4.2 Highlight of Contribution Factors

Figure 4- 6: Highlight of Contribution Factors.



Source: Author

This pie chart shows the highlighted description of the contributing factors identified in maritime accidents according to twenty investigation reports: (1) statutory; (2)

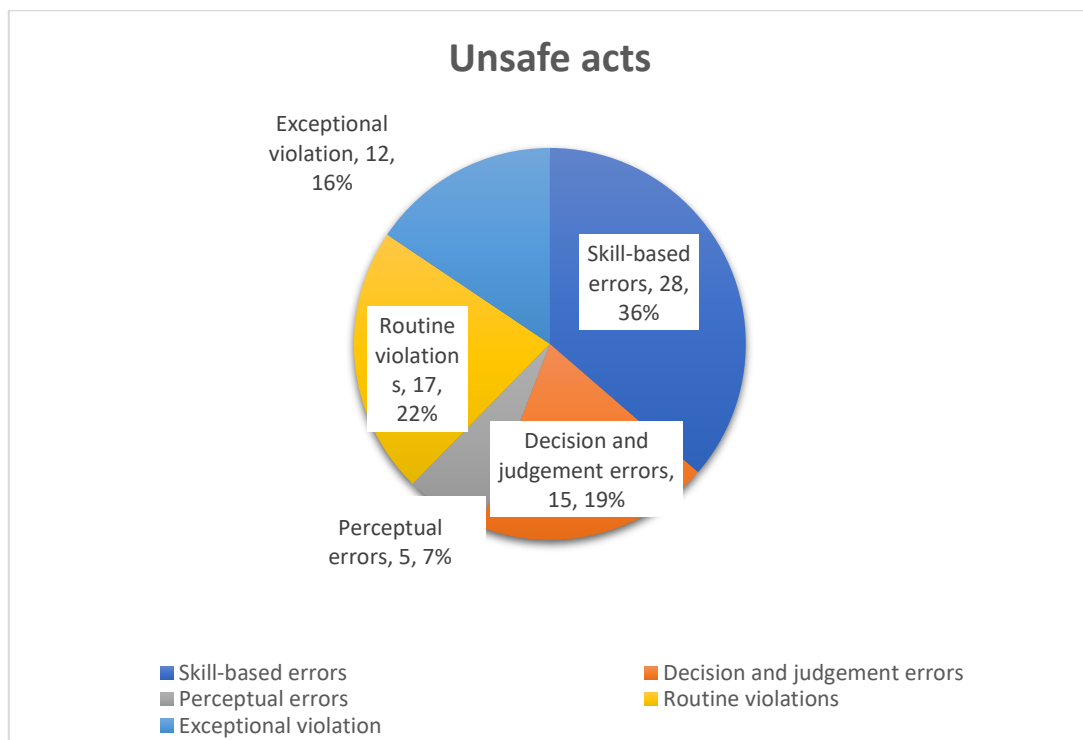
unsafe acts; (3) organizational influences; (4) unsafe supervision; (5) preconditions for unsafe acts.

Out of the contributing factors identified, unsafe supervision and preconditions for unsafe acts take the leading role with 29 percent and 27 percent, respectively, representing slightly over one-quarter of all categories. Those two categories, as mentioned earlier, are immediately followed by unsafe acts with 22 percent, representing approximately one-quarter of all categories. Finally, organizational influences stand the fourth rank with 20 percent, while statutory acts are the least contributing factor with 2 percent.

In conclusion, as per the investigation reports of domestic vessel accidents, unsafe supervision and preconditions for unsafe acts are the main root causes of such accidents.

#### 4.4.2.1 Unsafe Acts

Figure 4- 7: Contribution of unsafe acts



**Source:** Author

Unsafe acts are causal factors at the lowest organizational level. It relates to active actions carried out by crew members where the outcome does not necessarily match the original intention.

The pie chart stated above shows how many percentages of unsafe acts contribute to twenty maritime accidents stated in the investigation reports. As per the investigation reports on twenty maritime accidents, 77 identified unsafe factors (22 percent of the total causal factors) are the second least found in those twenty accidents. Unsafe acts can result from errors and/ or violations.

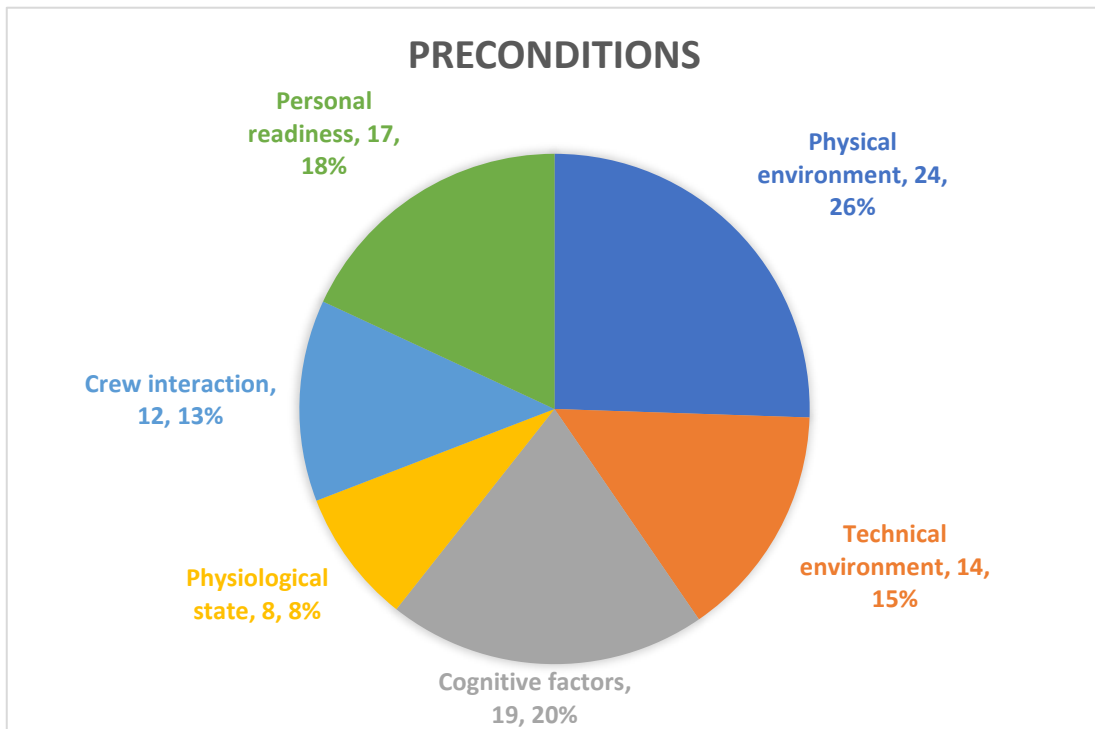
The details of the said unsafe acts (22% of total causal factors) according to twenty maritime accidents investigation reports, errors are the main root cause for causing accidents (62% in total), which represents (1) skill-based errors (36%); (2) decision and judgment errors (19%); and (3) perceptual errors (7%) respectively. Violations are factors in a mishap when the actions of the operator represent a willful disregard for rules and instructions and lead to an unsafe situation. Violations are also divided into two subcategories: (1) routine violations and (2) exceptional violations. According to the pie chart stated above, violations represent 38 percent of total causal factors of unsafe acts: (1) routine violations (22%); and (2) exceptional violations (16%), respectively.

To sum up, among the factors of unsafe acts, skill-based errors are the dominant factors (with 36%), representing over one-quarter of all factors, followed by the second dominant factor of routine violation with 22 percent. Decision and judgment errors stand the third rank with 19 percent, exceptional violations take the fourth with 16 percent, and perceptual errors are the least found with 7 percent.



#### 4.4.2.2 Preconditions for unsafe acts

Figure 4- 8: Contribution of preconditions for unsafe acts.



Source: Author

Preconditions for unsafe acts were introduced in the HFACS framework to consider the immediate precursors to unsafe acts. Factors on this level relate to environmental (workspace) factors (e.g., faulty equipment), crew conditions (e.g., fatigue), or personnel factors (e.g., inadequate training).

The above figure shows how many percentages of preconditions for unsafe acts contribute to twenty maritime accidents stated in the investigation reports. According to twenty maritime accidents investigation reports, 94 factors of preconditions for unsafe acts (with 27% of the total causal factors identified) take up the second most considerable portion of all aspects identified causing those twenty maritime accidents. However, in terms of severity, these preconditions for unsafe acts are the main factors contributing to moderate-severe accidents and less severe accidents.

Preconditions for unsafe acts are divided into three sub- categories, which are namely (1) environmental factors, (2) crew condition, (3) personnel factors.

Environmental factors are factors in a mishap if physical or technological factors affect individuals' practices, conditions, and actions and result in human error or an unsafe situation. Environment factors have two subcategories: (1) physical environment; and (2) technological environment.

Crew conditions are factors in a mishap if the cognitive, psycho-behavioural, adverse physical State or physical/mental limitations affect individuals' practices, conditions, or actions and result in human error or an unsafe situation. Crew conditions have two subcategories: (1) cognitive factors; and (2) physiological State.

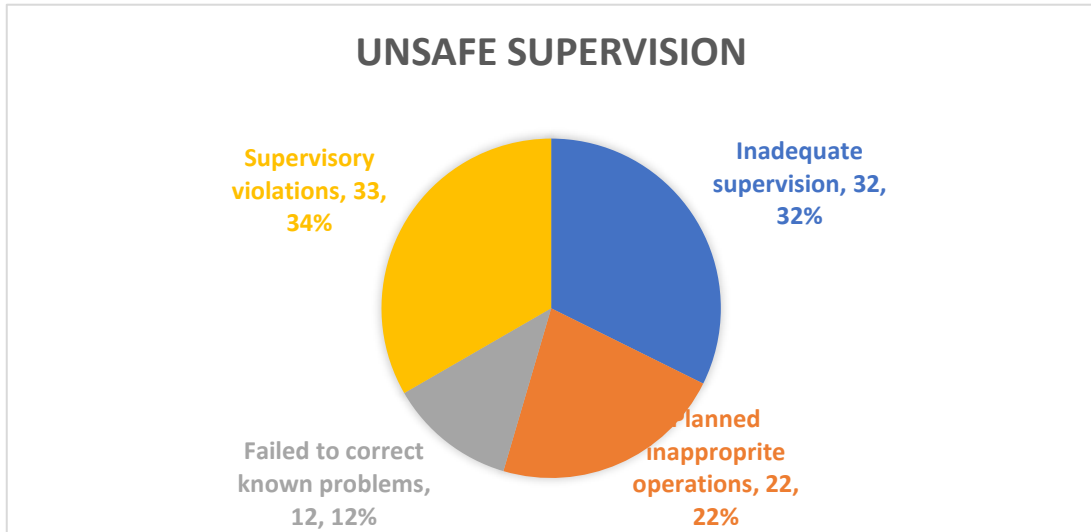
Personnel factors are factors in a mishap if self-imposed stressors or crew resource management affect individuals' practices, conditions, or actions and result in human error or an unsafe situation. Personnel factors are divided into two subcategories: (1) crew interaction; and (2) personnel readiness.

In consideration of the details of such preconditions for unsafe acts (27% of the total causal factors identified in the figure 4-6 ), as stated in the pie chart above according to 20 maritime accidents investigation reports. Environmental factors lead with 41 percent representing physical environment with 26 percent and technological environment with 15 percent respectively. Personnel factors take the second rank with 31 percent, representing crew interaction with 13 percent and personnel readiness with 18 percent. Finally, crew conditions are the least found with 28 percent, which represents cognitive factors with 20 percent and physiological State with 8 percent, respectively.

In conclusion, the physical environment is the most dominant factor (with 26%), while cognitive factors are the second leading factor with 20 percent. Personal readiness stands the third rank with 18%, and technical environment takes the fourth rank with 15 percent, followed by crew interaction with 13 percent. Finally, the lease one is the physiological state of crew condition about 8 percent.

#### 4.4.2.3 Unsafe supervision

Figure 4- 9: Contribution of unsafe Supervision.



**Source:** Author

Unsafe Supervision is a factor in a mishap if the methods, decisions, or policies of the supervisory chain of command (officers at management level over operational and support levels) directly affect individuals' practices, conditions, or actions and result in human error or an unsafe situation.

The above figure states how many unsafe supervision percentages contribute towards twenty maritime accidents stated in the investigation reports. According to HFACS analysis from twenty investigation reports, 99 factors of unsafe Supervision (with 29% of the total causal factors identified) take up the most significant portion of all causal factors identified, causing the said twenty maritime accidents. In terms of severity, unsafe supervision is the main root cause of moderate, severe accidents and very high severe accidents.

Unsafe Supervision is divided into four categories, namely, (1) inadequate Supervision, (2) planned inappropriate operations, (3) failure to correct known problems, and (4) supervisory violations.

Inadequate Supervision is a factor in a mishap when Supervision proves inappropriate or improper and fails to identify the hazard, recognize and control risk, provide guidance, training, and/or oversight, and results in human error or an unsafe situation. In addition, inadequate Supervision has a subcategory – shipborne and shore supervision, which is a factor in a mishap when the interaction between officers at the management level and managers directly bear the day-to-day running and operation of the machinery space leading to an unsafe situation.

Planned inappropriate operations are factors in a mishap when Supervision fails to assess the hazards associated with an operation adequately and allows for unnecessary risk. It is also a factor when Supervision allows non-proficient or inexperienced personnel to attempt tasks beyond their capability or when crew complement is inappropriate for the task. The planned improper operation has a subcategory – shipborne operations, which are factors in a mishap when the interaction between officers at management and operational levels and support levels directly bears the day-to-day running and operation of the machinery space to an unsafe situation.

Failed to correct known problems is a factor in a mishap when officers at the management level fail to correct deficiencies in documents, processes, or procedures or fail to correct inappropriate or unsafe actions of individuals. This lack of supervisory action creates an unsafe situation. In addition, failed to correct know problems has a subcategory – shipborne shortcomings, which is a factor in a mishap when officers at the management level do not comply with safety management practices, leading to an unsafe situation.

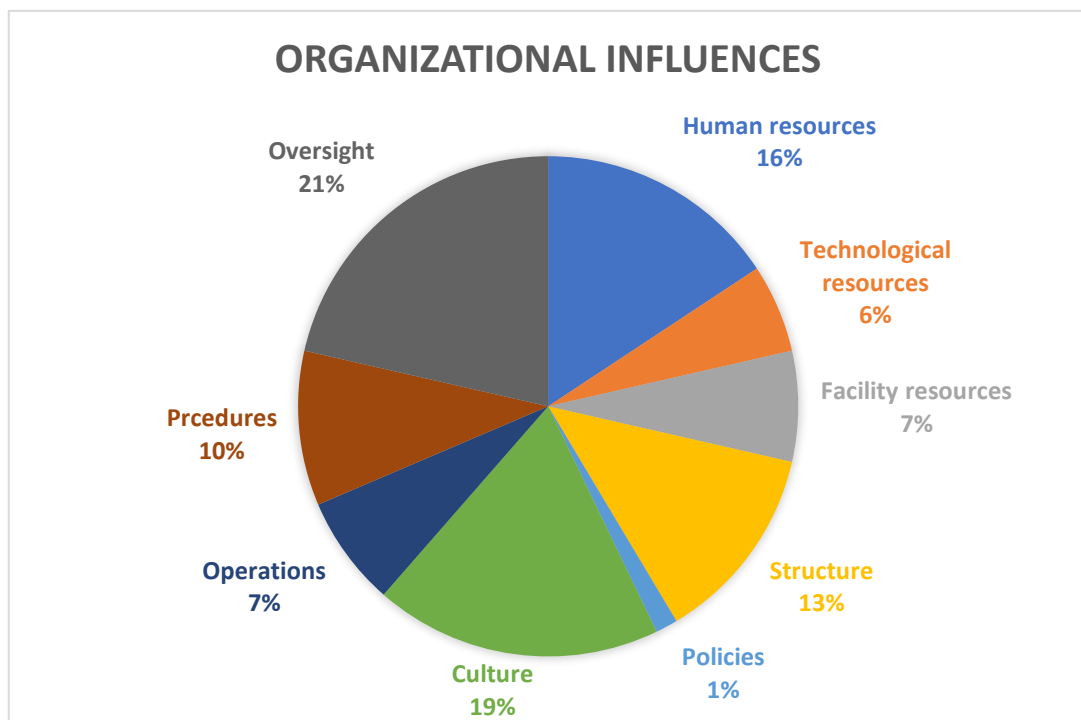
Supervisory violations are factors in a mishap when officers at the management level willfully disregard instructions, guidance, rules, or operating instructions whilst managing organizational assets, and this lack of supervisory responsibility creates an unsafe situation. Supervisory violations have a subcategory – shipborne violations, which are factors in a mishap when violations are committed by operating and support level, machinery space crew members are tolerated by officers at management level, leading to an unsafe situation.

Having conducted a thorough review of the details of such unsafe Supervision as stated in the pie chart of this chapter 4.4.2.3, supervisory violations lead with 34 percent, followed by inadequate Supervision with 32 percent. Finally, the planned inappropriate operation took the third with 22 percent and failed to correct known problems is the causal factor which least found with 12 percent.

In summary, among factors of unsafe supervision, supervisory violations are the most dominant factor (with 34%) while failed to correct known problems is the least dominant factor (with 12%).

#### 4.4.2.4 Organizational Influences

**Figure 4- 10:** Contribution of organizational influences.



**Source:** Author

Organizational influences are factors in a mishap if the communications, actions, omissions, or policies of upper-level management directly or indirectly affect

supervisory practices, conditions, or actions of the crew member(s) and result in system failure, human error, or an unsafe situation.

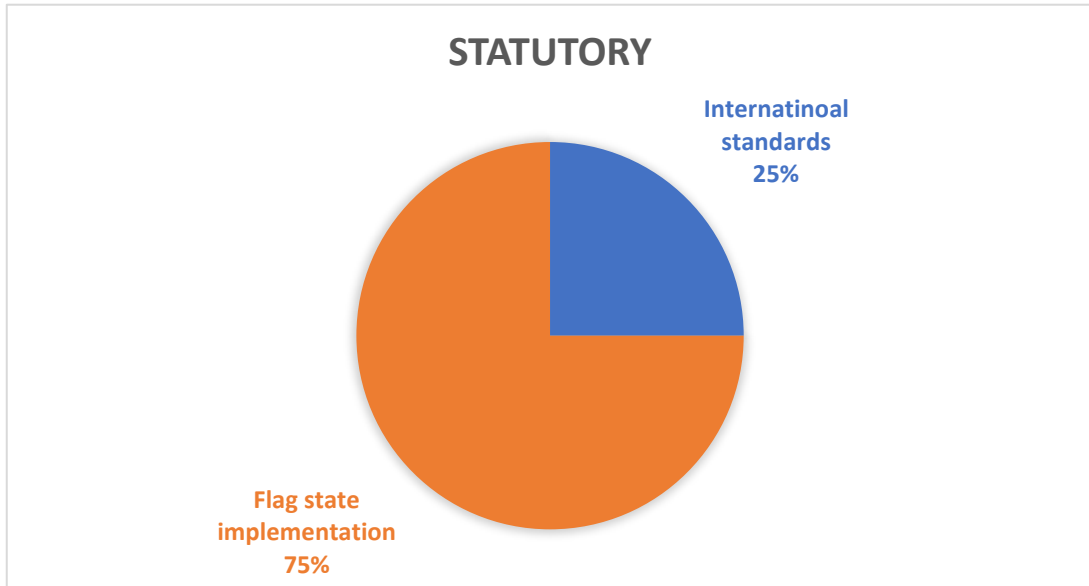
The above figure shows how many percentages of organizational influences contribute towards investigation reports. According to HFACS analysis, 70 organizational influences factors (with 20% of the total causal factors identified) take up the second least portion of all factors identified, causing those twenty maritime accidents. In terms of severity, the factors of organizational influences together with statutory factors take the leading role in the moderate-severe maritime accidents and the most severe maritime accidents.

In thorough consideration of the above figure, oversight to organizational process contributes to human error of unsafe situation take the leading role with 21 percent. Safety culture within the organization creates an unsafe condition which stands the second rank with 19 percent, followed by human resource with 16 percent. Improper structure and framework of the organization stand the fourth role with 13 percent, while the improper procedure of the organizational process contributes 10 percent only. Poor or lack of facility resources and sub-standard operation equally take the fifth rank with 7 percent. Finally, policy influences on organizational safety are least contribute to those twenty maritime accidents.

The most dominant factors are oversight under the organizational process and culture under the organizational climate. In contrast, policies under the organizational climate are the least dominant factors.

#### 4.4.2.5 Statutory

Figure 4-11: Contribution of statutory.



**Source:** Author

Statutory are factors in a mishap if the regulator's regime is either sub-standard or lacks the necessary depth, leading to an unsafe situation.

Under statutory, there are two factors, namely (1) international standards; and (2) flag state implementation. International standards are factors in a mishap when setting international standards or contributing to human error or an unsafe situation. Flag state implementation is a factor in an accident when the enforcement of regulations at the national level is sub-standard, contributing to an unsafe condition.

The above figure shows how many percentages of related statutory factors contribute to domestic vessel accidents. According to analysis, flag stage implementation is the leading factor with 75 percent, while international standards rank with 25 percent.

## **Chapter Five**

### **5.1 Interview with stakeholders**

The analysis with the HFACS method helped highlight the key contributing factors and consider overall domestic vessel safety together with interview results from individual stakeholders. The interview result may support the discussion and recommendation section aligning with general and HFACS analysis to get clear pictures.

### **5.2 Discussion for the contributing factors of HFACS analysis and interview questions**

Several studies have found that specific organizational factors are not always investigated under the IMO models. Furthermore, for various reasons, accident investigation reports are typically missing in the organizational context (Schroder-Hinrichs, 2010). The outcomes from the previous chapter were examined relate to twenty accidents investigated reports. However, some reports are impossible to get a clear picture of contributing factors to proceed discussion section. Therefore, an additional interview with specific stakeholders for reviewing the information and analyzing the gap between the investigation reports and on-ground conditions achieves an essential data source for understanding how domestic vessel accidents are handled in Myanmar.

### **5.3 Unsafe Acts**

Unsafe acts involving errors and violations are more common in fishing vessels, coastal vessels, and cargo barges than in other types of vessels. Errors, mainly skilled-based errors and decision/judgment errors, are the most common unsafe acts that caused accidents throughout the research. Statistically, skill-based errors are significantly higher than other factors. Masters and crew with poor seamanship and techniques: where there were no draft measurement and adjustment of the mooring line during dock; all fishing nets stored at one side only; sailing with full speed with against the current and not given way for other vessels with the current; sail the wrong way from the regular lane and proceed to swirl; the poor practice of hot work and



usage of naked flame in machinery space; not having anyone assigned for a proper lookout and watch-keeping on the vessels, and the inadequacy of the system to provide training and drills especially for cases of emergency. Such poor seamanship and techniques are consequently causing a delay in commencing the orders, thus resulting in too late to reduce speed, preparing the life-saving appliance before sinking; delay in radiocommunication. Not only are delays in commencing orders concerned, but wrong decision-making during operation accounts for a considerable percentage of unsafe acts. Thus, it clearly shows under-qualification of crews and masters mainly causes the errors of unsafe acts. Regardless of their under-qualification, the crew and operators are generally overconfident and have negative habits that trigger the likelihood of causing accidents. Perceptual errors were also shared in unsafe acts errors in cases where the operators presumed that the accident was unlikely during the voyage. Skippers are found to be grounding and, in a collision, due to the choice of the wrong waterway. Intentional routine violations are found to be the repeating causes of frequent collisions increasing the risk of grounding. Violation of standing orders and regulations, the voyage with overcrowded passengers, and overloaded vessels are identified as the recurring actions that lead to capsizing and sinking of the vessels. As a result, the possibility of miscommunication and misunderstanding during operations increases when uncertified masters make incorrect decisions and the crew is unable to follow complex orders. Habitual actions, in particular, cargo barges carrying petroleum products, including diesel and gasoline, enhances the potential cause of accidents during the trade. Most fishing and coastal vessels had fuel oil in drums and stored onboard, resulting in vessel fire. Most capsizing is caused by improper loading and overcrowding, unavoidable touching with underwater objects, and the wrong decision of unqualified masters.

## **5.4 Preconditions**

### **5.4.1 General and crew conditions**

Many unsafe acts have been attributed to other forms of preconditions, including but not limited to the use of old age vessels and failure of adequate maintenance of the vessels. Due to a lack of certified masters, crews, and engineer officers, multiple errors of the exact nature are recurring on a routine basis until the day of the occurrence of the accident. Masters are not familiar with current vessels since the positions are not permanent and have poor crew understanding of safety awareness. No specific safety guidelines and no certification system for crew master and engine driver only have the certificate. Owing to low education level, the mindset of the crew, and poor safety awareness, use mobile phones during working hours leads to a lack of alertness and focus on work. The crew were not trained for proper fire fighting procedures and safety emergency response; consequently, minor errors lead to high accident severity. Owing to loop hole of the training program, safety awareness of master and crew in domestic shipping has not dramatically improved within ten years.

### **5.4.2 In coastal shipping**

Navigational types of equipment are out of date, and improper use of navigation aids leads to collision and not backup arrangements such as the incomplete set of the chart may not support GPS out of order. The outbreak of engine room fire results from improper wiring arrangement and poor knowledge of fuel oil storage and handling procedure. There is no lifeboat on coastal vessels and equivalent means of provision with life rafts which are not actual servicing and only approved on documents due to insufficient service providers. Most masters and managers fail to alert all crew during heavy weather. The incorrect procedure of cargo lashing and securing arrangements may lead to capsizing during heavy weather and collide with other vessels due to miss-communication and Inadequate training for COLREG 72.

### 5.4.3 Inland waterway

Most shippers operating in upper Myanmar are uncertified and navigate the vessel with the aid of shore-side marking by their experience. There may be high draft variation between raining when the swirl effect leads to capsizing and summertime may lead to grounding. Therefore, design features for the summer season operate along the Chindwin River are unfit for trade-worthy in raining season, vice versa. In 2006, time constraints of passengers demanded high-speed craft construction and issued licenses to operate in upper Myanmar. After 2010, most passengers preferred high-speed ferries and kicked out the larger vessels owned by Inland Water Transport (IWT); as a result, small and high-speed vessels were more prone to endanger safety. High-speed craft with outboard engine design combines with propeller and rudder more prone to failure after jam with floating material. There is no permanent crew onboard, and they move to gold mining projects according to seasonal business. Typically, the end of the rainy season causing landslides may lead to collapsing trees into rivers - tree floats and tree sunken causing the collision with the ship (unavoidable accidents); it is a high risk for wooden vessels. For steel barge and vessel, separate watertight compartments provide sufficient buoyancy even one compartment is flooding. However, the old age of the barge and poor maintenance of the watertight bulkhead is more prone to sink after a run ground or collide. Ayeyarwaddy west coast frequent landslides- Myin Mu has only one lane with rocky reefs, resulting in a higher risk of collision. Worst areas- between Myan Aung and KaNaung filled with rocky reefs and tidal effects/ river current. Pyay-ShweTaung summer rocky reefs alongside A-Kout-Mountain, the wider passage led to more shallow water creating a higher risk of touching with reefs. Danu Phyu and Yay Kin do not have tidal effects/ tidal free area (1ft difference -high tide and low tide). Areas lower to DaNu Phyu do not have grounding but only collision. Before the rainy season, grounding shows as the most significant number and Fire has the smallest number. Another reason for high risk is the water level only decreases at a high rate resulting in a short duration to prepare and avoid the collision. Bamaw, KaThar, Mandalay, Min Bu, Aung Lan- most frequent accident areas.

#### **5.4.4 Dockyards**

Lack of standards for welding equipment, wiring system, breakers, safety expert in dockyard field, inadequate safety measures and personal protective equipment, unskilled labour, lack of risk assessment procedure before any repair or modification, lack of compulsory life insurance for all dock workers.

#### **5.5 Unsafe Supervision**

The HFACS data and interview data identified several unsafe supervision factors. The indicated that lack of adequate supervisory system and enforcement on crew awareness are deliberately neglected to presume as a vital factor. Inadequate Supervision of various forms, i.e., inadequate leadership or oversight in shipborne and shore Supervision; lack of supervisory situational awareness has been identified to be highly frequent. Failure to order the assigned duty; failure to report back to monitoring team; improper watch-keeping system established; no explicit instruction; concern more on the sale of tickets rather than checking the actual boarding passenger list; lack of Supervision for tidal condition, cargo securing arrangement; lack of instruction to alert heavy weather are all the result of inadequate supervisions before and during the voyage. During the night, supervisory policies are less likely to be followed, increasing the chances of accidents. Additionally, lack of effective execution of feedback to fix the underlying problem regardless of reporting procedure was identified as one of the factors contributing to the unsafe Supervision.

In terms of planned inappropriate operations, it is normal for local crew members to have limited recent or overall experience and proficiency in seamanship because the majority of crew members did not get systematic seamanship training and instead learned it naturally from their seniors. The ship owners were operating the voyage without systematic seamanship, appropriate monitoring, adequate Supervision, or formal risk assessment, emphasizing the monetary profit from the voyage. Additionally, a lack of verifying process for crew and ship owner certificates as well as vessel certificates loosen the threshold of the quality of the domestic crew.

The majority of incidents of failure to correct known problems arose when management was aware that the vessel was unfit or required maintenance yet permitted it to continue operating. The supervisory positions failed to correct inappropriate and risky behaviour and safety hazards, update manuals, and initiate corrective action mainly because of two reasons: firstly, they view such actions as unnecessary extra work, and secondly, cutting costs. Supervisors and ship owner representatives who remain onboard and the shipper or master fail to undertake efforts to improve vessel safety standards, only realizing the repercussions after incidents.

Repeated violations of engaging with the unqualified crew and failing to enforce rules and regulations against such violations hinder the effective supervision system, resulting in being unable to manage the subordinates effectively. The shore-based management instance only applied to river cruises. There is no linked to insurance policies and safety management certifications due to the significant challenges in complying with the DSM system in inland waterways. However, some ship owners voluntarily insured their barges trading in inland waterways and general cargo ships trading in coastal voyages. The vessel monitoring team did not inspect the overloaded vessel before departure.

Furthermore, there are contradictions between the DMA survey and the underwriting survey for insurance. The main reason is the shortage of fire safety appliances and shifts to other vessels after inspection of DMA surveyors. Furthermore, masters on coastal vessels are only trained for navigation purposes, while cargo clerks are officially listed as crew and manage the loading and discharging operation.

## **5.6 Organizational Influence**

### **5.6.1 Organization**

**Policy:** There were no effective outcomes from Myanmar Maritime University (MMU) delegations who attended international seminars and workshops for the maritime legislation process due to insufficient resources. Most lecturers and professors

specialized in academic teaching only, and no standardized educational system for all domestic crew to improve skill-based.

**Resource Management:** Collision avoidance training is not aligned with COLREG 72, and no clear collision avoidance rule has been published. Furthermore, lack of training for emergency response and proper radio usage for all domestic masters and crew. As a result, shipowners and managers run their vessels with cheap and unqualified operators to save costs and provide unsuitable equipment. Additionally, no training and drill prevent accidents, especially before the festival, long public holidays, and vacation time.

**Organizational Climate:** Operational management plan and a safety certificate to be submitted to DMA before applying the license to comply for all companies; however, some ferries owners manage their vessels with individual interest after being issued the license to operate. For example, the Vessel association was allowed to run for the unregistered vessel. The general administrative department issues license for the small boat without following the registration guidelines. As a result, small boats operate in rural areas without a carried or insufficient life jacket. In addition, accidents are not recorded systematically, thus leading to a lack of correct data. Significantly, a lot of accidents happened in Homaling. At the same time, it was not recorded, it is difficult to come up with exact data for the public improper navigational traffic management system.

**Process:** Currently, only 25 vessels trading in near-coastal voyages carried a safety management certificate. Two kinds of crew lists are submitted to the fishing department, and DMA are not matching, and the monitoring team may not inspect all vessels at every checkpoint. Issuing the dockyard license by general authorities office, and no specific orders and guidelines for dockyards safety standards; as a result, lack of monitoring for safety compliance and accountability for any accidents that happen in docking. Furthermore, Myanmar shipyards, an enterprise under MOTC, controls all dockyards and has insufficient technical experts for maritime safety.

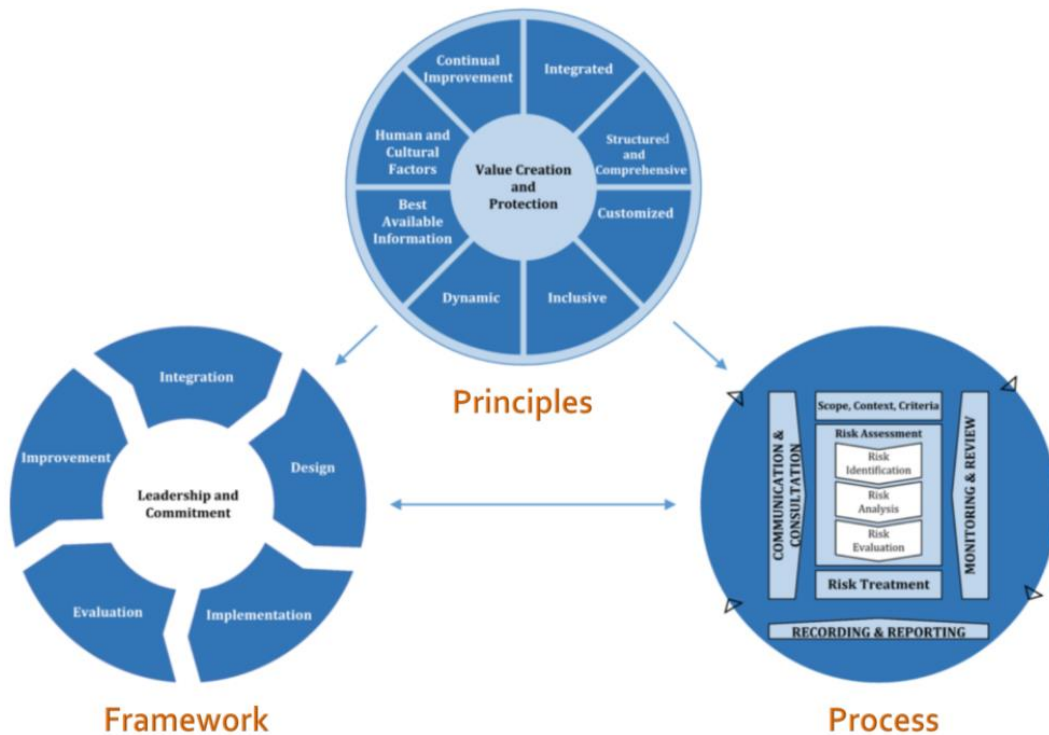
### **5.6.2 Statutory**

Lack of adequate safety standards and enforcement systems for all domestic fleets. Inland steam vessel out of date is a loophole between regulatory framework and enforcement. The major weak point of the private vessel monitoring rule developed by the Sagaing divisional government was monetary penalties only and allowed port clearance during weather warnings for coastal and fishing vessels.

## Chapter Six

### 6.1 Implementation framework

Figure 6- 1: Implementation Framework for Domestic Safety Management System.



**Source:** ISO 31000 and Dr Anish Hebbar's ppt; IMO-UN ESCAP Expert Group Meeting on Improving Domestic Ferry Safety (2020).

According to IMO member state obligation and enhancing the maritime safety standards, Myanmar shall have a regulatory framework as shown in the figure above, which will disclose the problems and provide practical solutions.

#### 6.1.1 Integration

MSC Circular 103/8, draft model regulation for domestic ferry safety, will be used to develop the framework, which will include all articles elaborate on the construction,



alteration, conversion, monitoring of management, and operational safety of domestic shipping, in addition to onboard and shore staff education and training.

### **6.1.2 Design Principle**

Design concepts of domestic safety management system design shall be aligned with technical, economic, and legal requirements to bring safety and economic benefits.

### **6.1.3 Implementation**

The implementation process align with health safety and environmental protection policy shall retain direct responsibility of DMA for monitoring and auditing of operating companies whose fly in Myanmar domestic water. According to the international practice of DSM code, clearly define the duties and responsibilities of master and all crew as well as line of communication to designated person from shore management. Companies or shipowners are responsible for providing appropriate training to ensure an effective implementation process of top to bottom down a level. Additionally, the company or owner draw up simple procedures and guidelines for every operation and respond to emergency conditions regarding safety and pollution matter.

### **6.1.4 Evaluation**

DMA will conduct the appropriate audit and provide the Document of Compliance certificate (DOC) for the company and the Safety management certificate (SMC) for the vessel. The renewal audit develops the safety framework, evaluate regulatory gaps and effectiveness, and review and revise as needed annually for every vessel and every 2.5 years for a company.

### **6.1.5 Improvement**

By promoting technological and economic progress, the safety framework can be improved to meet regional and international standards.

### **6.1.6 Recommendation**

To improve Myanmar tourism and maritime transportation, the Department of Marine Administration (DMA) under the Ministry of Transport and Communications had to set up and establish the safety of navigation, the proper safety regulations, safety standards, and the rationalized inspection system for all domestic vessels. Inland,

smooth water, and maritime zones are needed to be set up for safe navigation of vessels to improve safe navigation and good tourism. Inland vessel trading zone can be extended wider so that passenger ships and other inland vessels may have travel areas until a smooth water zone. Furthermore, every alternate docking, all domestic steel ships older than ten years shall be examined hull plate thickness and replaced as necessary and standardized the dockyards.

An efficient insurance policy shall be developed to provide a second line of defence for safety standards, allowing underwriter surveyors to examine their insured ships. To achieve an effective legal framework, assigning the regulatory body (DMA) to attend an international seminar and workshop regarding maritime safety. Engaging in interaction, debate, and consultation with shipowners and drivers, DMA adopts operative techniques to establish and strengthen safety culture. Safety standards may achieve not only on one Organization. Best way to approach- authority should provide detailed instruction to companies. Companies should provide detailed instructions to the owner and crew. All stakeholders should be harmonized in approaching the problems; onboard and shore-based management should be coordinated.

The shipowner shall establish a sea service matrix system for a specific type of voyage that may support an experience-based promotion system. Life-Saving Appliances should be consistent with each trading area rather than having fixed equipment for all kinds of routes. Cargo storage and securing arrangements, as well as dedicated places for hazardous items, should be provided. To prevent overcrowded and overload for all passenger vessels, establish the monitoring arrangement provided with CCTV camera for before departure inspection at all major ports and random spot check scheme along the rivers. The adequate mean of access for embarkation and disembarkation in every port to be provided Establishing the reporting procedure for Key Performance Indicator (KPI) for the specific type of vessels and inspection team. Safety videos and teaching facilities were made available onboard, in ports, and at local administrative offices to reduce human error. Before festival seasons, it was appointed with a dedicated management team to conduct exercises and drills.

As a top priority, establish the Domestic Safety Management System (DSMS) in the Sagaing and Rakhine regions as soon as possible due to individual responsibilities

(Muster list), safety manuals, operational procedures, emergency drills, and exercises with various scenarios are all extremely useful in improving safety standards. Drill and exercise to be carried out for good practice to eliminate skill-based errors, apply to standardize rules and procedures for rule-based errors elimination, and provide safety lecture and video for knowledge-based errors of individual and organizational mistakes. To be submitted project proposals related to domestic safety to the World Bank and other financial supported organizations. Negotiate with all financial authorities for import and income tax relief for shipowners in accordance with domestic safety regulations. Domestic vessels shall be the co-operative or public company to align with free and fair competition law according to the DMA system's registration process and standard operating procedure.

## **6.2 Challenges for Implementation of DSM**

Several challenges for implementation of domestic vessel safety are:

- (a) Tight budget of the government to establish adequate means of access for every port ;
- (b) Insufficient number of workforces in the government to establish monitoring team;
- (c) Interest of government on other prioritized areas ;
- (d) River boundary changed due to mining and deforestation which may affect navigable marking along the river;
- (e) Draft variation due to expansion of delta region by settlement from the upriver;
- (f) Too many archipelagos at the mouth of rivers;
- (g) Traditional ship design travelling to shallow water is dangerous;
- (h) Shipowners consider safety as an unnecessary means, only target to gain profit which may threaten for capsizing due to overcrowding; and
- (i) Insufficient designated service provider for all maritime appliances.

## **Chapter Seven**

### **Conclusion**

The relationship between particular accident types and human element components was investigated using correspondence analysis, and it was discovered that groundings and collisions were closely linked to the ship's master. In contrast, mechanical failures and fires were linked to engine officers, and cargo changes and flooding were linked to bridge officers. (Tzannatos, E.2010). The investigation into these accidents has found a minimal technical contribution in such accidents; however, a lot of human and organizational influence for safety is not solely dependent on the onboard ship but also on the natural environment, socio-technical, and economic factors. Therefore, the Department of Marine Administration (DMA) ensures that the ships and companies comply with the safety management manual for safe worthy. The compliance requirement for all marine environment operations should be met with safety standards, the proper procedure for survey and certification, and permit for operation (AMSA,2020). However, the fly of the Myanmar flag for the international voyage is only ten general cargo vessels, and about 4000 vessels are trading along the coastal and inland waterway. Consequently, effective implementation of domestic safety management system in Myanmar is vital of administrative responsibility. Therefore, should not wait for an accident to happen, and continuous upgrading the safety culture of all stakeholders align with technical progress. Additionally, regular safety inspections and audits will enhance domestic safety management and learn from previous accidents investigation and contribution factors, then proceeding to the zero fatalities era. Smithsonian Institute states that "We hardly give the maritime activity a second thought, yet we all depend on the vessels, ports, and workers who keep those global maritime connections going".

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## Appendix 1 - WNU Research Ethics Committee Protocol 63



### WMU Research Ethics Committee Protocol

Name of principal researcher:	KO KO ZIN
Name(s) of any co-researcher(s):	None
If applicable, for which degree is each researcher registered?	MSc in Maritime Affairs (MSEA)
Name of supervisor, if any:	Professor Dr. Jens-Uwe Schröder-Hinrichs
Title of project:	Implementation of Domestic Safety Management System In Myanmar
Is the research funded externally?	No
If so, by which agency?	No
Where will the research be carried out?	The research will be carried out in Malmo, Sweden and Myanmar.
How will the participants be recruited?	The participants will be recruited via email, Viber and Messenger
How many participants will take part?	Approximately 40
Will they be paid?	No
If so, please supply details:	No
How will the research data be collected (by interview, by questionnaires, etc.)?	Data will be collected through interviews and questionnaire.
How will the research data be stored?	The research data will be stored on my personal computer with password protection.
How and when will the research data be disposed of?	On completion of the MSc programme on 31 October 2021.
Is a risk assessment necessary? If so, please attach	No

Signature of Researcher •  Date : 12.07.2021

Signature of Supervisor  Date : 12.07.2021

Please attach:

- A copy of the research proposal
- A copy of any risk assessment
- A copy of the consent form to be given to participants
- A copy of the information sheet to be given to participants
- A copy of any item used to recruit participants

## Appendix 2 - Consent to interview

### Consent Form



Dear Sir / Madam,

Thank you for agreeing to participate in this research survey, which is carried out in connection with a Dissertation which will be written by the interviewer, in partial fulfilment of the requirements for the degree of Master of Science in Maritime Affairs at the World Maritime University in Malmo, Sweden.

The topic of the Dissertation is Implementation of Domestic Safety Management System in Myanmar. The purpose of this research is to enhance safety standard in Domestic fleet what are the challenges faced and how to address those challenges.

The information provided by you in this interview will be used for research purposes and the results will form part of a dissertation, which will be published online and made available to the public. Your personal information will not be published. You may withdraw from the research at any time, and your personal data will be immediately deleted.

Anonymised research data will be archived on a secure virtual drive linked to a World Maritime University email address. All the data will be deleted as soon as the degree is awarded.

Your participation in the interview is highly appreciated.

Student's name      KO KO ZIN  
Specialization      Maritime Safety and Environmental Administration  
Email address      W2005312@wmu.se

\* \* \*

I consent to my personal data, as outlined above, being used for this study. I understand that all personal data relating to participants is held and processed in the strictest confidence and will be deleted at the end of the researcher's enrolment.

Name: ..... KO KO ZIN .....

A handwritten signature in black ink, appearing to be 'KO KO ZIN', written over a dotted line.

Signature: .....

Date: ..... 16.07.2021 ..... | .....

### **Appendix 3 - Interview Questions**

- (1) Please describe your specific role and involvement in Domestic Shipping in Myanmar.
- (2) Please share your experience with accidents in the Domestic fleet of Myanmar. Have you experienced accidents yourself? What trends do you see?
- (3) What is your view regarding the accidents on domestic ships? Why are these accidents happening?
- (4) When you look at accidents on domestic ships in Myanmar, what are the most common causes? Groundings, capsizing, fire, flooding and how are they caused people falling asleep, other violations etc.?
- (5) What are the precondition of unsafe acts leading to accidents in Domestic shipping? Lack of training, overloading or ignoring procedures and regulations could be examples in this respect.
- (6) Could you provide any discussion to enhance Domestic safety standards relate to crew condition and environmental factors?
- (7) Can you give us some ideas on how to effectively supervise for safe onboard conditions? Can this be achieved by a shore-based safety management system?
- (8) Could you please share your views in relation to organizational climate, process and management factors in the domestic fleet of Myanmar and how they influence the safety in domestic shipping?
- (9) What are the general challenges for implementing safety standards in the Domestic fleet?
- (10) Do you have any idea what is the best way to approach a safety management system/ atmosphere?
- (11) Do you have any additional suggestions for Domestic Safety Management System?

**Appendix 4 – Google drive link for the lists of domestic vessel accident in Myanmar between 2010 to 2020**

<https://docs.google.com/spreadsheets/d/1IQCzejO1OgVPcEs0bWvXmRxckcghZjNB/edit?usp=sharing&ouid=100068715047851313878&rtpof=true&sd=true>

**Appendix 5 - Coding HFACS analysis retrieved from investigation reports.**

The analysis has been taken from the internal document of DMA and retrieved from twenty accident investigation reports for the Domestic shipping sector.

**1. M.V "MALACCA HIGHWAY" & M.T "MYAN AUNG"**

**General Information**

**Accident no.: 1**

**Date: 28/04/2013**

<b>M.V MALACCA HIGHWAY</b>	<b>MT MYAN AUNG</b>
<b>Length: 139 m</b>	<b>Length : 63 m</b>
<b>Breadth : 23 m</b>	<b>Breadth : 10 m</b>
<b>Depth :</b>	<b>Depth :</b>
<b>GT: 17735</b>	<b>DWT : 1118</b>
<b>Engine Power :</b>	<b>Engine Power :</b>
<b>Built : 1996</b>	<b>Built : 1965</b>
<b>Falg &amp; Class : Panama /</b>	<b>Owner &amp; Operator: Myanmar ?</b>
<b>Owner :</b>	
<b>Dead / Missing</b>	<b>Dead / Missing : Sinking</b>

Injury	Injury
--------	--------

**Type of Vessel: Car Carrier (F.G) & Tanker (Coastal)**

**Type of Accident: Collision**

**Accident time: 14:50 hr**

**Location: Yangon River**

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** On the 23<sup>rd</sup> of April 2013, a car carrier, Malacca Highway, approached anchorage with a pilot onboard. While underway, the pilot tried to contact MT Myan Aung, a coastal tanker sailed with the tide but no reply. The captain raised the whistle tried to announce the Tanker vessel at a distance of about 0.3 N-miles. About 14: 45 hours, the pilot ordered to master of the Tanker vessel to change course via VHF radio. After that master of the tanker vessel responded that he had been ordered to alter starboard and refused to alter again to port. The pilot ordered to stop the engine and full astern; however, two vessels collided on 14: 50 hours in the position of 16` 35.49" N, 096` 14.8" E.

<b>( UNSAFE ACTS )</b>
<b>ERRORS</b>
<b>Skill -based errors AE 100</b>
<b>AE105 Poor techniques / seamanship</b>
No proper watch- keeping on the Tanker vessel
<b>AE108 Negative habit</b>

Improper look out
<b>Decision and Judgement errors AE 200</b>
<b>AE 204 Necessary action - delay</b>
Radio communication was delayed
<b>Perceptual errors AE 300</b>
<b>AE 301 Error due to misperception</b>
Master of Tanker ship maintain the course

<b>( Preconditions for unsafe acts )</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>
<b>PE104 Ship movements and manoeuvres</b>
Tidal affect
<b>Personal Factors</b>
<b>Crew interaction PP 100</b>
<b>PP106 Communication critical information</b>
First-order was hard the starboard then ordered course to port given by pilot to tanker master
<b>PP111 Miscommunication</b>
Conflict information
<b>Personal readiness PP 200</b>
<b>PP201 Inadequate training</b>
Inadequate training for COLREG 72
<b>Crew Condition</b>
<b>Cognitive factors PC 100</b>

<b>PC103 Confusion</b>
Confuse between first and second-order
<b>PC111 Overaggressive</b>
Tanker master refused to alter course to port
<b>PC114 Response set</b>
Lack of flexibility for problem-solving
<b>PC119 Misinterpreted/ misread instrument</b>

<b>( Unsafe Supervision )</b>
<b>Inadequate Supervision</b>
<b>Shipborne and shore supervision SI 000</b>
<b>SI 001 Leadership / supervision/ oversight inadequate</b>
The improper watch-keeping system established
<b>SI 005 Supervision - personal conflict</b>
Lack of guidance for conflict with outer source (ship to ship)
<b>Planned Inappropriate Operations</b>
<b>Shipborne Operation SP 000</b>
<b>SP 004 Limited total experience</b>
Poor knowledge for COLREG 72
<b>SP 005 Proficiency</b>
Lack of proficiency
<b>Failed to Correct Known Problems</b>
<b>Shipborne related shortcoming SF 000</b>
<b>SF 005 Failed to update manual</b>



Inland steam vessel act and other old regulations were not in line with COLREG 72
---

<b>( Organizational Influences )</b>
<b>Resource management</b>
<b>Human resources OR 000</b>
<b>OR 003 Training</b>
Collision avoidance training align with COLREG 72
<b>Organizational process OP XXX</b>
<b>Procedure OP 100</b>
<b>OP 103 Procedural guidance / publications</b>
No clear collision avoidance rule has been published
<b>OP 104 Informational resources / support</b>
Improper IALA buoyage system (Region A)
<b>Oversight OP 200</b>
<b>OP 202 Established safety programs/risk management programs</b>
No VTS centre
<b>OP 203 Monitoring and checking of resources, climate and process to ensure a safe work environment</b>
No AIS equipment on the coastal ship
<b>Statutory</b>
<b>International / national standards FS 000</b>
<b>FS 002 Regulations</b>
Inland steam vessels act out of date

## 2. MV Panja Bhum , Zwe Myint Myat Tun 3

### General Information

Accident no.: 2

Date: 26/04/2015

Type of Vessel: Container (F.G) & Tug

Type of Accident: Collision

MV Bangpakaew	Zwe Myint Myat Tun 3
Length: 147.8 m	Length: 95' 6"
Breadth : 24.43 m	Breadth : 21' 6"
Depth :	Depth : 86' 10"
GT: 4796	GT : 85.27
Engine Power :	Engine Power : 260x 2
Built : 2008	Built 2005
Flag & Class : Singapore	Owner & Operator: U Khin Maung Shein
Owner :	
Dead / Missing Nil	Dead / Missing

<b>Injury</b>	<b>Nil</b>	<b>Injury Nil</b>
<b>Hull damage</b>		<b>Total Loss</b>

**Accident time: 15:03 hour**

**Location: Yangon River**

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** On the 26<sup>th</sup> of April 2015, container vessel Panja Phum collided with an inland tug, Zwe Myint Myat Tun 3, due to bad weather. There was no proper lookout duty on both vessels and no VHF radio provided on the Inland tug. Master and pilot from container ship ignore the safe speed, and inland tug master violated the inland vessel rule ( sail to the right side as far as possible ).

<b>UNSAFE ACTS</b>
<b>ERRORS</b>
<b>Skill -based errors AE 100</b>
<b>AE108 Negative habit</b>
The vessel operates without VHF radio
<b>VIOLATION</b>
<b>Routine AV 400</b>
<b>AV406 Violated standing orders and regs</b>
Violate rule 6,7 and 8 (COLREG 72) Safe speed, available all means and reduce speed
<b>Exceptional AV 500</b>

<b>AV 502 Accepted unnecessary hazards</b>
Proceed voyage with full speed during poor visibility

<b>Preconditions for unsafe acts</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>
<b>PE102 Artificial light</b>
Poor visibility due to bad weather
<b>Technological environment PE 200</b>
<b>PE204 Communication equipment</b>
Lack of VHF radio on the inland tug
<b>PE205 Barriers</b>
Communication breakdown
<b>Personal Factors</b>
<b>Personal readiness PP 200</b>
<b>PP201 Inadequate training</b>
Improper trained Pilot and tug master for collision avoidance regulation

<b>Unsafe Supervision</b>
<b>Inadequate Supervision</b>
<b>Shipborne and shore supervision SI 000</b>
<b>SI 014 Loss of supervisory situational awareness</b>
Ignore poor visibility
<b>Planned Inappropriate Operations</b>
<b>Shipborne Operation SP 000</b>

<b>SP 003 Limited recent experience</b>
Lack of safety awareness during Monsoon climate
<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 002 Failed to enforce rules / regs</b>
No specific guidelines and procedures for inland vessels operating in the Yangon River
<b>SV 003 Violate procedures</b>
Tug master violated the inland vessel rule ( Sail to the right side as far as possible ).

<b>Organizational Influences</b>
<b>Organizational process</b>
<b>Oversight OP 200</b>
<b>OP 202 Established safety programs/risk management programmes</b>
Not establish the Vessels Traffic Management System
<b>Statutory</b>
<b>International / national standards FS 000</b>
<b>FS 002 Regulations</b>
No specific order and regulation regarding with communication arrangement between inland vessels and sea gong ship

### 3. Yazar Tun

#### General Information

Accident no.: 3

**Date: 31/10/2015**

**Type of Vessel: Ferry**

**Type of Accident: Capsizing**

**Accident time: 05:30**

**Location: Long Grate Swirl, Gazatte village, Kalaywa, Sagaing Division**

**Involved:**

**Length: 100' 03"**

**Breath: 11'00"**

**Depth: 2'8"**

**GT: - Unregistered vessel**

**Engine Type & Power:**

**Build: 2012**

**Owner & Operator: Registered owner U Aung Thu Sint**

**Dead / Missing : 14 / 25**

**Injury: - 4**

**Total loss: Yes**

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** The unregistered ferry, Yarzar Tun , has been controlled by the uncertified operator who departed from Monywa jetty on 31st October 2015, 13:00 hour, and arrived at Thintaw village about 20:00 hour. Then, proceeded to Kalaywa about 21:00hour and arrived at 13:00 hour on the first of November. After that, morning 04: 00 hour on the same day ferry departed from Kalaywa jetty and about 05:30 hour, and the ferry capsized during passing through the confluence.

<b>( UNSAFE ACTS )</b>
<b>ERRORS</b>
<b>Skill -based errors AE 100</b>
<b>AE105 Poor techniques / seamanship</b>
the wrong way from the normal lane and proceed to swirl
<b>Perceptual errors AE 300</b>
<b>AE 301 Error due to misperception</b>
Passing through the confluence without reducing speed
<b>VIOLATION</b>
<b>Routine AV 400</b>
<b>AV403 Operated when unauthorized</b>
Uncertified operators

<b>( Preconditions for unsafe acts )</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>
<b>PE102 Artificial light</b>
Poor visibility
<b>PE104 Ship movements and manoeuvres</b>
Heavy swirl

<b>Personal Factors</b>
<b>Personal readiness PP 200</b>
<b>PP201 Inadequate training</b>
Operators were not proper trained for driving the ferry
<b>PP203 Time constraints</b>
Departure time was 04:00 hour
<b>Crew Condition</b>
<b>Cognitive factors PC 100</b>
<b>PC123 Alertness (drowsiness)</b>
Morning 05: 30 hour
<b>Physiological state PC 200</b>
<b>PC204 Physical fatigue</b>
Driver runs the ferry for the whole night without assistance

<b>( Unsafe Supervision )</b>
<b>Inadequate Supervision</b>
<b>Shipborne and shore supervision SI 000</b>
<b>SI 001 Leadership / supervision/ oversight inadequate</b>
Gate officer failed to report vessel monitoring team for unregistered vessel
<b>SI 006 Supervision - lack of feedback</b>
Allow running night time
<b>Planned Inappropriate Operations</b>
<b>Shipborne Operation SP 000</b>
<b>SP 003 Limited recent experience</b>
Emerging high swirl on 4th and 5th day of every month



<b>SP 004 Limited total experience</b>
Change of navigational way due to nature of Chindwin river
<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 001 Engaged unqualified crew</b>
Uncertified operators
<b>SV 002 Failed to enforce rules / regs</b>
Night time running
<b>SV 005 Willful disregard of authority</b>
Unregistered vessel

<b>( Organizational Influences )</b>
<b>Resource management</b>
<b>Human resources OR 000</b>
<b>OR 001 Inadequate safe manning</b>
Driver runs ferry for the whole night without assistance
<b>Organizational Climate</b>
<b>Structure OC 000</b>
<b>OC 005 Formal accountability for action</b>
Vessel association allowed to run for unregistered vessel
<b>Policies OC 100</b>
<b>OC 104 Accident and incident investigation</b>
The same case happened on 2001
<b>Culture OC 200</b>
<b>OC 202 Organizational customs, beliefs and attitudes</b>

The vessel association and monitoring team only focused on monetary penalties.
<b>Organizational process</b>
<b>Operation OP 000</b>
<b>OP 004 Schedules</b>
Vessel monitoring office open from 6 am to 6 pm, and ferries run 24 hour
<b>Oversight OP 200</b>
<b>OP 203 Monitoring and checking of resources, climate and process to ensure a safe work environment</b>
Lady gate -officer lack of vision for safety aspect and did not manage owners and masters.

#### **4. Shwe Thiha (Aung Soe Moe Kyaw 2)**

##### **General Information**

**Accident no.: 4**

**Date: 15/10/2016**

**Type of Vessel: Ferry**

**Type of Accident: Capsizing and Sinking**

**Accident time: 04:45**

**Location: Mi Chaung Twin village, Monywa, Sagaing Division**

**Involved:**

**Length: 120' 11"**

**Breath: 13'15"**

**Depth: 3'1"**

**GT: 40**

**Engine Type & Power: Mitsubishi & 216 BHP**

**Build: 2013 (Myanmar)**

**Owner & Operator: Original Registered owner (U San Win) / Actual owner (U Htay Zaw & U Myint Kyaw)**

**When the ship was sold out: 28.12.2015**

**Dead / Missing : 73 / 41**

**Injury: -**

**Total loss: Yes**

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** Maximum design limit to carry passengers was 86, and Administration permitted only 36 persons. About (10:00) hr on (14.10.2016), Shwe Thiha vessel departed from Homemalin City and carried with an estimated passenger about 180 and various goods. At (04: 45)hr on ( 15.10.2016), near Michaungtwin village, the western bank of Chindwin River, the vessel capsized due to overturning the steering because the driver tried to return back to normal water way from the wrong direction which directed to the river bank.

<b>( UNSAFE ACTS )</b>
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<b>ERRORS</b>
<b>Decision and Judgement errors</b> AE 200
<b>AE 203 Necessary action - rushed</b>
Overtuned steering while trying to get back into the right way
<b>VIOLATION</b>
<b>Routine</b> AV 400
<b>AV406 Violated standing orders and regs</b>
To proceed with an overcrowded and overloaded ship.

<b>( Preconditions for unsafe acts )</b>
<b>Environmental Factors</b>
<b>Physical environment</b> PE 100
.
<b>PE104 Ship movements and manoeuvres</b>
Sand Bank
Night time
No aid to navigation
<b>Personal Factors</b>
<b>Personal readiness</b> PP 200
<b>PP201 Inadequate training</b>
<b>Crew Condition</b>
<b>Cognitive factors</b> PC 100
<b>PC108 Overconfidence</b>
<b>PC110 Complacency (reduce consciousness due to overconfidence and undermotivation)</b>
Run the vessel without proper navigational assistance with overloaded conditions and nighttime
<b>Physiological state</b> PC 200
<b>PC204 Physical fatigue</b>
The driver got fatigued, and sleepiness when handling the vessel for over 20 hours continuously.

<b>( Unsafe Supervision )</b>
<b>Inadequate Supervision</b>
<b>Shipborne and shore supervision SI 000</b>
<b>SI 001 Leadership / supervision/ oversight inadequate</b>
Gate Officer, they only know the number of tickets and do not inspect and check the actual boarding passenger list
<b>SI 004 Supervision - policy</b>
Lack of supervising for prohibited during night time
<b>SI 006 Supervision - lack of feedback</b>
There was no action taken by the vessel monitoring team even though the passenger has been reported to office staff, U Mya Than Tun.
<b>SI 008 Failed to provide an adequate rest period</b>
The vessel was run the whole night by the driver, Zaw Myo Win, with the GPS data
<b>SI 009 Lack of accountability</b>
There was no vessel inform to the team, and they did not monitor and inspect on the ground.
There is no safety enforcement will achieve without the participation of marine police and the general administration department.
<b>Planned Inappropriate Operations</b>
<b>Shipborne Operation SP 000</b>
<b>SP 009 Failed to provide adequate opportunity for crew rest</b>
The driver handover to one of the crew while having food time only, and the crew has no certificate for driving the vessel
<b>Failed to Correct Known Problems</b>
<b>Shipborne related shortcoming SF 000</b>
<b>SF 004 Failed to report unsafe tendencies</b>
There was a lot of passengers and cargo onboard, and some passengers embarked on the roof of the vessel
Nobody reported the condition of cargo on top by the modified roof then loaded over the assigned freeboard.

<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 001 Engaged unqualified crew</b>
<i>Shwe Thiha</i> vessel was owned by U Zaw Zaw and U Myint Kyaw, run with expert drivers but without certificates due to lack of certified persons.
<b>SV 002 Failed to enforce rules / regs</b>
Ferries run at night time, and for this condition, no monitoring team reported to the divisional government, and nobody cared for this case.
<b>SV 005 Willful disregard of authority</b>
The divisional government prohibited running at night; however, Aye Nyein Chan Thar association ran their vessel during the night
All other vessel associations have not followed this instruction.

<b>( Organizational Influences )</b>
<b>Resource management OR</b>
<b>Human resources</b>
<b>OR 001 Inadequate safe manning</b>
There were not enough certified drivers for all vessels where running along the Chindwin river
<b>OR 003 Training</b>
No training and drill exercise to prevent all accidents, especially before the festival, long length of public holiday and vacation time
<b>Equipment/facility resources OR</b>
<b>OR 202 Acquisition policies/design process</b>
To be modified the roof design with tarpaulins to prevent passengers and cargoes carried on top
<b>Organizational Climate OC</b>
<b>Structure OC</b>
<b>OC 003 Accessibility/visibility of supervisor</b>
Thar vessel association had 27 vessels and ran one vessel per day. Therefore, the vessel had not been notified during the surprised check and expired the certificate was not reported from port security and monitoring committee

The divisional transport department and general administration department have participated two times only and then no more join this committee.
<b>OC 005 Formal accountability for action</b>
The chairman assigned gate officers to sell the ticket only not over the passenger limit and no additional duty
<b>Culture OC 200</b>
<b>OC 202 Organizational customs, beliefs and attitudes</b>
Aye Nyein Chan Thar association run their vessel during the night because all other vessel associations did not follow the instruction for sailing prohibited at night time
<b>Organizational process</b>
<b>Oversight OP 200</b>
<b>OP 201 Doctrine (philosophy of risk acceptance lead to an unsafe situation)</b>
Enforcement was poor due to conflict of interest because the most of vessel monitoring team members run their owned the vessels
<b>OP 203 Monitoring and checking of resources, climate and process to ensure a safe work environment</b>
Expired the certificate was not reported from port security and monitoring committee
<b>Statutory FS</b>
<b>International / national standards FS 000</b>
<b>FS 002 Regulations</b>
A major weak point of the private vessel monitoring rule developed by the Sagaing divisional government was monetary penalties only.
<b>Flag state implementation FS 100</b>
<b>FS 103 Class and statutory surveys</b>
overdue for dry docking
<b>FS 104 Communication</b>
On (28.12.2015), sold to U Htay Zaw and U Myint Kyaw under a mutual sales agreement, but the owner's name on the vehicle registration certificate was not change and registered in administration as the previous owner

**5. Pathein Thu 15 , Chan Myae Tun 2**

**General Information**

**Accident no.: 5**

**Date: 19/12/2016**

**Type of Vessel: Ferry & Wooden cargo boat**

**Type of Accident: Collision**

**Accident time: 17:00 hr**

**Location: Toe River (Kye Htaw )**

<b>Pathein Thu 15</b>	<b>Chan Myae Tun 2</b>
<b>Length: 162'</b>	<b>Length :</b>
<b>Breadth : 36'</b>	<b>Breadth :</b>
<b>Depth : 6'3"</b>	<b>Depth :</b>
<b>GT: 162.31</b>	<b>GT :</b>
<b>Engine Power : 500 BHP</b>	<b>Engine Power :</b>
<b>Built : 2012</b>	<b>Built</b>
<b>Falg &amp; Class :</b>	<b>Owner &amp; Operator:</b>
<b>Owner : U Aung Myint</b>	



<b>Dead / Missing</b>	<b>Nil</b>	<b>Dead / Missing</b>
<b>Injury</b>	<b>Nil</b>	<b>Injury</b>

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** On the 19<sup>th</sup> December 2016, Inland ferry, Pathein Thu 15, collided with a wooden boat, Chan Myae Tun 2, at the Wae Gyi curve, Toe River. The ferry sailed against the tide and proceeding from starboard lane with reduce speed. However, the Wooden boat suddenly turned and crossing over the ferry; consequently, the wooden boat entered into the twin-hull of the ferry then sunk.

<b>UNSAFE ACTS</b>
<b>ERRORS</b>
<b>Skill -based errors AE 100</b>
<b>AE108 Negative habit</b>
Crossing over the larger vessel
<b>Decision and Judgement errors AE 200</b>
<b>AE 206 Wrong decision making during operation</b>
Suddenly turned

<b>Preconditions for unsafe acts</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>
<b>PE104 Ship movements and manoeuvres</b>

Limited visibility due to curve of river
<b>Technological environment PE 200</b>
<b>PE204 Communication equipment</b>
No additional communication equipment fitted on both vessels instead of VHF
<b>Personal Factors</b>
<b>Personal readiness PP 200</b>
<b>PP201 Inadequate training</b>
No safety training and awareness program for the boat driver
<b>Crew Condition</b>
<b>Physiological state PC 200</b>
<b>PC219 Insufficient reaction time</b>
Crossed over with full speed

<b>Unsafe Supervision</b>
<b>Inadequate Supervision</b>
<b>Shipborne and shore supervision SI 000</b>
<b>SI 003 Local training issues/programs</b>
No safety training and awareness program for the boat driver
<b>Planned Inappropriate Operations</b>
<b>Shipborne Operation SP 000</b>
<b>SP 004 Limited total experience</b>
Lack of experience for passing the curve of the river
<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 002 Failed to enforce rules / regs</b>

Expired boat license
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<b>Organizational Influences</b>
<b>Organizational Climate</b>
<b>Culture OC 200</b>
<b>OC 202 Organizational customs, beliefs and attitudes</b>
Traditional practice lead to an accident

## 6. MV Anan Bhum and MV Htet Aung Lin 1

### General Information

**Accident no.: 6**

**Date: 01/03/2017**

**Type of Vessel : Container (F.G) & Cargo (Coastal)**

**Type of Accident: Collision**

**Accident time: 05:00 hr**

**Location: Yangon River**

<b>MV Anan Bhum</b>	<b>MV Htet Aung Lin 1</b>
<b>Length: 146 m</b>	<b>Length :</b>
<b>Breadth : 22 m</b>	<b>Breadth :</b>
<b>Depth :</b>	<b>Depth :</b>

<b>GT: 9675</b>	<b>GT :</b>
<b>Engine Power :</b>	<b>Engine Power :</b>
<b>Built : 1996</b>	<b>Built</b>
<b>Falg &amp; Class : Thailand / DNV- GL</b>	<b>Owner &amp; Operator:</b>
<b>Owner : RCL</b>	
<b>Dead / Missing</b>	<b>Dead / Missing</b>
<b>Injury</b>	<b>Injury</b>

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** On the 1<sup>st</sup> March 2017, container vessel Anan Bhum departed from Yangon (NEA) anchorage and coastal vessel Htet Aung Lin 1 proceeded to Yangon in the current. On the morning of about 04:20, the master from Htet Aung Lin called Anan Bhum via VHF channel 16 and reduced speed due to no reply from the Container ship. Myanmar pilot controlled Anan Bhum, and Thailand captain and Htet Aung Lin handled the coastal master who holds the pilot exemption permit. All navigation and manoeuvring equipment was satisfactory, and at about 05:00 hour, the two vessels collided during the port to port passing.

<b>( UNSAFE ACTS )</b>
<b>ERRORS</b>
<b>Skill -based errors AE 100</b>
<b>AE105 Poor techniques / seamanship</b>

No person has been assign for proper look out on container ship
<b>AE108 Negative habit</b>
The pilot was unwilling to reply to other small coastal ships when calling from a radio
<b>Decision and Judgement errors AE 200</b>
<b>AE 204 Necessary action - delay</b>
The pilot commenced action 24 seconds before collided
<b>AE 206 Wrong decision making during operation</b>
Coastal vessel waiting order from a larger container ship
<b>Perceptual errors AE 300</b>
<b>AE 301 Error due to misperception</b>
<b>VIOLATION</b>
<b>Routine AV 400</b>
<b>AV404 Violated training rules</b>

<b>( Preconditions for unsafe acts )</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>
<b>PE102 Artificial light</b>
Limited visibility (04:45 hour)
<b>PE104 Ship movements and manoeuvres</b>
Proceeding with/against the current
<b>Technological environment PE 200</b>
<b>PE204 Communication equipment</b>
Failed contact with another form of communication system

<b>Personal Factors</b>
<b>Crew interaction</b> PP 100
<b>PP104 Rank gradient/power distance</b>
Inland masters perform piratical exercises under the supervision of pilots to get a pilot exemption permit
<b>PP111 Miscommunication</b>
No agreement has been taken before crossing each other
<b>Personal readiness</b> PP 200
<b>PP203 Time constraints</b>
Bound to and from Yangon with tidal schedule due to draft limit
<b>PP204 Pattern of poor risk judgement</b>
Container master failed to assign additional look out during limited visibility
<b>Crew Condition</b>
<b>Cognitive factors</b> PC 100
<b>PC108 Overconfidence</b>
The pilot commands the vessel without look out
<b>PC123 Alertness (drowsiness)</b>
Morning (05:00 Hour)
<b>PC124 Peer pressure</b>
Inland master called container ship two times only
<b>Physiological state</b> PC 200
<b>PC204 Physical fatigue</b>
The container ship just passed with five larger ships, and the Pilot ordered and communicated with others pilots and crew.

<b>( Unsafe Supervision )</b>
<b>Planned Inappropriate Operations</b>
<b>Shipborne Operation SP 000</b>
<b>SP 004 Limited total experience</b>
Coastal vessel proceed with left bounded in Yangon river
<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 003 Violate procedures</b>
The pilot did not order for proper lookout

<b>Organizational Influences</b>
<b>Organizational Climate OC</b>
<b>Structure OC</b>
<b>OC 001 Chain - of - command</b>
Container master failed to take necessary action
<b>OC 002 Communication</b>
No communication between container master and pilot
<b>OC 004 Delegation of authority / rigidity</b>
Container master considered that no additional command need after the pilot onboard
<b>OC 005 Formal accountability for action</b>
Nobody informed to pilot to reply via VHF
<b>Culture OC 200</b>
<b>OC 201 Norms and rules</b>
Pilots influence over all inland and coastal masters

<b>Organizational process</b>
<b>Operation OP 000</b>
<b>OP 003 Time pressure</b>
Proceed with tidal schedule
<b>Procedure OP 100</b>
<b>OP 104 Informational resources / support</b>
No facilitation of VTS centre

## 7. Nadi Shwe Sin , Ngwe Kyal Pwint

### General Information

**Accident no.:** 7

**Date:** 07/04/2017

**Type of Vessel :** Tug & Under 20 H.P ferry

**Type of Accident:** Collision

**Accident time:** 19:0 hour

**Location:** Ngawon River, Pathein

<b>Nadi Shwe Sin</b>	<b>Ngwe Kyal Pwint</b>
<b>Length:</b> 97'09 "	<b>Length :</b> 52'
<b>Breadth :</b> 23'04"	<b>Breadth :</b> 10'09"
<b>Depth :</b> 07'11"	<b>Depth :</b> 03'
<b>GT:</b> 87.39	<b>GT :</b>
<b>Engine Power :</b> Hino V22C (250x 2 H.P)	<b>Engine Power :</b> 18 H.P
<b>Built :</b>	<b>Built</b>



<b>Owner: U Thein Htay</b>	
<b>Dead / Missing</b>	<b>Dead / Missing 31</b>
<b>Injury</b>	<b>Injury</b>

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** On the 7<sup>th</sup> April 2017, at about 19:00 hours, a small ferry boat departed from Pathein jetty with 59 persons onboard that was twice the allowable limit and some passengers seated on the roof. There was no navigational or signal light and life-saving appliance onboard. A few minutes after departure, a small ferry boat collided with a tug and barge when passing through the curve of Ngawon River.

<b>UNSAFE ACTS</b>
<b>ERRORS</b>
<b>Skill -based errors AE 100</b>
<b>AE105 Poor techniques / seamanship</b>
overtaking to the larger vessel
<b>Decision and Judgement errors AE 200</b>
<b>AE 204 Necessary action - delay</b>
Delay action for the rescue operation
<b>VIOLATION</b>
<b>Routine AV 400</b>
<b>AV403 Operated when unauthorized</b>
Uncertified boat driver

<b>AV406</b>	<b>Violated standing orders and regs</b>
	Improper navigation light on small boat and barge
	Not carried life-saving appliance as per Inland vessel law (Reg. 30)
<b>Exceptional AV 500</b>	
<b>AV 501</b>	<b>Exceeded limits of a system</b>
	Carried twice of allowable passenger limit
<b>AV 504</b>	<b>Unauthorized to operate beyond design criteria</b>
	The passengers seated on the roof

<b>Preconditions for unsafe acts</b>	
<b>Environmental Factors</b>	
<b>Physical environment PE 100</b>	
<b>PE102</b>	<b>Artificial light</b>
	Poor visibility during sunset
<b>PE104</b>	<b>Ship movements and manoeuvres</b>
	Tug and barge sailed with full loaded which may affect the momentum of vessel
<b>Technological environment PE 200</b>	
<b>PE204</b>	<b>Communication equipment</b>
	Failed to blast with ship whistle while passing the narrow and dense area

<b>Unsafe Supervision</b>	
<b>Inadequate Supervision</b>	
<b>Shipborne and shore supervision SI 000</b>	
<b>SI 001</b>	<b>Leadership / supervision/ oversight inadequate</b>
	The vessel monitoring team did not inspect the overloaded boat before departure

<b>SI 009 Lack of accountability</b>
General administration department issue license for ply without checking any safety requirement
<b>SI 011 Failed to track qualification</b>
Boat owner allowed to operate with an uncertified driver
<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 001 Engaged unqualified crew</b>
Uncertified driver
<b>SV 002 Failed to enforce rules / regs</b>
Lack of order for the small boats to operate during day time only

<b>Organizational Influences</b>
<b>Organizational Climate</b>
<b>Structure OC 000</b>
<b>OC 005 Formal accountability for action</b>
Local general administrative departments issue licenses without following the registration guidelines
<b>Culture OC 200</b>
<b>OC 202 Organizational customs, beliefs and attitudes</b>
Small boats operate in a rural area without carried or insufficient life jacket
<b>Organizational process</b>
<b>Oversight OP 200</b>
<b>OP 203 Monitoring and checking of resources, climate and process to ensure a safe work environment</b>

Lack of monitor and reporting procedure of vessel and cargo on every jetty

## **8. RV Poukan**

### **General Information**

**Accident no.:** 8

**Date:** 01/08/2017

**Type of Vessel :** River Cruise

**Type of Accident:** Fire

**Accident time:** 21:50

**Location:** Gawine jetty, Mandalay

**Length:** 188'

**Breath:** 40'

**Depth:** 12'

**GT:** 14.6

**Engine Type & Power:** Cummins (425 x 2 BHP)

**Build :** 2014

**Owner & Operator:** U Than Oo

**Dead / Missing :** Nil

**Injury:** - Nil

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** During under repairing process, the cruise dock at Gawain jetty, Mandalay power supply from shoreside. On the evening of 1<sup>st</sup> August 2018, about 09:30 hours, the fire broke out from repaired room after regain from the shore power supply due to surge voltage and short circuit. There was no fire petrol arrangement and switch off the power of sprinkler and fire main system due to voltage variation (220 ~ 440 v). Fire has been killed by portable extinguisher after the 60 minutes, as a result, diminished one cabin.

<b>UNSAFE ACTS</b>
<b>ERRORS</b>
<b>Skill -based errors AE 100</b>
<b>AE105 Poor techniques / seamanship</b>
No safety in charge during repaired
<b>AE108 Negative habit</b>
Switch off power of fire fighting equipment

<b>Unsafe Supervision</b>
<b>Inadequate Supervision</b>
<b>Shipborne and shore supervision SI 000</b>
<b>SI 001 Leadership / supervision/ oversight inadequate</b>
No fire petrol arrangement
<b>SI 003 Local training issues/programs</b>
Lack of training for using BA set and fire man out fit
<b>Planned Inappropriate Operations</b>
<b>Shipborne Operation SP 000</b>
<b>SP 008 Failed to provide adequate brief time/supervision</b>
No counter checking system
<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 003 Violate procedures</b>
No fire petrol or watch keeping arrangement during repaired time

<b>Organizational Influences</b>
<b>Resource management</b>
<b>Technological resources OR 100</b>
<b>OR 101 Excessive cost-cutting</b>
Shore power supplied only for 220 v, and harbour generators do not supply fire pumps.
<b>Organizational process</b>
<b>Oversight OP 200</b>
<b>OP 203 Monitoring and checking of resources, climate and process to ensure a safe work environment</b>
Improper safety management system

**9. MV Bangpakaew , MFV Phyo Pwint Maung / Lin Yaung Thit 4**

**General Information**

**Accident no.: 9**

**Date: 29/08/2017**

**Type of Vessel: Container (F.G) & Fishing**

**Type of Accident: Collision**

**Accident time: 19:15 hour**

**Location: Yangon River**

<b>MV Bangpakaew</b>	<b>MFV Phyto Pwint Maung / Lin Yaung Thit 4</b>		
<b>Length: 98.5 m</b>	<b>Length :</b>		
<b>Breadth : 18 m</b>	<b>Breadth :</b>		
<b>Depth :</b>	<b>Depth :</b>		
<b>GT: 4796</b>	<b>GT :</b>		
<b>Engine Power :</b>	<b>Engine Power :</b>		
<b>Built : 1998</b>	<b>Built</b>		
<b>Falg &amp; Class : Thailand</b>	<b>Owner &amp; Operator:</b>		
<b>Owner :</b>			
<b>Dead / Missing Nil</b>	<b>Dead / Missing</b>	<b>Nil</b>	
<b>Injury Nil</b>	<b>Injury</b>	<b>Nil</b>	
<b>Hull damage</b>		<b>Total loss</b>	

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** On the 29<sup>th</sup> of August 2017, container vessel, Bangpakaew departed from Yangon against the tide and fishing vessel Phyto Pwint Maung was towed with Lin Yaung Thit due to engine damage. Both fishing vessels proceed to Yangon with the. About 19:07, the Pilot from the Container ship informed that "Port-to-Port crossing" via VHF radio. Meanwhile, the Fishing vessel did not

reply due to VHF malfunction. After eight-minute, Fishing vessels altered the course to port immediately due to steering malfunction; consequently, collided with the starboard bow of a container ship and sunk the fishing vessel, Lin Yaung Thit 4, due to hull damage and flooding.

<b>UNSAFE ACTS</b>
<b>ERRORS</b>
<b>Skill -based errors AE 100</b>
<b>AE105 Poor techniques / seamanship</b>
Sudden alternation, of course
<b>AE108 Negative habit</b>
Over-reliance on VHF radio rather than collision avoidance action
<b>VIOLATION</b>
<b>Routine AV 400</b>
<b>AV403 Operated when unauthorized</b>
Both skippers from fishing vessels operated without a competency certificate
<b>AV404 Violated training rules</b>
Failure to consider that the vessel against the tide should give privilege to the vessel with the tide in a narrow channel

<b>Preconditions for unsafe acts</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>
<b>PE104 Ship movements and manoeuvres</b>
Both vessels proceed the voyage with and against the current
<b>Technological environment PE 200</b>
<b>PE204 Communication equipment</b>
Malfunction of VHF radio
<b>Personal Factors</b>
<b>Crew interaction PP 100</b>



<b>PP111 Miscommunication</b>
Notified by blowing with the whistle and fishing vessel did not understand the signal
<b>Personal readiness PP 200</b>
<b>PP201 Inadequate training</b>
Lack of sufficient training for the ship to ship communication

<b>Unsafe Supervision</b>
<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 001 Engaged unqualified crew</b>
There was no skipper onboard and controlled by assistant skippers who did not have the certificate
<b>SV 002 Failed to enforce rules / regs</b>
Lack of law enforcement regarding monitoring for operating the vessel without necessary certificates
<b>SV 003 Violate procedures</b>
Lack of contingency planning

<b>Organizational Influences</b>
<b>Organizational process</b>
<b>Procedure OP 100</b>
<b>OP 104 Informational resources / support</b>
Absent of vessel traffic service

## 10. Under 20 Horse Power Boat

### General Information

**Accident no.: 10**

**Date: 25/02/2018**

**Type of Vessel: Ferry**

**Type of Accident: Capsizing**

**Accident time: 18:30**

**Location: Indawgyi Lake, Kachin State**

**Length: 18'**

**Breath: 3'06"**

**Depth: 1'03"**

**Engine Type & Power: Honda (6 BHP)**

**Build: 2013 (Myanmar)**

**Owner & Operator: U Maung Oo**

**Dead / Missing: Nine**

**Total loss: Yes**

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** On the 25<sup>th</sup> February 2018, at about 18:00 hours, an unregistered small ferry capsized near Iwaemon village in the Indawgyi Lake during bad weather. The small boat was designed for fishing and operated by fishermen without a driver license and carried passengers for island pagoda during festival season. According to the design feature, the boat can carry six persons only. However, 18 passengers were carried before the accident happened and remaining the freeboard six inches consequently, ingress water and sinking after the strong wind.

<b>UNSAFE ACTS</b>
<b>ERRORS</b>

<b>Skill -based errors AE 100</b>
<b>AE108 Negative habit</b>
Negligence of safety and carried overload
<b>VIOLATION</b>
<b>Routine AV 400</b>
<b>AV403 Operated when unauthorized</b>
Operate without driver license
<b>AV406 Violated standing orders and regs</b>
Carried passenger without ferry license
<b>Exceptional AV 500</b>
<b>AV 502 Accepted unnecessary hazards</b>
Most of the passengers onboard were students, and no life-saving appliance was provided
<b>AV 504 Unauthorized to operate beyond design criteria</b>
Carried more than safe loaded limit

<b>Preconditions for unsafe acts</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>
<b>PE104 Ship movements and manoeuvres</b>
Bad weather effects on boat steering control
<b>Personal Factors</b>
<b>Personal readiness PP 200</b>
<b>PP201 Inadequate training</b>
Lack of safety awareness due to uncertified driver

<b>Unsafe Supervision</b>
<b>Failed to Correct Known Problems</b>
<b>Shipborne related shortcoming SF 000</b>
<b>SF 001 Failed to correct inappropriate/risky behaviour</b>
Water pumping out manually before proceeding the route
<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 001 Engaged unqualified crew</b>
Uncertified driver
<b>SV 005 Willful disregard of authority</b>
The fishing boat carried passenger

<b>Organizational Influences</b>
<b>Organizational process</b>
<b>Operation OP 000</b>
<b>OP 004 Schedules</b>
Festival season demand overcrowded condition

## 11. Aung Chan Thar 3

### General Information

**Accident no.: 11**

**Date: 26/03/2018**

**Type of Vessel: Fishing**

**Type of Accident: Fire**

**Accident time: 10:30**

**Location: Daw Nyein village, Pyarpone, Ayarwaddy Division**

**Involved:**

**Length: 44' 10"**

**Breath: 13'07"**

**Depth: 4'9"**

**GT: 14.6**

**Engine Type & Power: Nissan FE -6106765 B (148 BHP)**

**Build: 2013 (Myanmar)**

**Owner & Operator: Original Registered owner U Naing Soe**

**Dead / Missing: Nil**

**Injury: - Nil**

**Total loss: Yes**

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** *Aung Chan Thar 3* was towed by other vessels due to engine damage. During under repairing process, the vessel dock at Daw Nyein village. The shipowner and crew brought the old engine to the shore and left the

vessel without a crew or any watchkeeper. Before leaving the ship, one of the crew charged the mobile phone with a power bank and lit it with a candle on the shrine in the engine room. After the fire occurred, all crew fought with portable fire pump .however, a fire was an uncontrollable condition and led to exploding fuel oil storage tank. Consequently, it burned out some houses from shore and the whole vessel. Major root causes were: usage of naked light in the engine room, fuel oil service tanks made with plastic, and there was no ready to the fire extinguisher and sandbox.

<b>UNSAFE ACTS</b>
<b>ERRORS</b>
<b>Skill -based errors AE 100</b>
<b>AE105 Poor techniques / seamanship</b>
the poor practice of hot work and usage of naked flame in machinery space
<b>AE108 Negative habit</b>
use of naked flame and no watch keeper in E/R
<b>AE111 Procedures not used</b>
Improprate fire fighting procedure
<b>VIOLATION</b>
<b>Routine AV 400</b>
<b>AV401 Violation based on risk assessment</b>
Charging power bank for mobile phone and lighting with the candle in E/R

<b>Preconditions for unsafe acts</b>
<b>Personal Factors</b>
<b>Crew interaction PP 100</b>
<b>PP101 Machinery space leadership</b>
No fire watch during alongside
<b>PP102 Cross- monitoring performance</b>
No counter check before leaving machinery space
<b>Personal readiness PP 200</b>
<b>PP201 Inadequate training</b>
The crew were not trained for proper fire fighting procedure

<b>Crew Condition</b>
<b>Cognitive factors PC 100</b>
<b>PC125 Technical/procedural knowledge</b>
Lack of knowledge for oil fire
<b>Physiological state PC 200</b>
<b>PC215 Misplaced motivation</b>
The owner and manager focused the safety after the job satisfaction completion

<b>Unsafe Supervision</b>
<b>Inadequate Supervision</b>
<b>Shipborne and shore supervision SI 000</b>
<b>SI 003 Local training issues / programs</b>
lack of fire fighting training
<b>SI 010 Perceived lack of authority</b>
Poor enforcement to the rural area
<b>Planned Inappropriate Operations</b>
<b>Shipborne Operation SP 000</b>
<b>SP 004 Limited total experience</b>
Lack of knowledge for fire hazard
<b>SP 006 Lack of risk assessment - formal</b>
Traditional working practice is apart from the risk assessment procedure

<b>Organizational Influences</b>
<b>Resource management</b>
<b>Human resources OR 000</b>
<b>OR 003 Training</b>
Fishery associations do not organize to provide proper safety training to their worker
<b>Organizational Climate</b>
<b>Culture OC 200</b>
<b>OC 202 Organizational customs, beliefs and attitudes</b>
lack of safety culture

<b>Organizational process</b>
<b>Oversight OP 200</b>
<b>OP 203 Monitoring and checking of resources, climate and process to ensure a safe work environment</b>
The local fishery association does not notify and monitor for safety awareness to the owner and crew
<b>Statutory</b>
<b>Flag state implementation FS 100</b>
<b>FS 101 Link with vessel/company</b>
Ship owners and crew do not conduct safety training and seminars hosted by Administration

## 12. Shwe Sin Oo

### General Information

**Accident no.: 12**

**Date: 13/06/2018**

**Type of Vessel : Under 20 horse power boat**

**Type of Accident: Capsizing**

**Accident time: 13:15**

**Location: Kawyar village , Homemalin**

**Involved:**

**Length:**

**Breath:**

**Depth:**

**GT:**

**Engine Type & Power:**

**Build :**



**Owner & Operator: Original Registered owner**

**Dead / Missing : One**

**Injury: - Nil**

**Total loss: Yes**

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** On the 13<sup>th</sup> June 2018, about 13:00 hr, Shwe Sin Oo, under 20H.P cargo boat, departed from the jetty with cargoes and 25 passengers. Vessel out of control due to jammed with floating dunnage between propeller and rudder after 15 minutes departure. After that, the vessel collided with another ship and sunk.

<b>UNSAFE ACTS</b>
<b>ERRORS</b>
<b>Decision and Judgement errors AE 200</b>
<b>AE 204 Necessary action - delay</b>
Failed to prioritized the collision-avoidance action after steering error
<b>Violation</b>
<b>Routine AV 400</b>
<b>AV403 Operated when unauthorized</b>
Carried passenger without ferry license

<b>Preconditions for unsafe acts</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>
<b>PE104 Ship movements and manoeuvres</b>

High current and swirl during monsoon season along Chindwin River
<b>Technological environment PE 200</b>
<b>PE206 Faulty equipment</b>
Outboard engine design, combined with propeller and rudder more prone to failure after jam with floating material

<b>Unsafe Supervision</b>
<b>Planned Inappropriate Operations</b>
<b>Shipborne Operation SP 000</b>
<b>SP 003 Limited recent experience</b>
Lack of experience to recover for any control system failure
<b>SP 004 Limited total experience</b>
Poor awareness for risk of operating during monsoon season
<b>Failed to Correct Known Problems</b>
<b>Shipborne related shortcoming SF 000</b>
<b>SF 001 Failed to correct inappropriate/risky behaviour</b>
Nobody informed or notify to authority for such kind of vessel carried passenger without permission
<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 002 Failed to enforce rules / regs</b>
Local authorities do poor law enforcement

<b>Organizational Influences</b>
<b>Organizational process</b>

<b>Oversight OP 200</b>
<b>OP 202 Established safety programs/risk management programs</b>
Lack of safety training and program before Monsoon season

### **13. Cargo Barge ( CBR – 0740 )**

#### **General Information**

**Accident no.: 13**

**Date: 24/03/2019**

**Type of Vessel: Cargo Barge**

**Type of Accident: 7. Cargo Barge ( CBR – 0740 )**

**Accident time: 16:00 hour**

**Location: Maw Tin Soon (Lat. 16' 03.5'(N) & Long 094' 11.8"**

**Involved: Tug Lawpan 6 65.84x16.46x3.05M**

**Length: 65.84 M**

**Breath: 16.46 M**

**Depth: 3.05 M**

**GT: 755**

**Engine Type & Power of Tug : HINO diesel x 2 & 500 BHP**

**Build : -**

**Owner & Operator: Registered owner U Myo Tun**

**Dead / Missing : One missing**

**Injury : One sever injured**

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** On the 24<sup>th</sup> March 2019, about noon, Inland tug, Tug Lawpan 6 towed with Inland cargo barge which carried ship breaking parts and fuel oil from wreck removing project near Maw Tin Soon. One hour after departure, cargo barge flooded from bottom hull where temporary repaired and after another one more hour, flooded excessively even pumping out. The vessel turns to the port side for landing on the ground, and water ingress from opened- manholes then difficult to handle. At about 16:00 hour, cargo barge bumps with rock and sinking. Tug and Barge were only permitted for inland waterways, and accidents happened in the coastal area. Barge bottom part bumped with seabed twice per day due to tidal condition when operating over three months in wreck removal project. Before departure, damaged bottom parts were repaired temporary only due to insufficient facilities and resources. Finally, four after departure, the barge flooded, grounded and sunk.

<b>( UNSAFE ACTS )</b>
<b>ERRORS</b>
<b>Skill -based errors AE 100</b>
<b>AE105 Poor techniques / seamanship</b>
Opened- manholes
<b>Decision and Judgement errors AE 200</b>
<b>AE 204 Necessary action - delay</b>

Lack of preparing the life-saving appliance before sinking
<b>VIOLATION</b>
<b>Routine AV 400</b>
<b>AV403 Operated when unauthorized</b>
Tug master and engine driver were not certified, person
<b>Exceptional AV 500</b>
<b>AV 501 Exceeded limits of a system</b>
Insufficient Tug power, only 500 BHP cannot properly handle for 1833 DWT cargo barge in the open sea.
<b>AV 503 Not qualified as engineer officer (driver)</b>

<b>( Preconditions for unsafe acts )</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>
<b>PE104 Ship movements and manoeuvres</b>
Barge bumped with sand bed twice a day due to tidal wave during operating three months in wreck removal project.
<b>Technological environment PE 200</b>
<b>PE209 Inaccessible maintenance area</b>
Insufficient resource for repairing bottom part

<b>( Unsafe Supervision )</b>
<b>Inadequate Supervision</b>
<b>Shipborne and shore supervision SI 000</b>
<b>SI 014 Loss of supervisory situational awareness</b>

Without necessary action for evacuation from the grounded barge
<b>Planned Inappropriate Operations</b>
<b>Shipborne Operation SP 000</b>
<b>SP 006 Lack of risk assessment - formal</b>
loaded full capacity onto bottom damage barge
<b>Failed to Correct Known Problems</b>
<b>Shipborne related shortcoming SF 000</b>
<b>SF 001 Failed to correct inappropriate/risky behaviour</b>
Temporary repaired
<b>SF 002 Failed to correct a safety hazard</b>
Opened- manholes
<b>SF 003 Failed to initiate corrective action</b>
Lack of major repaired before back to sea
<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 001 Engaged unqualified crew</b>
Lack of coastal experience of master, crew and all workers
<b>SV 002 Failed to enforce rules / regs</b>
Inland tug and barge operated in the coastal area

<b>( Organizational Influences )</b>
<b>Organizational Climate</b>
<b>Structure OC 000</b>
<b>OC 005 Formal accountability for action</b>
<b>Culture OC 200</b>

<b>OC 202 Organizational customs, beliefs and attitudes</b>
Lack of safety awareness
<b>OC 203 Safety as a value</b>
No safety standards and procedures were followed
<b>Organizational process</b>
<b>Operation OP 000</b>
<b>OP 001 Operational tempo / workload</b>
Wrack removal process only allows before monsoon season
<b>Oversight OP 200</b>
<b>OP 202 Established safety programs/risk management programs</b>
Lack of systematic arrangement to handle the impact of tidal condition
<b>OP 203 Monitoring and checking of resources, climate and process to ensure a safe work environment</b>
Lack of preplanning for major repair

**14. MV. Htarwara Aharman (ON – 6583 A)**

**General Information**

**Accident no.: 14**

**Date: 25/07/2019**

**Type of Vessel: Cargo (Coastal) landing Craft**

**Type of Accident: Capsizing**

**Accident time: 15:20 hour**

**Location: 26 Nautical miles from Pathein lighthouse (Lat. 15' 43.5'(N) & Long 094' 38.9. "**

**Involved:**

**Length: 59.44 M**

**Breath: 11.81 M**

**Depth: 3.66 M**

**GT: 677**

**Engine Type & Power: Nissan diesel (3) & 1140 BHP**

**Build: - 2011 at Shwe Nagar Dockyard**

**Owner & Operator: Registered owner U Khin Maung Kyaing**

**Dead / Missing: Five dead and Two missing**

**Injury: - -**

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** *MV Htarwara Aharman*, Coastal landing craft, departed from Yangon on 24.07.2019 morning 08:00 hour with carried 25,000 packs of cement and proceeded to Thantwe, Rakhine State. On the 25<sup>th</sup> July 2019, about 08:00 hour, vessel speed was 3.5 N-mile and away six N-mile from Thuriya lighthouse. After six hours, about 14:13, seawater ingresses to the main deck passed over 7 feet of bulwark due to heavy wave with a strong wind from the port bow. Consequently, two-third of the cement pack from the forecastle moved to the port side alleyway then all cargo collapsed to the port side after 30 min. The ship



manager ordered to master to abandon the ship, and after 50 min, the vessel capsized and sunk.

<b>UNSAFE ACTS</b>
<b>ERRORS</b>
<b>Decision and Judgement errors AE 200</b>
<b>AE 204 Necessary action - delay</b>
The ship manager ordered to master to abandon the ship after all cargo shifted to the port side; however, he maintained the vessel for another 50 minutes.
<b>AE 205 Warning ignored</b>
Ignored weather warning for ( 23.07.2019 to 26.07.2019)
<b>VIOLATION</b>
<b>Exceptional AV 500</b>
<b>AV 502 Accepted unnecessary hazards</b>
Master proceed voyage during heavy weather

<b>( Preconditions for unsafe acts )</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>
<b>PE104 Ship movements and manoeuvres</b>
Excessive rolling and pitching may lead to cargo shifting
<b>Technological environment PE 200</b>
<b>PE217 Incorrect procedure</b>
Improper cargo lashing and securing arrangement
<b>Personal Factors</b>
<b>Personal readiness PP 200</b>
<b>PP204 Pattern of poor risk judgement</b>

Failed to change course or proceed to shelter area
<b>Crew Condition</b>
<b>Cognitive factors PC 100</b>
<b>PC108 Overconfidence</b>
Proceed voyage with weather warning
<b>Physiological state PC 200</b>
<b>PC205 Seasickness</b>

<b>( Unsafe Supervision )</b>
<b>Inadequate Supervision</b>
<b>Shipborne and shore supervision SI 000</b>
<b>SI 014 Loss of supervisory situational awareness</b>
Lack of supervision for cargo securing arrangement
<b>SI 015 Lack of communication with company representatives</b>
Shipowner or manager failed to inspect or check before departure
<b>Planned Inappropriate Operations</b>
<b>Shipborne Operation SP 000</b>
<b>SP 004 Limited total experience</b>
Failed to Correct Known Problems
<b>Shipborne related shortcoming SF 000</b>
<b>SF 002 Failed to correct a safety hazard</b>
Failed to counter check before bad weather
<b>SF 003 Failed to initiate corrective action</b>
Failed to change course
<b>Supervisory Violation</b>

<b>Shipborne violation SV 000</b>
<b>SV 003 Violate procedures</b>
Improper procedure for bad weather preparation
<b>SV 004 Authorized unnecessary hazard</b>
Allowed to proceed voyage during bad weather

<b>( Organizational Influences )</b>
<b>Organizational Climate</b>
<b>Structure OC 000</b>
<b>OC 005 Formal accountability for action</b>
The ship manager failed to order to alter the course
<b>Culture OC 200</b>
<b>OC 202 Organizational customs, beliefs and attitudes</b>
Shipowner, manager, master and all responsible person ignored the weather warning
<b>Organizational process</b>
<b>Oversight OP 200</b>
<b>OP 202 Established safety programs/risk management programs</b>
No risk assessment has been done
<b>OP 203 Monitoring and checking of resources, climate and process to ensure a safe work environment</b>
Failed to check cargo securing arrangement and lashing tools before departure
<b>Statutory FS</b>
<b>Flag state implementation FS 100</b>
<b>FS 101 Link with vessel/company</b>

Allowed port clearance during a weather warning

**15. Regency 1 with OB 404 & Yokohama 4 with CBR 351, CBR 510**

**General Information**

**Accident no.: 15**

**Date: 17/10/2020**

**Type of Vessel: Tug with Oil Barge & Tug with Cargo Barges**

**Type of Accident: Collision**

**Accident time: 10:30 hour**

**Location: Tamalo village , Nyaungtone , Hlaing river, Ayarwaddy**

<b>Regency 1</b>	<b>Oil Barge (OB – 404)</b>
<b>Length: 121'5"</b>	<b>Length : 200'</b>
<b>Breadth : 24'9"</b>	<b>Breadth : 45'</b>
<b>Depth : 8' 2"</b>	<b>Depth : 10'</b>
<b>GT: 143</b>	<b>GT : 636</b>
<b>Engine Power : Nissan RT10x 2 (500 BHP)</b>	<b>Engine Power :</b>
<b>Built : 2012</b>	<b>Built</b>

<b>Owner &amp; Operator : Regency Trading Co.</b>	<b>Owner &amp; Operator: Regency Trading Co</b>
<b>Dead / Missing</b>	<b>Dead / Missing</b>
<b>Injury</b>	<b>Injury</b>

<b>Yokohama 4</b>	<b>Cargo Barge (CBR – 510)</b>	<b>Cargo Barge (CBR-0351)</b>
<b>Length: 85' 00"</b>	<b>Length : 48.77 M</b>	<b>Length : 53.34 M</b>
<b>Breadth : 17'9"</b>	<b>Breadth : 9.75 M</b>	<b>Breadth : 11.28 M</b>
<b>Depth : 6'5"</b>	<b>Depth : 2.44 M</b>	<b>Depth : 2.44 M</b>
<b>GT: 54.63</b>	<b>GT : 256</b>	<b>GT : 327</b>
<b>Engine Power : HINO EF750x 2 (500 BHP)</b>	<b>Engine Power :</b>	<b>Engine Power :</b>
<b>Built : 2002</b>	<b>Built</b>	<b>Built</b>
<b>Owner : U Maung Maung Win.</b>	<b>Owner : U Maung Maung Win</b>	<b>Owner: Daw win Thandarlin</b>
<b>Dead / Missing</b>	<b>Dead / Missing</b>	<b>Dead / Missing</b>
<b>Injury</b>	<b>Injury</b>	<b>Injury</b>

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** On the 17<sup>th</sup> October 2020, about 10:00 hour, Inland tug Regency 1 vessel towed against the current with the Oil barge (OB 404) and Inland tug Yokohama 4 towed with Cargo barges (CBR 510 & 351) were collided at Pantaing tringle near Tamalo village ,Nyaungtone , Hlaing river. Regency 1 vessel towed with full speed and communicated to Yokohama 4 via VHF radio before passing the tringle; however, loss of connection after replied from Yakohama vessel which manned with uncertified master and engine driver. Both vessels passed the tringle without continuous communication via radio and collided with an oil barge and two cargo barges.

<b>( UNSAFE ACTS )</b>
<b>ERRORS</b>
<b>Skill -based errors AE 100</b>
<b>AE103 Failure to see and avoid</b>
No necessary action has been taken after loss of communication
<b>AE105 Poor techniques / seamanship</b>
Full speed with against the current and not given way for other vessels with the current
<b>Decision and Judgement errors AE 200</b>
<b>AE 204 Necessary action - delay</b>
Too late to reduce speed
<b>AE 206 Wrong decision making during operation</b>
Do not reduce speed after the loss of communication
<b>Perceptual errors AE 300</b>
<b>AE 301 Error due to misperception</b>

Operators from both vessels considered that safely pass the tringle without seeing each other
<b>VIOLATION</b>
<b>Routine AV 400</b>
<b>AV403 Operated when unauthorized</b>
Yokohama was operated with an uncertified master and engine driver
<b>Exceptional AV 500</b>
<b>AV 502 Accepted unnecessary hazards</b>
Yokohama vessel towed with overload (two barges)

<b>( Preconditions for unsafe acts )</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>
<b>PE104 Ship movements and manoeuvres</b>
With and Against the current
<b>Technological environment PE 200</b>
<b>PE204 Communication equipment</b>
Communication error due to VHF radio
<b>Personal Factors</b>
<b>Crew interaction PP 100</b>
<b>PP106 Communication critical information</b>
Proceed voyage without agreement between two vessel
<b>PP111 Miscommunication</b>
Miss communication
<b>Personal readiness PP 200</b>

<b>PP201 Inadequate training</b>
No VHF training has been taken to the uncertified operator from Yokohama
<b>Crew Condition</b>
<b>Cognitive factors PC 100</b>
<b>PC125 Technical/procedural knowledge</b>
Lack of knowledge collision avoidance rule

<b>( Unsafe Supervision )</b>
<b>Inadequate Supervision</b>
<b>Shipborne and shore supervision SI 000</b>
<b>SI 009 Lack of accountability</b>
Yokohama owner assign uncertified operator as a master
<b>SI 013 Over-tasked / untrained officer at management level</b>
Yokohama master has not been trained for radio communication method
<b>Planned Inappropriate Operations</b>
<b>Shipborne Operation SP 000</b>
<b>SP 003 Limited recent experience</b>
Lack of awareness for passing other vessels without seeing each other
<b>SP 007 Authorized unnecessary hazard</b>
Yokohama towed two barges with a full load
<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 001 Engaged unqualified crew</b>
Run with uncertified crew
<b>SV 002 Failed to enforce rules / regs</b>



Failed to reduce speed and give way to for upstream vessel
<b>SV 004 Authorized unnecessary hazard</b>
Run with the unqualified crew and overloaded

<b>( Organizational Influences )</b>
<b>Resource management</b>
<b>Human resources OR 000</b>
<b>OR 001 Inadequate safe manning</b>
Fail to reassign with new certified operator after signing off certified master and engine driver
<b>OR 003 Training</b>
Lack of training for collision rules and radio usage.
<b>Technological resources OR 100</b>
<b>OR 101 Excessive cost-cutting</b>
Run with a cheap and unqualified operator
<b>Organizational Climate</b>
<b>Culture OC 200</b>
<b>OC 202 Organizational customs, beliefs and attitudes</b>
Lack of safety awareness for collision when operating with untrained person

## 16. Aung Mingalar 5 ( ON 4702 )

### General Information

**Accident no.: 16**

**Date: 19/10/2020**

**Type of Vessel: Fishing**

**Type of Accident: Capsizing**

**Accident time: 07:30 hour**

**Location: Layan island, Myeik, Tanintharyi Division**

**Involved:**

**Length: 56'24"**

**Breath: 18'50"**

**Depth: 31'33"**

**GT: 59.35**

**Engine Type & Power: Cummins & 350 BHP**

**Build: -**

**Owner & Operator: Registered owner Daw Hla Sein 6**

**Dead / Missing: Two missing**

**Injury: - Two**

**Total loss:**

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** On the 15<sup>th</sup> October 2020 vessel returned from the fishing zone with all fishing nets stored on the starboard side for sheltering due to a storm warning. On the 19<sup>th</sup> October 2020, about (07:30), the vessel capsized to

starboard were stored the fishing net due to strong wind, then sunk two nautical away from the island.

<b>( UNSAFE ACTS )</b>
<b>ERRORS</b>
<b>Skill-based errors AE 100</b>
<b>AE105 Poor techniques / seamanship</b>
All fishing net stored at starboard side only
<b>AE112 Failed to prioritize attention</b>
improper lashing

<b>( Preconditions for unsafe acts )</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>
<b>PE104 Ship movements and manoeuvres</b>
Excessive rolling and pitching due to heavy weather
<b>Personal Factors</b>
<b>Crew interaction PP 100</b>
<b>PP111 Miscommunication</b>
Fial to Alerting all crew during heavy weather
<b>Personal readiness PP 200</b>
<b>PP204 Pattern of poor risk judgement</b>
Continuing the fishing operation after received weather information (15.10.2020)
<b>Crew Condition</b>
<b>Cognitive factors PC 100</b>

<b>PC123 Alertness (drowsiness)</b>
Two crews were Sleeping during heavy weather
<b>PC125 Technical/procedural knowledge</b>
Lack of knowledge for heavy weather preparation
<b>Physiological state PC 200</b>
<b>PC205 Seasickness</b>

<b>( Unsafe Supervision )</b>
<b>Inadequate Supervision</b>
<b>Shipborne and shore supervision SI 000</b>
<b>SI 001 Leadership / supervision/ oversight inadequate</b>
No clear instruction was given for heavy weather
<b>SI 014 Loss of supervisory situational awareness</b>
Lack of instruction to alert during Heavy weather

<b>( Organizational Influences )</b>
<b>Organizational Climate OC</b>
<b>Culture OC 200</b>
<b>OC 203 Safety as a value</b>
No ordered to proceed shelter as soon as the storm warning
<b>Organizational process</b>
<b>Procedure OP 100</b>
<b>OP 103 Procedural guidance / publications</b>
No procedure was provided for heavy weather

**17. Win Thiri Aung ( Ya Nya Na / Ayar - 1376 )**

**General Information**

**Accident no.: 17**

**Date: 24/10/2020**

**Type of Vessel: Dredging and sand carrying boat**

**Type of Accident: Flooding**

**Accident time: 07:30 hour**

**Location: Myaungmya, Ayarwaddy Division**

**Involved:**

**Length: 67'9"**

**Breath: 20'00"**

**Depth: 5'6"**

**GT: 29**

**Engine Type & Power: Cummins & 137 BHP**

**Build: -**

**Owner & Operator: Registered owner U Zarni Win & Operator U Win Hlaing**

**Dead / Missing: One dead**

**Injury: - -**

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** Dredging and sand carrying vessel Win Thiri Aung carried sand with the overloaded condition and docked at the river bank for waiting for the low tide. On the 24<sup>th</sup> October 2020, about (07:30) hour, during low tide, flooded from stern part and then sunk; as a result, one crew has been drowned together with vessel and life was loss.

<b>UNSAFE ACTS</b>
<b>ERRORS</b>
<b>Skill -based errors AE 100</b>
<b>AE105 Poor techniques / seamanship</b>
No draft measurement and adjust the mooring line
<b>VIOLATION</b>
<b>Exceptional AV 500</b>
<b>AV 501 Exceeded limits of a system</b>
Overloaded condition

<b>( Preconditions for unsafe acts )</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>
<b>PE104 Ship movements and manoeuvres</b>
Vessel draft altered with tidal condition
<b>Personal Factors</b>
<b>Cognitive factors PC 100</b>
<b>PC108 Overconfidence</b>

Sand loaded until the water level reached near the deck line
<b>PC118 Misperception of operational condition</b>
Without adjusting the mooring line
<b>Physiological state PC 200</b>
<b>PC219 Insufficient reaction time</b>
Flooding and sinking within a short period due to weight of sand

<b>( Unsafe Supervision )</b>
<b>Inadequate Supervision</b>
<b>Shipborne and shore supervision SI 000</b>
<b>SI 001 Leadership / supervision/ oversight inadequate</b>
Failed to order assign duty
<b>SI 014 Loss of supervisory situational awareness</b>
Lack of supervision for tidal condition
<b>Shipborne Operation SP 000</b>
<b>SP 004 Limited total experience</b>
<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 002 Failed to enforce rules / regs</b>
Carried with overloaded

<b>( Organizational Influences )</b>
<b>Organizational Climate</b>
<b>Culture OC 200</b>
<b>OC 202 Organizational customs, beliefs and attitudes</b>

Lack of safety awareness

**18. Win Win Htet (15284)**

**General Information**

**Accident no.: 18**

**Date: 11/11/2020**

**Type of Vessel: Cargo (Shallow water)**

**Type of Accident: Fire**

**Accident time: 09:45 hr**

**Location: Five mile away from Monywa , Sagaing Division**

**Involved:**

**Length: 132'**

**Breath: 18'11"**

**Depth: 4' 5"**

**GT: 86**

**Engine Type & Power: Mitsubishi & 216 BHP**

**Build : -**

**Owner & Operator: Registered owner U Khin Maung Win**

**Dead / Missing: Nil**



**Injury: - Two**

**Total loss: No**

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** On the 11<sup>th</sup> November 2020, about (09:45) hr, shallow water cargo vessel Win Win Htet fired onboard during sailing Monywa to Namptaw . The initial source of the fire was an overheated socket of battery charging unit in engine room then the fire spread out to fuel oil level gauge which provided with plastic. There was no watchkeeper in the engine room and consequently did not fight in time, leading to vessel fire. Additional contribution factors were

1. Engine starting and speed was controlled from navigation bridge located at foremost part ;
2. The old age of wiring system and not industrial standard ;
3. The certified engine driver was only mentioned in the crew list, and no certified engine driver or oiler actually worked onboard; and
4. The vessel was driven by the shipowner, U Khin Maung Win whose certificate has been expired even though, in the crew list, the master was another person and he who not working onboard.

<b>( UNSAFE ACTS )</b>	
<b>ERRORS</b>	
<b>Skill -based errors AE 100</b>	
<b>AE101</b>	<b>Inadvertent use of equipment control and switches</b>
	The old age of wiring system and not industrial standard
<b>AE108</b>	<b>Negative habit</b>
	Cleanness of engine room
<b>Decision and Judgement errors AE 200</b>	
<b>AE 201</b>	<b>Risk assessment during operation</b>
	Run without engine room watchkeeper
<b>AE 204</b>	<b>Necessary action - delay</b>

Lack of knowledge for emergency response procedure
<b>VIOLATION</b>
<b>Routine AV 400</b>
<b>AV403 Operated when unauthorized</b>
No certified master and vessel was driven by shipowner who holds expired certificate)
<b>AV404 Violated training rules</b>
<b>Exceptional AV 500</b>
<b>AV 503 Not qualified as engineer officer (driver)</b>
The certified engine driver was only mentioned in the crew list

<b>( Preconditions for unsafe acts )</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>
<b>PE101 Temperature - thermal stress</b>
Overheated from the battery charging socket
<b>PE103 Vibration</b>
loosen connection due to vibration
<b>PE105 Toxins and cleanliness in machinery space</b>
Oily in the engine room
<b>Technological environment PE 200</b>
<b>PE201 Control and switches</b>
The old age of wiring system and not industrial standard
Oil level gauge used with plastic
<b>PE203 Machinery space layout</b>
Navigation bridge at foremost part and engine room at aftermost part
<b>PE206 Faulty equipment</b>
Loosen socket
<b>Personal Factors</b>
<b>Crew interaction PP 100</b>
<b>PP101 Machinery space leadership</b>

No engine driver or oiler onboard
<b>Personal readiness PP 200</b>
<b>PP201 Inadequate training</b>

<b>( Unsafe Supervision )</b>
<b>Planned Inappropriate Operations</b>
<b>Shipborne Operation SP 000</b>
<b>SP 004 Limited total experience</b>
The shipowner who manages the vessel holds the temporary license for the Chindwin River only and already expired
<b>Failed to Correct Known Problems</b>
<b>Shipborne related shortcoming SF 000</b>
<b>SF 001 Failed to correct inappropriate/risky behaviour</b>
Use of loosening socket
<b>SF 002 Failed to correct a safety hazard</b>
Maintenance of engine room cleanliness and renewed old electric wire
<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 001 Engaged unqualified crew</b>
No certified engine room staff
<b>SV 002 Failed to enforce rules / regs</b>
<b>SV 005 Wilful disregard of authority</b>
<b>SV 006 Inadequate documentation</b>
Crew list did not match with the actual onboard

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<b>( Organizational Influences )</b>
<b>Resource management</b>
<b>Human resources OR 000</b>
<b>OR 001 Inadequate safe manning</b>
No engine room staff
<b>OR 003 Training</b>
Lack of training for emergency response
<b>Technological resources OR 100</b>
<b>OR 101 Excessive cost-cutting</b>
The owner does not want to expanse additional costs for certified operators
<b>Equipment / facility resources OR 200</b>
<b>OR 201 Engineer support</b>
<b>OR 206 Poor engine - room machinery design</b>
Vibrated engine room
<b>OR 207 Purchasing of unsuitable equipment</b>
Usage of electric cable with home appliance standard
<b>Organizational Climate OC</b>
<b>Culture OC 200</b>
<b>OC 202 Organizational customs, beliefs and attitudes</b>
Lack of knowledge for safety culture
<b>Organizational process</b>
<b>Flag state implementation FS 100</b>
<b>FS 103 Class and statutory surveys</b>
Lack of monitoring for actual and official crew list

**19. MV Kumudra 1**

**General Information**

**Accident no.:** 19

**Date:** 27/02/2021

**Type of Vessel :** Cargo (coastal )

**Type of Accident:** Grounded and Capsizing

**Accident time:** 18:35

**Location:** Myebon , Rakhine State

**Length:** 53.77 m

**Breath:** 12.45 m

**Depth:**

**GT:** 642

**Engine Type & Power:** Hino (620 HP)

**Build :**

**Owner & Operator:** U Tin Nyein

**Dead / Missing :** Nil

**Injury:** - Nil

**Total loss:** Yes

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** On the 27<sup>th</sup> February 2021, about 08:30 hour, **Kumudra 1** departed from Kantaung Gyi jetty, Myebon and loaded with 600 tones of construction rock. About 12:00 hour, Commenced heavy waves and strong wind from starboard beam together with high tide due to full moon day. The vessel proceeds voyage with difficult steering control and poor visibility. At about 13:30 hours, the vessel collided with black rock and ran aground, consequently flooded due to tank damage. Ship crew pumping out with three water pumps and informed

to ship owner and other vessels. On the 18:00 hour, the vessel cleared from black rock and capsized to the starboard side. Yadanarwin, a coastal vessel, safely rescued Master and crew.

<b>UNSAFE ACTS</b>
<b>ERRORS</b>
<b>Skill -based errors AE 100</b>
<b>AE103 Failure to see and avoid</b>
Lack of pre-planning and weather forecasting before departure
<b>AE105 Poor techniques / seamanship</b>
Failure to proceed the sheltered zone by altering course during bad weather
<b>AE111 Procedures not used</b>
Failure to check echo sounder and to assign proper lookout
<b>Decision and Judgement errors AE 200</b>
<b>AE 204 Necessary action - delay</b>
Failure to change course since bad weather commences
<b>Perceptual errors AE 300</b>
<b>AE 301 Error due to misperception</b>
Failure to choose weather routing, Master, tried to handle alone all operations without job distribution

<b>Preconditions for unsafe acts</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>
<b>PE102 Artificial light</b>
Poor visibility

<b>PE104 Ship movements and manoeuvres</b>
Heavy wind and strong current
<b>Personal Factors</b>
<b>Crew interaction PP 100</b>
<b>PP103 Teamwork delegation</b>
Lack of teamwork ( Master and his assistant did not cooperate during emergency condition)
<b>Personal readiness PP 200</b>
<b>PP201 Inadequate training</b>
Lack of knowledge and training for responding in emergency conditions

<b>Unsafe Supervision</b>
<b>Inadequate Supervision</b>
<b>Shipborne and shore supervision SI 000</b>
<b>SI 001 Leadership / supervision/ oversight inadequate</b>
Master tried to operate everything alone ( engine control, steering and lookout)
<b>SI 013 Over-tasked / untrained officer at management level</b>
Over workload on Master due to his assistance did not support him
<b>Planned Inappropriate Operations</b>
<b>Shipborne Operation SP 000</b>
<b>SP 004 Limited total experience</b>
Master, never has been experienced for that course
<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 001 Engaged unqualified crew</b>

Unqualified master command the vessel
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<b>Organizational Influences</b>
<b>Resource management</b>
<b>Human resources OR 000</b>
<b>OR 003 Training</b>
Lack of training for resource management

**20. Toe Myat Annawar**

**General Information**

**Accident no.: 20**

**Date: 28/04/2021**

**Type of Vessel : Fishing**

**Type of Accident: Fire**

**Accident time: 06:00 hour**

**Location: Lat 17' 57 (N) ,Long 94' 00(E)**

**Involved:**

**Length:**

**Breath:**

**Depth:**

**GT: 104**

**Engine Type & Power:**

**Build :**

**Owner & Operator:**

**Dead / Missing : Nil**



**Injury: - Nil**

**Total loss: Yes**

**Source of information about the accident:** Investigation Report ( Internal Document of DMA)

**Summary of the accident:** On the 28<sup>th</sup> April 2021, the morning of 06:00 hour, a fishing vessel Caught fire from the engine room due to electric shock. There was no certified engine driver onboard and operated with an assistance driver before the accident happened. Electric shock immersed from loosening socket, plug and poor wiring system then the fire spread out to fuel and finally the whole vessel has been destroyed although all crew has been safe.

<b>UNSAFE ACTS</b>
<b>ERRORS AE XXX</b>
<b>Skill -based errors AE 100</b>
<b>AE101 Inadvertent use of equipment control and switches</b>
Loosen socket and plug
<b>VIOLATION</b>
<b>Routine AV 400</b>
<b>AV403 Operated when unauthorized</b>
No certified operators for Engine room
<b>Exceptional AV 500</b>
<b>AV 503 Not qualified as engineer officer (driver)</b>
uncertified assistance engine driver has operated the vessel

<b>Preconditions for unsafe acts</b>
<b>Environmental Factors</b>
<b>Physical environment PE 100</b>

<b>PE103 Vibration</b>
Source of electric shock happened by vibration and loosened socket
<b>Technological environment PE 200</b>
<b>PE201 Control and switches</b>
Usage of poor quality appliance
<b>Personal Factors</b>
<b>Personal readiness PP 200</b>
<b>PP201 Inadequate training</b>
The crew has not been trained to fight engine room fire

<b>Unsafe Supervision</b>
<b>Inadequate Supervision</b>
<b>Shipborne and shore supervision SI 000</b>
<b>SI 008 Failed to provide an adequate rest period</b>
Assign for engine room watchkeeping and maintenance duty with two crew members only
<b>Planned Inappropriate Operations</b>
<b>Shipborne Operation SP 000</b>
<b>SP 002 Poor crew interaction</b>
Failed to respond immediately for cutting fuel and power source
<b>SP 007 Authorized unnecessary hazard</b>
Allowed electrical switchboard over the fuel oil tank
<b>Failed to Correct Known Problems</b>
<b>Shipborne related shortcoming SF 000</b>
<b>SF 004 Failed to report unsafe tendencies</b>

Failed to inform for providing new crew after certified engine driver went back home
<b>Supervisory Violation</b>
<b>Shipborne violation SV 000</b>
<b>SV 001 Engaged unqualified crew</b>
Mater did not manage to engine room crew for sufficient rest

<b>Organizational Influences</b>
<b>Resource management</b>
<b>Human resources OR 000</b>
<b>OR 001 Inadequate safe manning</b>
Assigned two crew members in the engine room for overall job
<b>Technological resources OR 100</b>
<b>OR 101 Excessive cost-cutting</b>
Shortage of engine room crew
<b>Equipment/facility resources OR 200</b>
<b>OR 205 Poor engine - room design</b>
Limited access for the engine room to shut off fuel oil and fight the fire
<b>Organizational process</b>
<b>Operation OP 000</b>
<b>OP 001 Operational tempo / workload</b>
Seasonal demand for operation as per nature of the fishing sector
<b>Procedure OP 100</b>
<b>OP 101 Performance standards</b>
Low crew performance and management due to poor income and low education

<b>Oversight OP 200</b>
<b>OP 203 Monitoring and checking of resources, climate and process to ensure a safe work environment</b>
Allowed poor electric wiring system