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**SAFETY DELIVERY, SITUATIONAL AWARENESS,  
WAYFINDING AND SELF-AWARENESS  
PREDICTION OF FERRY PASSENGER  
SAFETY AWARENESS IN PENANG**

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**MASTER OF SCIENCE  
(TRANSPORTATION & LOGISTICS MANAGEMENT)  
FINAL YEAR PROJECT  
UNIVERSITI UTARA MALAYSIA  
JANUARY 2026**

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WAYFINDING AND SELF-AWARENESS  
PREDICTION OF FERRY PASSENGER  
SAFETY AWARENESS IN PENANG**

**FYP 2026**

**SAFETY DELIVERY, SITUATIONAL AWARENESS, WAYFINDING AND  
SELF-AWARENESS PREDICTION OF FERRY PASSENGER SAFETY  
AWARENESS IN PENANG**



**Thesis Submitted to  
College of Business  
Universiti Utara Malaysia,  
in Partial Fulfillment of the Requirement for the Master of Sciences (Management)**



**Kolej Perniagaan**  
(College of Business)  
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# **SAFETY DELIVERY, SITUATIONAL AWARENESS, WAYFINDING AND SELF-AWARENESS PREDICTION OF FERRY PASSENGER SAFETY AWARENESS IN PENANG.**

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## **Abstract**

Passenger safety remains a central concern for domestic ferry operations, especially along the busy Georgetown–Butterworth route in Penang. While ongoing safety measures have been implemented, a comprehensive understanding of the factors that influence passengers' awareness of safety procedures is still lacking. This research investigates how safety delivery, situational awareness, wayfinding and self-awareness influence to passengers' safety awareness in Penang. A cross sectional design was adopted, with data collected through a structured questionnaire administered to 400 domestic ferry passengers using non-probability convenience sampling. Descriptive analysis was conducted using SPSS to examine respondents' demographic characteristics. Pearson correlation analysis was employed to assess the relationships between the independent variables and passengers' safety awareness, while multiple linear regression analysis was used to determine the prediction influence of each factor. The findings reveal that all four independent variables are positively and statistically significant predictors of passengers' safety awareness. Among the factors examined, wayfinding emerged as the strongest predictor ( $\beta = 0.299$ ), followed by situational awareness, self-awareness and safety delivery. The results indicate that passengers' ability to navigate the ferry environment and clearly identify safety features plays a crucial role in enhancing overall safety awareness. From a practical perspective, the findings highlight the importance of improving wayfinding systems through clear signage, standardised safety symbols and visible emergency routes, as well as strengthening safety communication through effective briefings and visual aids. This study provides valuable insights for ferry operators and policymakers in developing human-centred safety strategies. Future research may adopt longitudinal or mixed-method approaches and extend the scope to other domestic ferry routes in Malaysia.

**Keywords:** Domestic ferries, passengers, safety awareness

## **Acknowledgement**

I would like to express my deepest gratitude to Allah SWT for His blessings and guidance that have enabled me to complete this thesis.

I would like to extend my sincere appreciation to my principal supervisor, Ts. Dr. Chuah Lai Fatt, for their invaluable guidance, encouragement and constructive feedback throughout the course of this research. Your expertise and dedication have been instrumental in shaping the direction and quality of this work.

Special thanks to my fellow colleagues and friends for their constant encouragement and for providing a supportive and motivating environment.

I owe a heartfelt debt of gratitude to my family for their unwavering support, patience and prayers throughout my academic journey. Your love and belief in me have been my greatest source of strength.

Any shortcomings or errors in this work are entirely my own. I hope that the findings of this research will contribute meaningfully to the field of maritime studies and benefit all stakeholders in the Malaysian ferries industry.

Fathin Nabilah Binti Jelani

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## **List of abbreviations**

ANOVA	Analysis of variance
EEZ	Exclusive economic zone
GISIS	Global intergrated shipping international system
GT	Gross tonnage
IACS	International association of classification societies
ILO	International labour organization
IMO	International maritime organization
IACS	International association of classification societies
MIMA	Maritime institute of Malaysia
PPC	Penang port commission
PPSB	Penang port sendirian berhad
R	Pearson correlation coefficient
R <sub>2</sub>	Coefficient of determination
SD	Standard deviation
SERVQUAL	Service quality
SPSS	Statistical package for the social sciences
TPB	Theory planned behaviour
UNCLOS	United nations convention on the law of the sea
UNCTAD	United nations conference on trade and development
VIF	Variation inflation factor



## **CHAPTER ONE : INTRODUCTION**

### **1.1 Background of the study**

Passenger safety has become a significant global concern, particularly within ferry transportation systems (Hebbar, 2025), which play essential roles in urban coastal transit networks. Incidents involving domestic ferries, including emergencies and accidents (AMET, 2025), have continually raised critical questions about passenger preparedness and safety awareness. In Malaysia, despite strict safety measures implemented by ferry operators, there remain ongoing concerns regarding passengers' actual safety awareness (Gohari et al., 2025). This issue is notably pronounced on the heavily utilized ferry route connecting Georgetown and Butterworth in Penang (Ting, 2021).

Georgetown–Butterworth, Penang ferry route is integral to daily commuting, supporting the travel needs of thousands, including commuters, tourists and local residents (Rubric, 2025). The effectiveness of existing safety protocols heavily depends on passenger response, which varies according to several influential factors (Luger-Bazinger et al., 2021). These include demographic characteristics, the clarity and effectiveness of safety delivery (Lau et al. (2021), passengers' situational awareness (Gohari et al., 2025) regarding their immediate surroundings, the efficiency of wayfinding systems onboard and the level of individual self-awareness about safety practices.

Although transportation safety has been widely researched, studies specifically addressing the context of domestic ferry operations in Malaysia remain limited. There is a particular gap concerning how demographic characteristics and practical variables viz safety delivery, situational awareness, wayfinding and self-awareness influence passengers' safety awareness

levels. Addressing this gap is essential to developing targeted, effective strategies for enhancing passenger safety.

This research specifically investigates the demographic profiles of ferry passengers traveling between Georgetown and Butterworth, Penang. It further aims to identify the relationships among safety delivery, situational awareness, wayfinding, self-awareness and collective impact to boost passengers' safety awareness.

Two theory applied for this research viz Situational awareness theory and Service quality theory or SERVQUAL theory. It emphasize on the role of effective communication, environmental perception, cognitive understanding and decision-making in promoting safety. Situational awareness theory by Endsley (1995) highlights the passengers' perception and comprehension of safety risks in their environment. SERVQUAL founded by Parasuraman et al. (1988) provides a way to measure service quality across 5 main dimensions such as tangibles, reliability, responsiveness, assurance and empathy. This theory highlight gap among customers expectation and perceptions of service delivery to identifying areas that need improvement.

A quantitative research design using a structured questionnaire (Ghanad, 2023) distributed to 400 ferry passengers, selected via stratified random sampling and facilitate robust data collection. Statistical Package for the Social Sciences (SPSS) software enables descriptive analysis of passenger demographics, correlation analysis to explore variable relationships and regression analysis to evaluate the predictive effect of safety delivery, situational awareness, wayfinding and self-awareness on passenger safety awareness.

This study significantly contributes to academic literature and practical knowledge, providing insights for ferry operators, policymakers and safety educators to improve ferry transportation

safety strategies. Focus to the influencing factors demographics, safety delivery, situational awareness, wayfinding and self-awareness this research guides strategic interventions to foster a safer ferry travel environment, ensuring enhanced passenger safety outcomes.

## **1.2 Problem statement**

Despite continuous improvements in ferry safety regulations and the implementation of standardized protocols and incidents involving domestic ferries in Malaysia continue to raise concerns about the effectiveness of passenger safety awareness. The Star (2023) reported that on the Penang ferry route, which has a high daily passenger volume, the true extent of passengers' readiness and understanding of safety measures remains uncertain.

Existing research has often focused on technical and operational aspects of ferry safety, but has largely overlooked the human and behavioral dimensions that can directly affect safety outcomes (Enyinda Chukwuemeka Albert, 2024). As the number of passengers on these ferries increases, the concerns about passenger safety awareness have become more prominent. Previous research indicates a consistent gap in passengers' understanding of safety protocols and emergency procedures with a significant risk to both passengers and crew members (Wang et al., 2021).

Previous existing research focuses on operational features viz vessel maintenance and crew training Shiwakoti et al., (2019) limited research to the passengers' role in ensuring safety, especially in the context of Penang's ferry services. To support, Lau et al. (2020) stated that overcrowded conditions on ferry vessels significantly impact situational awareness, as high passenger reduce focus towards safety protocols and emergency procedures. Passengers' situational awareness, wayfinding abilities and adherence to safety information remain

inadequately addressed especially in high-traffic routes such as Georgetown-Butterworth, Penang ferry route.

Demographic factors consist of age, educational background, frequency and purpose of travel have been found to significantly influence safety awareness and behaviors but these factors remain underexplored in the context of ferry passengers in Malaysia. Research in the aviation and public transportation (Shiwakoti et al., 2019) sectors has shown that demographic characteristics can shape individuals' safety behaviors, with younger passengers often show lower levels of safety compliance (Herno Della et al., 2020). In the ferry sector, studies examining how these demographic characteristics influence safety awareness in Malaysia remain under study (Serap et al., 2017).

MMD (2024) reported a significant surge in maritime traffic, viz 70% increase in arrivals between 2021 ( $0.59 \times 10^6$ ) and 2024 ( $1.01 \times 10^6$ ). Forecasts suggest continued growth in passenger volume, particularly during tourism and peak seasons, which may further challenge existing safety infrastructures. The escalation in passenger volume poses a critical risk to maritime safety. Bernama (2024b) stated that according to warnings from the MMEA, the practice of overloading ferries during high-demand periods creates a direct correlation with increased accident on the sea. Previous empirical research examined passenger safety awareness in different countries and different sectors contribute to valuable perceptions towards safety procedures and passengers preparedness during emergencies. As an example research conducted in China (Wang et al., 2021) viz cross sector transport studies, train station in Australia (Shiwakoti et al., 2016), airport Melbourne, Australia (Shiwakoti et al., 2019), Taiwan (Chang & Liao, 2009),

Indonesia (Herno Della et al., 2020), Norwegian (Hystad et al., 2016) and Hong Kong (Lau et al., 2020).

Understanding safety measures is crucial for improving safety protocols and ensuring better compliance among passengers particularly on high-demand ferry routes like Georgetown-Butterworth. This study aimed to explore the prediction of ferry passengers' safety awareness in Penang, with a focus on the role of situational awareness, wayfinding, safety information and safety delivery. By addressing these gaps, this research provided actionable insights to ferry operators, regulators, and policymakers, contributing to enhanced safety practices and a reduced risk of accidents.

### **1.3 Research questions**

Based on the queries identified in the problem statement, this study lead to following research questions:

- a. What are the demographic characteristics of passengers in domestic ferries in Penang?
- b. What are the relationships between safety delivery, situational awareness, wayfinding self-awareness in influencing passengers' safety awareness?
- c. What is the impact of safety delivery, situational awareness, wayfinding and self-awareness on passengers' safety awareness?

### **1.4 Research objectives**

The main objectives of this study are as follows:

- a. To identify the demographic characteristics of passengers on domestic ferries in the Georgetown-Butterworth route and their impact on safety awareness.

- b. To examine the correlation between safety delivery, wayfinding, self-awareness and situational awareness influencing passengers' safety awareness.
- c. To evaluate the impact of safety delivery, wayfinding, self-awareness and situational awareness on passengers' safety awareness.

### **1.5 Significance of the study**

This research significant as it contributes to the prediction of ferry passenger safety awareness specifically in Georgetown-Butterworth, Penang. Ferry services are a crucial mode of transportation for both locals and tourists, there is a lack of empirical research addressing the role of passenger safety awareness in maritime transportation particularly in Malaysia.

The findings of this research provide valuable insights viz safety delivery, wayfinding, self-awareness and situational awareness prediction influence passengers' understanding and compliance with safety protocols. These insights are critical for ferry operators and maritime safety regulators to improve the quality and effectiveness of safety measures to ensure passengers are prepared for evacuation during emergencies.

Key gap in this literature by identify and study the impact of demographic characteristics on ferry passengers also how these factors viz age, education, frequency of travel impact individual safety awareness. Understanding these relationships is important to form a targeted safety campaigns with strategies towards different demographic groups.

The implications of this study encompass beyond academic knowledge, offering actionable recommendations for improving safety communication, operational practices and regulatory frameworks. The research help ferry operators in refining the safety delivery practices and contribute to the development of new policies that strengthen passenger safety on domestic

ferry routes. Indirectly enhance the overall safety culture in Malaysia's maritime transport sector.

### **1.6 Scope of the study**

This research is geographically limited to passengers traveling on the Georgetown-Butterworth ferry route in Penang, Malaysia, with data collection exclusively at the Pangkalan Raja Tun Uda, Georgetown ferry terminal. This terminal is one of the main departure points for ferry passengers traveling between Penang Island to mainland and Butterworth is also a key terminal, this research focus solely on passengers departing from Georgetown to ensure consistency in the data collection process. The findings may not be directly applicable to other ferry terminals or routes within Penang or beyond as passengers behaviour may vary across different terminals.

The study have been conducted over a 5 month period, from Sept 2025 to January 2026, which coincides with the peak tourist season. This period has been chosen to capture data during a time especially during year end and school holiday lead to congestion in ferry traffic, providing insights into passenger safety awareness during this periods delicate the risk. Collecting data during peak season is important as crowded conditions often increase safety awareness issues making this time frame crucial for the study.

The criteria of respondent viz passengers must be over the age of 18 years and have traveled on the Georgetown-Butterworth ferry at least once in the past 6 months. This to ensure that respondents have experience to the ferry services and safety procedures, which is to evaluate their awareness and compliance with safety protocols. The passengers with first-time ferry users, has limited exposure and unable to provide a full understanding of ferry safety practices. Crew members and staff working at the Georgetown terminal were excluded as the study focuses specifically on passengers.

Data was collected using a non-probability convenience sampling method. Respondents selection based on their availability at the Georgetown terminal during the data collection period. This approach ensured a diverse representation of ferry passengers, including both residents and tourists who regularly use the ferry services. The focus on a single terminal meant that the findings may be limited to the specific context of Georgetown-Butterworth ferry operations and may not fully reflect the dynamics at other terminals or ferry routes. While this limits generalizability, it ensured that the study remains focused, manageable and provides in-depth insights into passenger safety awareness at a single point of operation.

The population sample was passengers traveling using ferry from Georgetown-Butterworth Penang, Malaysia with estimation of 8,000 passengers per day (The Star, 2023). The Star (2025) reported about  $5 \times 10^6$  passengers used new fleet ferries since open August 2023 in Penang. To determine the required sample size for this study, the (Krejcie & Morgan, 1970) sampling table was utilized. This method was widely accepted in academic research as it provided a standardized simplified calculation for finite populations. Population (N) exceeding 1,000,000, the required sample size (s) remains constant at 384, based on a 95% confidence level and a 5% margin of error. As the current ferry passenger population has reached approximately 5,000,000, a minimum of 384 respondents was required. This study exceeded that threshold by surveying 400 respondents, this was to enhance the precision of the findings and ensured that the data remains robust.

## 1.7 Operational definition

To ensure intelligibility and reliability with this study, variables to the research context as shown below.

**Safety delivery:** Refers to the methods and effectiveness by which safety information, instructions and procedures are communicated to ferry passengers. This includes the clarity of safety briefings, signage, announcements and crew instructions that aim to increase passenger understanding and compliance with safety protocols. Several studies found out the significance of effective safety delivery in enhancing passenger safety awareness on ferries. Lau et al. (2020) study that safety delivery, including safety facilities and demonstrations, highly influences passengers awareness and behavior especially in safety protocols. Wang et al. (2021) highlighted the importance of clear signage and emergency wayfinding tools, influence the passengers awareness of safety procedures, but many faced difficulty to fully comprehend the provided information if poor signaged applied.

**Situational awareness:** Describes the extent to which passengers are conscious of their surroundings and able to perceive and interpret relevant safety cues during their ferry journey. Situational awareness in ferry pertaining to passengers ability to observe and interpret safety-related cues during their journey, which is important for emergency response. A study by Wang et al. (2021) identified that many passengers were aware of emergency evacuation plans and signage, but unlikely did not realise the content or availability, indicating a gap in situational awareness. To support research by Lau et al. (2020) study that if the passengers familiar through the vessel's environment can affects positively to safety awareness, by emphasizing the main point of situational awareness in enhancing safety outcomes. This findings suggest that improving passengers situational awareness through better

communication and familiarization with safety features can lead to an effective emergency evacuation.

**Wayfinding:** Relates to passengers' ability to navigate the ferry environment and locate essential safety equipment and exits. Effective wayfinding is crucial for ferry passengers to navigate their environment and recognize the safety equipment and exits, especially during emergencies evacuate. Studied by Shiwakoti et al. (2019) determine if passengers' have no trust on emergency wayfinding tools and procedure viz evacuate maps or assembly area toward their personal safety. To support this statement, research by Wang et al. (2021) claims safety awareness and perception of emergency wayfinding tools may influence by the passengers behaviour and affected the whole evacuation process. Wayfinding includes the ease of understanding signs, pathways and instructions that guide passengers to safety in both normal and emergency situations.

**Self-awareness:** Represents the passengers' understanding and evaluation with their knowledge, attitudes and preparedness towards safety practices and responsibilities during emergency response. Rahman et al. (2022) stated even though the passenger recognize the evacuation route to exit but the way their react and response towards specific warning may be differ due to the main factors influence them which is self-awareness and self-preparedness. Most of the rail passengers does not achieve satisfaction level of self-awareness on evacuation tools during emergencies.

**Passengers' safety awareness:** The main focus of this study, passengers' safety awareness refers to the overall level of knowledge, understanding and attentiveness that ferry passengers possess regarding safety procedures, equipment and expected behaviors. This awareness is considered crucial for effective safety outcomes and is the primary dependent variable in the

research. Wang et al. (2021) found passengers' safety awareness and perception toward wayfinding tools could impact their behaviour and effect the entire evacuation process. They stated a good significance in understanding passenger safety awareness and the accessibility of emergency wayfinding tools during evacuations by verifying evacuation sign systems in passenger ship environments.

**Demographic characteristics:** Attributes such as age, gender, education level, occupation and frequency of ferry usage, which are used in this study to describe and analyze the diversity of the passenger population and to contextualize the analysis of the independent and dependent variables. Hystad et al. (2016) reported demographic factors are related to passengers' knowledge and awareness of safety critical measures during on board. To support this statement, Gohari et al. (2025) added demographic factors into their research in order to identify the profile of participations with segregation of age, education level, years of services and grade.

**Domestic ferry:** A passenger vessel that operates on a scheduled route within Malaysian territorial waters, in this case specifically between Georgetown and Butterworth, Penang. Serap et al. (2017) employed a quantitative approach to study domestic ferry operations, surveying 690 passengers using the Knowledge, Attitude and Practices model to examine their awareness and behaviours regarding domestic ferry safety.

**Convenience sampling:** A non-probability sampling method (Golzar et al., 2022) is respondents are selected based on their availability and willingness to participate, rather than through random selection. This method was used in this study to efficiently collect data from ferry passengers within practical constraints.

These definitions are formulated in line with the research objectives, ensuring that each term directly supports the analysis of the relationships and impacts among the four independent variables safety delivery, situational awareness, wayfinding and self-awareness also dependent variable passengers' safety awareness as explored in this study.

## **1.8 The organization of the study**

This research proposal was structured into several chapters, each designed to address the study's objectives and to provide a logical progression from the identification of the research problem to the presentation of findings and recommendations.

**Chapter one** presented the introduction, providing an overview of the research background, problem statement, research questions, objectives, significance, scope, definitions of key terms, and the organisation of the study. It outlined the context and necessity of investigating the factors influencing passengers' safety awareness, specifically focusing on the independent variables of safety delivery, situational awareness, wayfinding and self-awareness, as well as the dependent variable of passengers' safety awareness within the context of domestic ferry travel in Penang.

**Chapter two** explained presented a comprehensive review of previous literature and the theoretical frameworks underpinning the research. This chapter discussed earlier studies on ferry safety, situational awareness, wayfinding, self-awareness and safety delivery, as well as gaps in current knowledge. Theoretical foundations consist of Situational awareness theory, Spatial cognition theory, SERVQUAL theory and underpinning theory Theory of Planned Behavior (TPB) were also examined in detail to justify the study's conceptual model and variable selection.

**Chapter three** explained the research methodology, including the research design, population and sampling procedures (convenience sampling), instrument development, data collection methods, and analysis techniques. The analytical approach for each objective was described: descriptive analysis to explore demographic characteristics (Objective 1), correlation analysis to determine relationships between the independent variables and passengers' safety awareness (Objective 2) and regression analysis to examine the effects of the independent variables on the dependent variable (Objective 3).

**Chapter four** presented the results and analysis of data collected from 400 respondents. The findings were organised to address each objective and to clearly illustrate the relationships and effects of safety delivery, situational awareness, wayfinding and self-awareness on passengers' safety awareness.

**Chapter five** offered a discussion of the findings by integrating them with existing literature and highlighting their theoretical and practical implications. It also provided recommendations for ferry operators, policymakers and safety educators based on the most significant variables and their influence on safety awareness. This chapter summarised the main findings, emphasised the contributions of the research to the field and suggested directions for future studies particularly in maritime passenger safety and related behavioural factors.

Overall the study was structured systematically and each chapter addressed the research objectives while examining the relationships among the four independent variables and the dependent variable. This structure contributed valuable knowledge to the field of ferry passenger safety..

## **CHAPTER TWO : LITERATURE REVIEW**

### **2.1 Introduction**

The maritime sector, particularly passenger ferry transportation, constitutes a critical component of public mobility in Malaysia, especially within key urban and coastal locales such as Penang (Saad Danial, 2025). Ensuring the safety of ferry passengers constitutes a fundamental responsibility encompassing not only ferry operators but also a network of governmental agencies, port authorities and regulatory bodies. Despite ongoing improvements in technical and operational safety standards, incidents occur in domestic ferries, underscoring the persistent necessity to address factors beyond infrastructure and procedures, including passengers' behavior and awareness.

In Malaysia, the safe and efficient operation of ferry services such as the high-traffic route between Georgetown and Butterworth relies on close collaboration among several key agencies. Penang Port Sdn Bhd (PPSB) is the principal operator responsible for managing ferry operations, overseeing vessel maintenance, passenger services and the implementation of safety protocols on board (PPSB, 2025). Penang Port Commission (PPC) as the statutory regulatory authority responsible to supervise, licensing and regulating all port and ferry activities in Penang, as well as the enforcement of safety standards, monitoring of compliance and promotion of safety awareness campaigns for both operators and the public (PPC, 2025). PPSB and PPC agencies such as Malaysia Marine Department and Malaysian Maritime Enforcement Agency (MMEA) provide further layers of oversight through policy development, marine safety inspections and emergency response coordination. Their involvement ensures that passenger ferry operations meet national and international maritime safety regulations and that effective risk communication strategies are in place to promote public safety.

This chapter provided previous literature related to passengers' safety awareness as the dependent variable of this study and four core factors identified as influencing it viz. safety delivery, situational awareness, wayfinding and self-awareness. The review drew on both international and Malaysian research and incorporated perspectives from regulatory agencies and operators such as PPSB and PPC. It synthesised empirical findings, theoretical developments and policy perspectives relating to how safety information was delivered, how passengers observed and interpreted safety cues, how they navigated ferry environments and the degree to which they were self-aware and prepared to act in emergency situations. Demographic characteristics of ferry passengers were also considered by recognising their importance in interpreting variations in safety awareness and compliance.

The structure of the literature review began with foundational concepts and definitions of passengers' safety awareness by highlighting its significance for maritime safety management and the regulatory responsibilities of relevant agencies. It then explored the influence of demographic factors and was followed by a detailed examination of the four independent variables. This research further analysed the interrelationships between the independent and dependent variables and identified the knowledge gaps that justified the current study.

The theoretical underpinnings of the study, specifically Situational awareness theory (Endsley, 1995), spatial cognition theory (Kwon et al., 2025), SERVQUAL Theory (Parasuraman et al., 1988) and TPB (Ajzen, 1991) were relevant to government safety mandates and strategies organised by agencies viz. PPSB and PPC. By concluding and summarising unresolved issues in the literature, this chapter provided a clear rationale for the research, which aimed to address these gaps through an in-depth investigation of ferry passengers in Penang.

By integrating academic and policy perspectives and stressing the essential roles of government agencies and port authorities, this chapter laid a robust foundation for the research. It guided the selection of variables, informed the research questions and shaped the methodology, ensuring that it aligned with current regulatory and operational realities in Malaysia's passenger ferry sector.

## **2.2 Overview history of ferries Penang**

The Penang ferry services was established in 1894, known as one of Malaysia's oldest and most iconic ferry services. Originally founded by Penang entrepreneur Quah Beng Kee and his four brothers, the service played a crucial role in connecting the mainland with Penang Island, particularly between Georgetown and Butterworth (Alan Teh, 2018). Over the years, ferry service has undergone significant evolution becoming an integral component of Penang's transportation infrastructure. Early operations featured small vessels that carry passengers across the Penang Strait. In 1924, the Penang Harbour Board took over the ferry services from Eastern Shipping Company Limited. This transition marked a significant milestone in the service's development, paving the way for its modernization and expanded role in the region's transportation network (Penang Ferry Museum, 2025).

In the following years, ferry services expanded to load in automobile transport and growing demand for vehicle ferries. The ferry service continued its status as the only connection between Penang Island and mainland until the completion of the Penang Bridge. Historical events takes place through out the years, ferry was visited by Yang Di-Pertua Agong and other royal family from different country such as Iranian, Japan and Thailand. Ferry started to lost its importance, on 3 August 1985 inauguration of Penang Bridge by our prime minister Tun Dr Mahathir Mohamad. Bridge connected Seberang Perai and Island area directly by road

transport indirectly reduced congestion of ferry transport. Added with tragedy of ferry terminal collapsed in 1988, worsen the ferry demand and safety (Penang Ferry Museum, 2025).

In 1994, the service was managed by Penang Port Sdn. Bhd, then changed management to Prasarana Malaysia from 2017 to 2020 (Rapid Penang, 2020). In past years, ferry service faced challenges due to aging fleet and maintenance problems. In 2020, ferry services was temporary suspended, after PPSB regained control and introduced speedboats for passenger and motorcycle only. In 2023, new fleet of four catamarans was introduced significantly enhancing the service's efficiency and capacity. As of 2024, the ferry service is a critical component of Penang's public transportation by serving millions of passengers annually. Original ferry terminal in Georgetown was located at Beach Street, this terminal was important in connecting the island with the mainland, allowing travel for both passengers and goods. In Butterworth, Mitchell Pier served as the dockage for ferries by linking the two locations. Penang ferry terminal have been improvised to meet the needs of both passengers and vehicles. Raja Tun Uda Ferry Terminal (Georgetown) was located at Weld Quay, both terminal function as the docking facility for ferries operating between Georgetown and Seberang Perai. The terminal was built in 1960s and has experienced several upgrades to accommodate increasing passenger and vehicle traffic. Now, the terminal was collaborate with the Weld Quay Bus Terminal, to ensure effiecient transportation connectivity for passengers. Sultan Abdul Halim Ferry Terminal (Butterworth) his terminal replaced Mitchell Pier and now function as the main ferry terminal for routes between Butterworth and Georgetown. Strategic location near to Penang Sentral and Butterworth railway station, terminal provides passengers with easy access to other modes of transportation (Penang Ferry Museum, 2025). Below Table 2.1 summarize timeline Penangferries.

Table 2. 1 Timeline key event of ferries Penang

Years	Events
1893	Ferry service tender advertised
1894	Beng brothers initiate ferry services
1895	Quah Beng Kee takes full control of the business (Guan Lee Hin Steamship Company)
1897	Expanding business into Limited Company (Eastern Shipping Company Limited)
1924	Ferry service acquisition (managed by state port authority)
1925	New ferry “Seberang” starts operations and new jetty open
1928	Launch of “Feri Tanjong” and “Feri Kulim”
1929	New ferries start operating and jetty upgrade completed
1932	Closure of Bagan Tuan Kechil pier redirected to Mitchell Pier, Butterworth
1938	New ferry ordered by the Penang Harbour Board
1941	Ferry operation disrupted due to war (World War II, Japanese invasion of Malaya)
1945	British administration restores ferry operations
1946	Post-war ferry operations resumed
1948	Introduction of Z-Craft was modified with more comfortable design
1949	Last Z-Craft converted into a ferry
1956	Establish of PPC to manage ferry services
1957	First modern ferry by PPC named Feri Pulau Pinang
1958	Historic visit by the first Yang Di-Pertua Agong Tuanku Abdul Rahman Ibni Almarhum Tuanku Muhammad
1959	Additions of new ferries (Pulau Aman, Pulau Pangkor, Pulau Langkawi, Pulau Tioman)
1960	Old ferries converted for industrial use. (Feri Lidah converted to oil barge, Feri Tenggiri was use for cargo ship capacity 200 tons)
1961	Feri Talang converted to water boat and Feri Bagan sold public tender
1962	Special ferry provided for Thai Royal visit
1964	Launch of Feri Pulau Lumut construction
1965	Feri Pulau Lumut inaugurated and starts operations
1966	Official visit by YDPA Tunku Ismail Nasiruddin Shah and Raja Permaisuri to Penang
1968	Iranian royal couple visits the port
1970	Japanese royal couple visits the port took Feri Pulau Langkawi
1971	Added two more ferries due to high demand, Feri Pulau Redang and Feri Pulau Labuan
1975	Added three more ferries due to increased demand caused congestion in ferry services
1980	Introduction of new “Rimau Class” ferries to replace the old ferries
1985	Inauguration of Penang Bridge by the prime minister Tun Dr Mahathir Mohammad
1988	Tragedy of the collapse Sultan Abdul Halim ferry terminal, failure of concrete structure and extraordinary congestion due to two simultaneous celebrations
1994	Privatization of ferry operations to Penang Port Sdn.Bhd
2002	Addition of two “Kelas Pinang” ferries namely Feri Pulau Payar and Feri Pulau Pinang
2018	Rapid ferry takes over ferry operations a subsidiary of Prasarana Malaysia Berhad
2020	Termination of the iconic Penang ferry service
2021	New era of Penang ferry, introduced high-speed passenger boats and Ro-ro ferries for motorcyclist and cyclist
2023	New ferry service begins, four ferries launched
2025	Opening of the Penang ferry museum

Source: Penang Ferry Museum (2025)

### 2.2.1 Types of ferries

Throughout the years, Penang ferry fleet has evolved with several upgrades to meet growing demand and improve service reliability. Below Table 2.2 simplify that one of the earliest vessels Pulau Talang Talang was introduced in the 1975, which contributed to the ferry service's growth and modernization (Rapid Penang, 2020). Pulau Undan introduced in the same year as part of efforts to modernize the ferry fleet by expanding the services (PPC, 2023). The major changes was in 2023, the fleet was modernized with the introduction of four catamarans, designed to improve operational efficiency and safety. These modern vessels are equipped with advanced navigation systems and are capable of transporting larger numbers of passengers and vehicles, ensuring that the ferry service continues to meet the needs of the Penang population (Penang Ferry Museum, 2025).

The Penang ferry service has experienced significant transformation since the establishment in 1894. Started as a small, local ferry service has evolved into a modern efficient transportation network. The ongoing modernization of the terminals together with the fleet ensures the service continues to serve Penang Island and mainland efficiently. This transformation has been critical maintaining the relevance of the ferry service as a key part of Penang's public transport system, ensuring that it can continue to meet the demands of passengers' and contribute to the growth of the local economy (Jeremy Tan, 2023).

Table 2.2 Penang ferries type and details

Ferries name	POR	IMO number	Owner	Year built	LxWxD (m)	GT	NT	Capacity (Pax)	Hull material	Vessel type
<b>Old ferries</b>										
Pulau Talang-Talang	Penang	NIL	SPPP	1975	52.00 11.60 3.52	x 466.15	257.59	200	Steel	Passenger ship
Pulau Undan	Penang	NIL	SPPP	1975	52.00 11.60 3.52	x 466.00	209.00	200	Steel	Passenger ship
Pulau Angsa	Penang	NIL	PSUKN PP	1980	56.01 11.61 3.70	x 512.22	-	200	Steel	Passenger ship
Pulau Kapas	Penang	8101082	SPPP	1981	56.01 11.61 3.70	x 512.22	-	200	Steel	Passenger ship
Pulau Payar	Penang	9274393	SPPP	2022	53.53 11.60 3.70	x 1647.00	494.00	200	Steel	Passenger vehicle / RO-RO
Pulau Pinang	Penang	9275244	SPPP	2022	53.53 11.60 3.70	x 1647.00	494.00	200	Steel	Others
<b>New Ferries</b>										
Teluk Bahang	Penang	9977610	PPSB	2022	33.98x 8.30x 3.00	288.00	104.00	150	Steel	Passenger vehicle / RO-RO
Teluk Duyung	Penang	9977646	PPSB	2022	33.98x 8.30x 3.00	288.00	104.00	150	Steel	Passenger vehicle / RO-RO
Teluk Kampi	Penang	9977634	PPSB	2022	33.98x 8.30x 3.00	288.00	104.00	150	Steel	Passenger vehicle / RO-RO
Teluk Kumbar	Penang	9977622	PPSB	2022	33.98x 8.30x 3.00	288.00	104.00	150	Steel	Passenger vehicle / RO-RO

Source: JLM (2025a)

### **2.3 Overview of Malaysia's maritime safety rules and passengers' awareness**

The global maritime sector plays an important role in international trade with approximately 109,000 merchant ships currently in operation. These vessels facilitate a substantial portion of global trade that contribute to the growing volume of maritime traffic (UNCTAD, 2024). An expansion of maritime trade has increases safety challenges. The frequency of marine casualties and incidents continues to rise by underscoring the need for enhanced safety measures. From year 2004 until 2023, IMO's Global Integrated Shipping Information System (GISIS, 2024b) recorded a total of 7,411 marine casualties highlighting the urgency to improved safety regulations. Environmental risks, particularly climate change effect maritime safety concerns by influencing ship movements and increasing the likelihood of accidents. This convergence of factors underscores the critical need for improvement in maritime safety protocols.

In Malaysia, maritime safety particularly in passenger ferry sector is a public concern. The nation's ferry services crucial to intercity transport especially in regions like Penang, where routes such as Georgetown to Butterworth experience high volumes of passenger traffic. The growth in ferry operations stringent safety measures in terms of infrastructure and passenger awareness. As an example in 2023, Malaysia reported over 2,900 maritime incidents mostly due to machinery failure, collisions and severe weather (AWCS, 2024). These incidents underscore the critical necessity for enhanced adherence to safety protocols, increased public awareness and strengthened regulatory oversight.

The passenger ships that operates within Malaysian water compulsory entitle for a passenger certificate, whilst persons navigating international waters are required to have whichever a Passenger High-Speed Craft Safety Certificate or a Passenger Ship Safety Certificate that must be valid for 12 months (Rulefinder, 2023). To ensure ferry safety the certificate explains

important element viz safety construction, radio communication, equipment, and emergency preparation including fire and evacuation procedures. The implementation of these safety standards ensures that ferries are adequately prepared for emergencies. The international regulatory framework overseeing maritime operations including United Nations Convention on the Law of the Sea (UNCLOS, 2024) and International Convention for the Safety of Life at Sea (SOLAS) are 2 foundational frameworks that govern maritime operations. UNCLOS primarily addresses the legal dimensions of maritime governance, establishing rights over territorial waters, exclusive economic zone (EEZ) by ensuring freedom of navigation on the high seas (IMO, 2024), SOLAS focuses precisely on the operational safety of ships and the protection of human life at sea. Adopted by International Maritime Organization (IMO), SOLAS sets strict standards for ship design, construction, equipment and operational procedures to prevent accidents indirectly safeguard life during maritime activities (IMO, 2025a). The relationship between these two instruments is complementary UNCLOS runs the legal framework for marine resource management and navigational rights, for SOLAS ensures that ships operate under the highest safety standards, protecting lives and the environment. UNCLOS addressing broader legal concerns but SOLAS providing the specific operational protocols necessary to safeguard legal rights through practical safety measures (IMO, 2025a). This approach improves legal regulation also physical safety of maritime operations with solid framework for international maritime law. As a member of IMO since 1971, Malaysia adheres to various international maritime conventions that regulate vessel operations including the certification of passenger ferries (IMO, 2024). Passenger vessels operating within Malaysian waters are mandatory to hold either a valid Passenger High-Speed Craft Safety Certificate or Passenger Ship Safety Certificate, which confirm adherence to safety regulations concerning construction, equipment and emergency procedures (MSO, 2024). Despite the presence of these strict standards, incidents continue to occur and

often attributed to human factors with a lack of safety awareness. This suggests that while regulatory frameworks provide a foundation for safety, further attention is needed to address the human elements that contribute to maritime incidents too.

### 2.3.1 Classification authorize societies

Table 2.3 below illustrate the classification societies in maintaining the safety, legal compliance and operational standards of ships. In Malaysia, 11 organizations were authorized to conduct ship inspections, approve ship plans, review safety documentation and issue certifications for Malaysian-registered vessels (GISIS, 2024b). These organizations are categorized into two groups which is International Association of Classification Societies (IACS) and non-IACS societies.

International Association of Classification Societies comprises 9 out of the 12 members, the societies within this category are internationally recognized besides ensuring ships meet international safety and regulatory standards (GISIS, 2024b). For non-IACS organizations in Malaysia include Ship Classification Malaysia established in 1994 and MY Classification Sdn Bhd founded in 2021. These non-IACS organizations provide services in line with national safety standards are authorized to conduct inspections also issue certificates for vessels operating under the Malaysian flag.

These classification societies ensure that ships may comply with rigorous safety regulations including certification requirements that vary by vessel type and characteristics to minimize the risks of maritime accidents (GISIS, 2024a). Malaysia's Ministry of Transport manages maritime sector which consist of several key federal and statutory bodies. Below bodies

explains the responsible for regulating maritime operations, safeguarding safety standards and coordinating responses to maritime incidents.

- **Malaysia Marine Department (Jabatan Laut Malaysia):** Federal agency that enforcing maritime safety laws involving in vessel inspections and ensuring compliance with international maritime conventions (MOT, 2025a).
- **Port authorities:** There are 7 port authorities in Malaysia, each responsible for supervision the operations of its respective port. These statutory bodies ensure that safety protocols are followed, vessels dock safety and the movements of maritime traffic is smooth. It also implement emergency response procedures in the event of an incident (MOT, 2025b).

All of these agencies and authorities is under the Ministry of Transport as shown in Table 2.3 below, form a strong framework for regulating and safeguarding the safety of maritime operations within Malaysia ocean by sustaining maritime safety standards from policymaking to operational error and emergency responses.

Table 2. 3 Classification authorize societies in Malaysia

No.	Category	Name	Formed	Head office
1	IACS	American Bureau of Shipping (ABS)	1862	Houston
2	IACS	Bureau Veritas (BV)	1828	Paris
3	IACS	China Classification Society (CCS)	1956	Beijing
4	IACS	Det Norske Veritas Germanischer Lloyd (DNV GL)	1864	Oslo
5	IACS	Indian Register of Shipping (IRS)	1975	Mumbai
6	IACS	Korean Register of Shipping (KR)	1960	Busan
7	IACS	Lloyd’s Register (LR)	1760	London
8	IACS	Nippon Kaiji Kyokai (NK)	1899	Tokyo
9	IACS	Registro Italiano Navale (RINA)	1861	Genoa
10	NON-IACS	Ship Classification Malaysia (SCM)	1994	Shah Alam
11	NON-IACS	MY CLASSIFICATION SDN BHD <small>(Previously known as Chancellor Maritime and Offshore Sdn Bhd)</small>	2021	Shah Alam

Source: GISIS (2024)

### 2.3.2 Federal and statutory bodies

Figure 2.1 below show logos of federal and statutory bodies illustrate the federal and statutory bodies in Malaysian maritime sector, governed by a structured hierarchy to ensures the effective regulation and safety of maritime operations. The top of this hierarchy is Malaysia Marine Department a federal agency that operates under the Ministry of Transport. The role is to implementing maritime laws together align with international conventions UNCLOS also supervise the certification and inspection of vessels under safety standards (MOT, 2025c).

Beneath Malaysia Marine Department, there is several statutory bodies are in charge for the regulation and management of port operations across Malaysia. These bodies include PPC, Port Klang Authority, Kemaman Port Authority, Kuantan Port Authority and others. The role of statutory bodies is handling port logistics to ensure the docking safeness and movement of vessels also impose safety regulations at the regional level (MOT, 2025c).

Port Klang authority role handling one of Malaysia's busiest ports by managing port safety, cargo handling and facilitating for a smooth operation in maritime activities. Same as PPC controls ferry operations, safety and security to align with national standards and regional levels for both cargo and passenger vessels (MOT, 2025c).

The hierarchical structure helps coordinate maritime regulation by ensuring the enforcement of safety protocols to comply with international standards. Malaysia Marine Department with several statutory bodies collaborate as a team to safeguard maritime transport by reducing risks related with shipping and passenger ferry services.

Bernama (2024) reported incidents caused by bad weather or human error have led to casualties and significant disruptions, such as the 2014 Sewol ferry disaster. These events underscore the

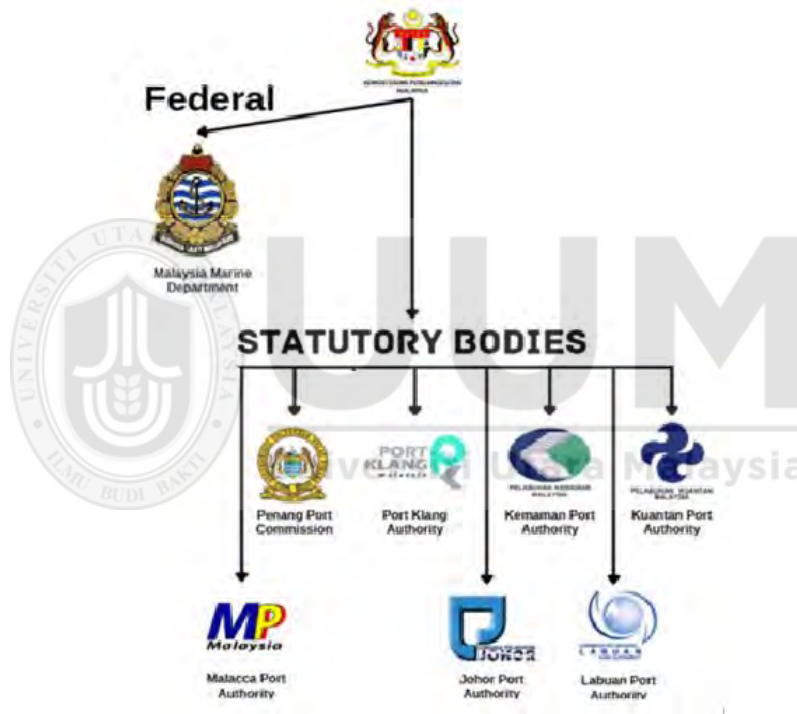
critical need to enhanced safety awareness programs targeting passengers, operators and regulatory bodies. The awareness of safety protocols such as evacuation procedures, fire safety and situational awareness can significantly help to reduce fatalities during emergencies (Shin, 2017). The effectiveness of these safety campaigns remains underexplored particularly in Malaysian context.

In Malaysia, the connection between Georgetown and Butterworth ferry services manage by PPSB to supervise ferry operations, managing vessel maintenance, passenger services and ensure the implementation of safety protocols on board (PPSB, 2025). PPC as the statutory regulatory authority role to supervise, licensing and regulating all port and ferry activities to comply with safety standards and promote safety awareness for both operators to the public (PPC, 2025).

Established in 1993 under Companies Act 1965, Maritime Institute of Malaysia (MIMA) serves as a national policy research entity dedicated to safeguarding Malaysia's strategic maritime interests. Operating as a company limited by guarantee rather than a statutory body, MIMA functions as a government-linked institute that provides interdisciplinary advisory support on maritime governance, security and economics. MIMA's primary mandate involves conducting rigorous research and producing policy papers to assist government ministries, such as the Ministry of Transport (MOT), in strengthening national and regional policy frameworks. Its unique organizational structure integrates seconded federal officers with private-sector personnel, facilitating a robust exchange of expertise. MIMA entitle receives federal budget allocations to maintains financial versatility through consultancy and international collaborations (MIMA, 2026). By providing independent strategic analysis, MIMA acts as a critical focal point in the Malaysian maritime context to ensure the development of sustainable and ocean policies.

Marine Department of Malaysia roles to safeguard the safety of merchant ships also provide shipping services to commercial vessels such as inspection, certification, registration and licensing (JLM, 2025b). For MMEA role is to enforce law, perform maritime rescue, offer maritime institution training, control ocean pollution, protect Malaysian water from piracy or any narcotic trafficking and to control Malaysian Armed Force during crisis. To conclude both federal and statutory bodies work together to protect Malaysian water from danger.

Figure 2. 1 Federal and statutory bodies



Source: MOT (2024)

## 2.4 Review of literature

Summarize of 11 empirical studies that related with IV and DV in this thesis as explain in below table.

Table 2. 4 Summarize of literature review

No	Authors Title Publication	Objectives of the study and the related Variables/ Parameters	Operational Definitions and Dimensions of Variables	Context of study	Methodology			Analysis Techniques	Results/ Findings	Criticisms/ Limitation
					Research Design	Population & Sampling	Measurement/ Instrument			
1	(Wang et al., 2021)	<p><b>Objectives:</b> To assess passengers' safety awareness and perception of emergency evacuation procedures and tools.</p> <p><b>Variables:</b> Ind. Vars: 1. Safety Awareness 2. Emergency Wayfinding 3. General Feeling of ship safety Dep. Var: Passengers' awareness and perception</p>	<p><b>IV</b> 1. Safety Awareness. Operation definition: Passengers' knowledge and understanding of safety measures, including evacuation routes, exit Dimensions: Awareness of evacuation procedures, recognition of safety tools 2. Emergency Wayfinding Operation definition: Dimensions: 3. General Feeling of ship safety Operation definition: Dimensions: <b>DV</b> Passengers' awareness and perception</p>	<p><b>Country:</b> China <b>Industry:</b> Ro-Ro passenger ship</p>	<p>i. Questionnaire ii. Quantitative analysis</p>	<p><b>Unit of analysis:</b> Individual <b>Population:</b> RoRo Passenger <b>Sampling Technique:</b> Convenient Sampling Technique <b>Sample Size:</b> 1800 respondent <b>Respondent:</b> 1800 respondent</p>	<p><b>Ind. Vars:</b> 1. Safety Awareness 2. Emergency wayfinding 3. General feeling of ship safety <b>Scale:</b> Ordinal (5-point Likert scales) <b>Dep. Var:</b> Passengers' awareness and perception <b>Scale:</b> Ordinal (5 point Likert scales)</p>	<p>Ordered logistic regression models Chi-square Wilcoxon single-sample test (Use because the data is not normally distributed)</p>	<p>32% of respondents were unaware of the ship's emergency evacuation plan, with demographic differences in safety awareness and perception of wayfinding tools.</p>	<p>Limited to one route (Yantai to Dalian); does not cover global maritime contexts. Respondents may not necessarily encounter all of the circumstances associated with the survey criteria due to the self-reporting method.</p>

2	(Shiwakoti et al., 2019)	<p><b>Objectives:</b> 1. To identify passengers' awareness and perceptions of the emergency way-finding instruments and procedures at the airport 2. To examine the correlation between passengers' perception of safety in the airport and awareness of way-finding tools and procedures.</p> <p><b>Variables:</b> Ind Vars: 1. Normal Wayfinding 2. Emergency Wayfinding</p> <p>Dep. Var: Awareness and perceptions of emergency evacuation tools and procedures</p>	<p><b>Ind Vars:</b> 1. Normal Wayfinding 2. Emergency Wayfinding 3. Situational Awareness</p> <p>Operation definition: Dimensions:</p> <p><b>Dep. Var:</b> Awareness and perceptions of emergency evacuation tools and procedures</p> <p>Operation definition: Passengers' knowledge and perceptions about the availability and effectiveness of emergency wayfinding tools and readiness to evacuate. Dimensions: Knowledge of exit routes, evacuation plans and emergency procedures in the airport environment.</p>	<p><b>Country:</b> China, Australia</p> <p><b>Industry:</b> Airports</p>	<p>i. Questionnaire ii. Quantitative analysis</p>	<p><b>Unit of Analysis:</b> Individuals</p> <p><b>Population:</b> Airports Passengers (2 countries Melbourne Airport (Australia) and Qingdao International Airport (China))</p> <p><b>Sampling Technique:</b> Convenient Sampling Technique</p> <p><b>Sample Size:</b> Australia - 500 respondents China - 450 respondents</p> <p><b>Respondent:</b> Australia - 500 respondents China - 450 respondents</p>	<p><b>Ind Vars:</b> 1. Normal Wayfinding 2. Emergency Wayfinding 3. Situational Awareness</p> <p><b>Scale:</b> Ordinal (5 point Likert scales)</p> <p><b>Dep. Var:</b> Awareness and perceptions of emergency evacuation tools and procedures</p> <p><b>Scale:</b> Ordinal (5 point Likert scales)</p>	<p>One sample t-test Reliability test Chi-square tests Regression models Reliability test greater than 0.7, one factor lower than 0.7 and has been removed)</p>	<p>Cultural differences played a significant role in passengers' perceptions and awareness. Passengers at Qingdao Airport showed a higher level of familiarity with emergency tools than those at Melbourne Airport.</p>	<p>The study only focused on two airports, which may limit the generalizability of the findings to other international airports with different cultural demographics</p>
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3	(Shiwakoti et al., 2016)	<p><b>Objectives:</b> To examine passengers' awareness and perceptions of wayfinding tools in a train station during normal and emergency conditions.</p> <p><b>Variables:</b> Ind Vars: 1. Normal Wayfinding 2. Emergency Wayfinding 3. Situational Awareness  Dep. Var: Passengers' awareness of way-finding tools, procedures and perception of feeling safe</p>	<p><b>Ind Vars:</b> 1. Normal Wayfinding 2. Emergency Wayfinding 3. Situational Awareness  Operation definition: Dimensions:  <b>Dep. Var:</b> Passenger awareness and perceptions of way finding tools Operation definition: The passengers' knowledge of emergency evacuation routes, exit locations, evacuation maps and assembly areas Dimensions: Awareness of emergency exit signs, evacuation plan location and knowledge of assembly areas and emergency button</p>	<p><b>Country:</b> China, Australia  <b>Industry:</b> Train station</p>	<p>i. Questionnaire ii. Quantitative analysis</p>	<p><b>Unit of Analysis:</b> Individuals  <b>Population:</b> Passengers in the train station  <b>Sampling Technique:</b> Convenient Sampling Technique  <b>Sample Size:</b> 1271 Passengers  <b>Respondent:</b> 1127 valid response (out of 1271)</p>	<p><b>Ind Vars:</b> 1. Normal Wayfinding 2. Emergency Wayfinding 3. Situational Awareness  <b>Scale:</b> Ordinal (5 point Likert scales)  <b>Dep. Var:</b> Passengers' awareness of way-finding tools, procedures and perception of feeling safe  <b>Scale:</b> Ordinal (5 point Likert scales)</p>	<p>One sample t-test Wilcoxon  Factor analysis is performed to detect the existence of significant patterns in the knowledge and perception statements  Reliability test Ordered logit regression</p>	<p>Many passengers were unaware of critical emergency tools like evacuation maps and exit locations.  Significant differences were found in awareness based on demographics, with older passengers and certain gender groups being less aware of safety features.</p>	<p>The study focuses only on one train station so the findings may not be generalizable to all transport hubs</p>
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4	(Rahman et al., 2022)	<p><b>Objectives:</b> To explore the self-awareness and self-preparedness of Malaysian rail passengers for emergency evacuations.</p> <p><b>Variables:</b> Ind Vars: 1. Gender 2. Age 3. Previous exposure to emergency procedures</p> <p>Dep. Var: 1. Self-awareness during emergency evacuation 2. Self-preparedness during emergency evacuation</p>	<p><b>Ind Vars:</b> 1. Gender 2. Age 3. Previous exposure to emergency procedures</p> <p>Operation definition: These variables examine the demographic factors and passengers' exposure to safety procedures.</p> <p>Dimensions: Gender (male, female), age (youth, adult, elderly), previous exposure to emergency training or drills.</p> <p><b>Dep. Var:</b> 1. Self-awareness during emergency evacuation 2. Self-preparedness during emergency evacuation</p> <p>Operation definition: Passenger awareness of evacuation tools and their level of preparedness to act during an emergency</p> <p>Dimensions: Knowledge of emergency exits, awareness of evacuation procedures</p>	<p><b>Country:</b> Malaysia</p> <p><b>Industry:</b> Rail transit terminal</p>	<p>i. Questionnaire ii. Quantitative analysis</p>	<p><b>Unit of Analysis:</b> Individuals</p> <p><b>Population:</b> Passengers of rail transit terminal</p> <p><b>Sampling Technique:</b> Convenient Sampling Technique</p> <p><b>Sample Size:</b> 342 Passengers</p> <p><b>Respondent:</b> 329 Responses (out of 342)</p>	<p><b>Ind Vars:</b> 1. Gender 2. Age 3. Previous exposure to emergency procedures</p> <p><b>Scale:</b> Ordinal (5 point Likert scales)</p> <p><b>Dep. Var:</b> 1. Self-awareness during emergency evacuation 2. Self-preparedness during emergency evacuation</p> <p><b>Scale:</b> Ordinal (5 point Likert scales)</p>	<p>Ordinal logistic regression</p> <p>Exploratory Factor Analysis (EFA) Statistical analysis</p> <p>Descriptive statistics Spearman Rank Correlation (The association between age and the scores for the statements were studied)</p> <p>Mann Whitney U (To examine the differences in self-preparedness and self-awareness by gender)</p>	<p>Cronbach's alpha was good (<math>&gt; 0.8</math>) for the first two factors and acceptable (<math>&gt; 0.7</math>) for the third factor. . This means that the statements in each of these three categories are internally consistent and closely related as separate categories.</p>	<p>Data collection was limited to one station, which may not represent the broader population of rail passengers in Kuala Lumpur, Malaysia</p> <p>In each of these three IV categories are internally consistent and closely related as separate categories.</p>
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5	(Lau et al., 2020)	<p><b>Objectives:</b> To examine the relationships between passengers' perceptions of safety awareness, safety delivery and preventive behaviours.</p> <p><b>Variables:</b> Ind Vars: 1. Safety delivery 2. Safety Awareness</p> <p>Dep Vars: Preventive behaviour</p>	<p><b>Ind Vars:</b> 1. Safety delivery Operational definition: Safety delivery refers to the communication and implementation of safety practice Dimension: Safety facilities (e.g., lifeboats, life jackets) 2. Safety Awareness Operational definition: safety awareness is the passengers understanding of safety measures Dimension: safety demonstrations, safety information overall safety communication from ferry operators.</p> <p><b>Dep. Var:</b> Preventive behaviour Operational definition: The passenger actions towards their preparedness to act in emergency Dimension: Passengers likelihood of engaging in safety protocols, including following evacuation routes and using safety equipment during an emergency</p>	<p><b>Country:</b> Hong Kong</p> <p><b>Industry:</b> Ferry Terminal</p>	<p>i. Questionnaire ii. Quantitative analysis</p>	<p><b>Unit of Analysis:</b> Individuals</p> <p><b>Population:</b> Passengers of ferry terminal</p> <p><b>Sampling Technique:</b> Convenient Sampling Technique</p> <p><b>Sample Size:</b> 422 passengers</p> <p><b>Respondent:</b> 422 Responses</p>	<p><b>Ind Vars:</b> 1. Safety delivery 2. Safety Awareness</p> <p><b>Scale:</b> Ordinal (5 point Likert scales)</p> <p><b>Dep. Var:</b> Preventive behaviour</p> <p><b>Scale:</b> Ordinal (5 point Likert scales)</p>	<p>Descriptive analysis</p> <p>Reliability test</p> <p>Confirmatory factor analysis (CFA)</p> <p>Structural equation modelling (SEM)</p> <p>Exploratory factor analysis</p> <p>Chi square</p>	<p>Safety delivery and safety awareness were found to significantly influence passengers' preventive behaviors, with improved safety delivery leading to better awareness and a higher likelihood of taking preventive actions.</p> <p>Cronbach's alpha was greater than the proposed minimum of 0.7</p>	<p>Self-reported statistics on preventive behaviour and safety knowledge may be biased due to respondents' willingness to answer appropriately.</p> <p>Limited to ferry passengers in Hong Kong; may not be applicable to other transportation</p> <p>One-year research needs to explore short- and long-term effects on passenger preventive behaviour.</p> <p>The research design framework examined safety awareness and preventative activity using only two variables</p>
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6	(Chang & Liao, 2009)	<p><b>Objectives:</b> To investigate the effect of aviation safety education on passenger cabin safety awareness, focusing on knowledge, attitude and behavior.</p> <p><b>Variables:</b> 1. Emergency equipment using procedures 2. Situational awareness &amp; response 3. Regulation necessary to know 4. Aviation safety education channels</p> <p>Dep Vars: Cabin safety awareness</p> <p>Theory: Theory of Research Action (TORA)</p>	<p><b>Ind Vars:</b> 1. Emergency equipment 2. Situational awareness &amp; response 3. Regulation necessary to know 4. Aviation safety education channels</p> <p>Operational definition: Educational interventions provided to passengers, including safety briefings and demonstrations on emergency procedures. Dimension: Frequency and content of safety education (pre-flight briefings, safety videos, in-flight instructions).</p> <p><b>Dep. Var:</b> Cabin safety awareness Operational definition: Passenger understanding of cabin safety measures, Dimension: Cabin safety knowledge,behaviour</p>	<p><b>Country:</b> Taiwan</p> <p><b>Industry:</b> Airport</p>	<p>i. Questionnaire ii. Quantitative analysis</p>	<p><b>Unit of Analysis:</b> Individuals</p> <p><b>Population:</b> Airline passenger</p> <p><b>Sampling Technique:</b> Convenient Sampling Technique</p> <p><b>Sample Size:</b> 300 passengers</p> <p><b>Respondent:</b> 300 Responses</p>	<p><b>Ind Vars:</b> 1. Emergency equipment using procedures 2. Situational awareness &amp; response 3. Regulation necessary to know 4. Aviation safety education channels</p> <p><b>Scale:</b> Ordinal (5 point Likert scales)</p> <p><b>Dep. Var:</b> Cabin safety awareness</p> <p><b>Scale:</b> Ordinal (5 point Likert scales)</p> <p>Software: AMOS 6.0</p>	<p>Reliability test</p> <p>Principal Component Analysis (PCA)</p> <p>Structural equation modeling</p> <p>Confirmatory factor analysis</p> <p>Exploratory factor analysis</p>	<p>Aviation safety education is significantly positively influences airline passenger cabin safety knowledge, attitude and behavior</p> <p>“Cabin safety knowledge has a positive effect on attitude”, was not supported due to the insignificance with a standardized coefficient</p> <p>Reliability test all above 0.7</p>	<p>Results limited to passengers at Taiwanese airports; may not be generalized to other regions or transport modes.</p>
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7	(Gohari et al., 2025)	<p><b>Objectives:</b> The aim of this research is to investigate the viewpoints of stakeholders, particularly MMEA, regarding safety standards for passenger ferry services in Tioman Island, Malaysia</p> <p><b>Variables:</b> 1. Safety and rescue equipment 2. Ship structure 3. Shipping documentation 4. Navigation and communication equipment 5. Safety instructions for passengers 6. Ferry employees' ability to respond to emergencies</p> <p>Dep Vars: Safety measures for passenger ferry services</p>	<p><b>Ind Vars:</b> 1. Safety and rescue equipment 2. Ship structure 3. Shipping documentation 4. Navigation and communication equipment 5. Safety instructions for passengers 6. Ferry employees' ability to respond to emergencies</p> <p>Operational definition: Dimension: Age,gender, educational background, emergency exit,emergency alarm,safety video,</p> <p><b>Dep. Var:</b> Safety measures for passenger ferry services</p> <p>Operational definition: Dimension: Ship structure, safety equipment, shipping documents, ferry employees ability</p>	<p><b>Country:</b> Malaysia</p> <p><b>Industry:</b> Ferry</p>	<p>i. Questionnaire ii. Quantitative analysis</p>	<p><b>Unit of Analysis:</b> Individuals</p> <p><b>Population:</b> Malaysia Maritime Enforcement Agency's (MMEA) personal</p> <p><b>Sampling Technique:</b> Convenient Sampling Technique</p> <p><b>Sample Size:</b> 130 passengers</p> <p><b>Respondent:</b> 130 Responses</p>	<p><b>Ind Vars:</b> 1. Safety and rescue equipment 2. Ship structure documentation 3. Shipping documentation 4. Navigation and communication equipment 5. Safety instructions for passengers 6. Ferry employees' ability to respond to emergencies</p> <p><b>Scale:</b> Ordinal (5 point Likert scales)</p> <p><b>Dep. Var:</b> Safety measures for passenger ferry services</p> <p><b>Scale:</b> Ordinal (5 point Likert scales)</p>	<p>Descriptive analysis</p> <p>Exploratory factor analysis</p> <p>Reliability test</p>	<p>The study identified ferry employees' ability to respond to emergencies, safety signage, ferry employees' knowledge of rescue procedures and radar systems as the most critical safety measures.</p> <p>High Reliability due to most factors exceeding the threshold of 0.70, which is considered satisfactory for research purposes</p> <p>Strongest Consistency: Crew and Ship Certificate and Ship Structure showed the highest internal consistency (0.96 and 0.95, respectively), indicating that these factors have a very strong alignment between the items within each group.</p>	<p>Lack of human element could further explore the specific impact of human error in maritime safety beyond just ferry employees' abilities</p> <p>Deficiency of comprehensive technological assessment, such as the integration of newer technologies like autonomous safety features, could have been considered for future safety measures.</p> <p>Geographical Limitation: Focus on passenger ferry services on Tioman Island, which may not fully show how safe ferries are in Malaysia.</p>
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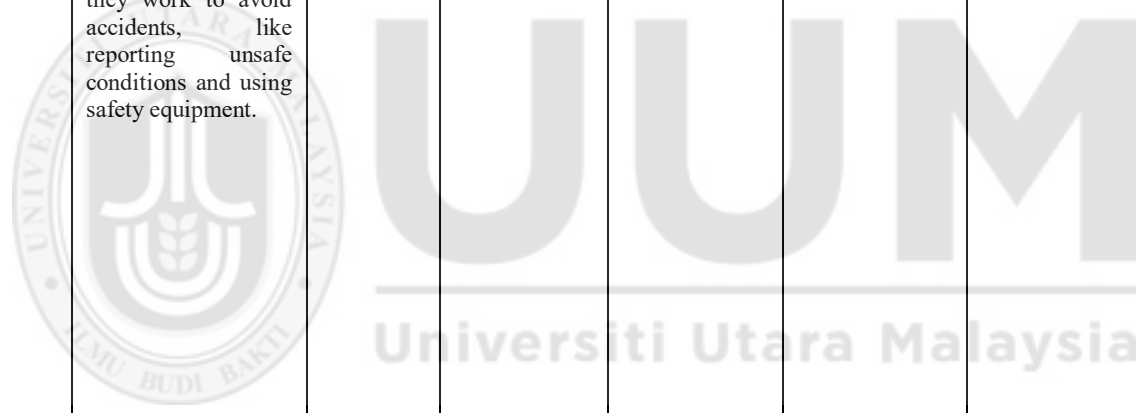
8	(Yang et al., 2023)	<p><b>Objectives:</b> Investigate the relationship between physiological (ECG, EEG), psychological (stress, safety behavior) and environmental factors (weather, passenger number) on seafarer fatigue.</p> <p><b>Variables:</b> 1. Age 2. Service Year 3. Health Condition 4. Psychological Stress 5. Safety Behavior 6. Environmental Conditions</p> <p>Dep Vars: Seafarer Fatigue</p>	<p><b>Ind Vars:</b> 1. Age Operational Definition: The age of the seafarer Dimension: How the seafarers age affects their fatigue, 2. Service Year Operational Definition: The number of years a seafarer worked Dimension: How the length of time a seafarer has worked affects their fatigue, 3. Health Condition Operational Definition: The physical health of seafarers, how well they sleep and any long-term health problems Dimension: The effect of a seafarer's health on their fatigue, like how chronic health conditions 4. Psychological Stress Operational Definition: The mental pressure seafarers feel, which can be caused by work demands Dimension: How much stress seafarers feel due to factors like their workload, working hours, or concerns about safety 5. Safety Behavior Operational Definition: The actions taken by seafarers to avoid risky</p>	<p><b>Country:</b> China</p> <p><b>Industry:</b> Passenger ship</p>	<p>i. Questionnaire ii. Quantitative analysis</p>	<p><b>Unit of Analysis:</b> Individuals</p> <p><b>Population:</b> Seafarers from passenger ship</p> <p><b>Sampling Technique:</b> Convenient Sampling Technique</p> <p><b>Sample Size:</b> 24 male seafarers</p> <p><b>Respondent:</b> 24 male seafarers Responses</p>	<p><b>Ind Vars:</b> 1. Age 2. Service Year 3. Health Condition 4. Psychological Stress 5. Safety Behavior 6. Environmental Conditions</p> <p><b>Scale:</b> Ordinal (5 point Likert scales)</p> <p><b>Dep. Var:</b> Seafarer Fatigue</p> <p><b>Scale:</b> Ordinal (5 point Likert scales)</p>	<p>Correlation and significance tests.</p> <p>Ordinal logistic regression</p>	<p>Key factors influencing fatigue: perceived stress, safety behavior, health condition, passenger number, weather and time.</p> <p>Fatigue prediction model with 81.13% accuracy based on age, ECG, EEG indice and ship departure interval.</p>	<p>Limited sample size.</p> <p>No control over environmental variables.</p> <p>Experiment conducted only on deck department personnel and male gender.</p>
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			<p>situations and ensure safety while working  Dimension: How often seafarers make safe decisions, especially when under pressure</p> <p>6. Environmental Conditions  Operational Definition: External conditions, like the weather, sea conditions,  Dimension: The effect of different environmental conditions, on a seafarer's fatigue</p> <p><b>DV</b>  Seafarer Fatigue  Operational Definition: Tiredness that affects workers physically and mentally because of long hours or stressful conditions  Dimension: How tired seafarers are, including physical tiredness and mental tiredness such as feeling sleepy or having trouble focusing.</p>						
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9	(Herno Della et al., 2020)	<p><b>Objectives:</b> To evaluates the effect of safety training, safety knowledge and safety management on employees' safety</p> <p><b>Variables:</b> Ind Vars: 1. Safety Training 2. Safety Knowledge 3. Safety Management</p> <p>Dep Vars: Safety Behaviour</p> <p>Hypothesis: Safety training affects safety behavior.</p>	<p><b>Ind Vars:</b> 1. Safety Training Operational Definition: A program that teaches employees how to work safely. Dimension: How well employees are taught about safety practices</p> <p>2. Safety Knowledge Operational Definition: The understanding that employees have about the safety rules and guidelines in their workplace Dimension: The amount of information employees know about staying safe, how to respond to emergencies</p> <p>3. Safety Management Operational Definition: Organizational safety practices. Dimension: How organized and effective the company's safety plans are, including leadership's role in supporting safety and how well safety rules are communicated to employees</p>	<p><b>Country:</b> Indonesia</p> <p><b>Industry:</b> Ferry services</p>	<p>i. Questionnaire ii. Quantitative analysis</p>	<p><b>Unit of Analysis:</b> Individuals</p> <p><b>Population:</b> Employees of ferry services</p> <p><b>Sampling Technique:</b> Convenient Sampling Technique</p> <p><b>Sample Size:</b> 469 Employees</p> <p><b>Respondent:</b> 469 Responses</p>	<p><b>Ind Vars:</b> 1. Safety Training 2. Safety Knowledge 3. Safety Management</p> <p><b>Scale:</b> Ordinal (5 point Likert scales)</p> <p><b>Dep. Var:</b> Safety Behaviour</p> <p><b>Scale:</b> Ordinal (5 point Likert scales)</p>	<p>Exploratory Factor Analysis (EFA)</p> <p>Confirmatory Factor Analysis (CFA)</p>	<p>Safety training significantly improved safety behavior.</p> <p>Safety knowledge and management mediate the relationship between safety training and safety behavior.</p>	<p>Focused only on ferry operators in Indonesia, limiting generalizability.</p> <p>Self-reported data.</p>
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			<p><b>Dep. Var:</b> Safety Behaviour Operational</p> <p><b>Definition:</b> The actions employees take to keep themselves and others safe while working.</p> <p><b>Dimension:</b> How closely employees follow safety rules and how actively they work to avoid accidents, like reporting unsafe conditions and using safety equipment.</p>							
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10	(Hystad et al., 2016)  <i>Study 1</i>	<p><b>Objectives:</b> <i>Study 1</i> To investigate the demographic factors related with passengers' knowledge or familiarity with various safety-critical measures on board passenger ships"</p> <p><b>Variables:</b> Ind Vars: Demographic factors</p> <p>Dep Vars: Safety knowledge of travellers on board passenger:</p>	<p><b>Ind Vars:</b> Demographic factors Operational definition: The personal characteristics of the passengers, such as how old they are Dimension : Age,sex,previous travel experience, trip duration</p> <p><b>Dep. Var:</b> Safety knowledge of travellers on board passenger Operational definition: The passengers' awareness and understanding of essential safety procedures on the ship Dimension: Evacuation Knowledge, first aid and alarm system</p>	<p><b>Country:</b> Norway</p> <p><b>Industry:</b> Ro-Ro passenger ship</p>	<p>i. Questionnaire ii. Quantitative analysis</p>	<p><b>Unit of Analysis:</b> Individuals</p> <p><b>Population:</b> Ro-Ro passenger</p> <p><b>Sampling Technique:</b> Cross-sectional survey.</p> <p><b>Sample Size:</b> 320 passengers</p> <p><b>Respondent:</b> 170 responses (52.9%)</p>	<p><b>Ind Vars:</b> Demographic factors</p> <p><b>Scale:</b> Ordinal (7 point Likert scales)</p> <p><b>Dep. Var:</b> Safety knowledge of travellers on board passenger:</p> <p><b>Scale:</b> Ordinal (7 point Likert scales)</p>	<p>Descriptive analysis</p> <p>Exploratory factor analysis</p> <p>Reliability test</p>	<p>The knowledge of safety-relevant to passengers can be range between medium and good" Passengers on longer trips more knowledge about evacuation routines than passengers on shorter trips</p> <p>The youngest passengers tend to have less safety knowledge than olders</p>	<p>The study relied on self-reported data, which may be biased.</p> <p>There was no interaction effect between sex and age on safety knowledge.</p>
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11	(Hystad et al., 2016)  <i>Study 2</i>	<p><b>Objectives:</b> <i>Study 2</i> To identify if different formats of safety briefings will influence the passengers' perception of trust, safety and risk on board</p> <p><b>Variables:</b> Inv Vars: Safety Instruction Format  Dep Vars: 1. Perception of Trust in Crew 2. Perception of Safety on Board 3. Perception of Risk 4. Need for More Information about Safety :</p>	<p><b>Ind Vars:</b> Safety Instruction Format Operational definition: The type of safety briefing the passengers during the trip, either in a live demonstration or a video-based format. Dimension : In Vivo Presentation (Live Demonstration): Passengers receive a live, in-person demonstration Video-Based Format: Passengers only watch a video</p> <p><b>Dep. Var:</b> 1. Perception of Trust in Crew Operational Definition: How much the passengers trust the crew to ensure their safety during the trip. Dimension : Trust level in the crew's ability to handle emergency situations and ensure passenger safety. 2. Perception of Safety on Board Operational Definition: How safe passengers feel during their journey based on the</p>	<p><b>Country:</b> Norway</p> <p><b>Industry:</b> Ro-Ro passenger ship</p>	<p>i. Questionnaire ii. Quantitative analysis</p>	<p><b>Unit of Analysis:</b> Individuals</p> <p><b>Population:</b> Ro-Ro passenger</p> <p><b>Sampling Technique:</b> Cross-sectional survey.</p> <p><b>Sample Size:</b> 303 passengers</p> <p><b>Respondent:</b> 196 responses (64.6%)</p>	<p><b>Ind Vars:</b> Safety Instruction Format</p> <p><b>Scale:</b> Ordinal (7 point Likert scales)</p> <p><b>Dep. Var:</b> 1. Perception of Trust in Crew 2. Perception of Safety on Board 3. Perception of Risk 4. Need for More Information about Safety</p> <p><b>Scale:</b> Ordinal (7 point Likert scales)</p>	<p>Descriptive analysis</p> <p>Exploratory factor analysis</p> <p>Reliability test</p>	<p>Passengers who received in vivo safety demonstrations felt better informed, safer and had more trust in the crew than those who only received video-based instructions.</p> <p>The video-based format showed lower effectiveness in building trust and information retention compared to the live demonstration.</p>	<p>Differences in passenger engagement with safety information were not fully explored.</p> <p>The study's small sample size might limit generalizability.</p>
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			<p>information provided to them.</p> <p>Dimension : General feeling of safety on the ship, influenced by the safety information received.</p> <p>3. Perception of Risk Operational Definition: How risky passengers perceive their journey to be, influenced by the safety information they receive.</p> <p>Dimension : How likely passengers think accidents are and how risky the trip feels to them.</p> <p>4. Need for More Information about Safety Operational Definition: The extent to which passengers feel they need more safety information after receiving their briefing.</p> <p>Dimension : The desire for additional details or clarification regarding safety procedures.</p>						
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### 2.4.1 Categorization of significant variables

Table 2. 5 Categorization of variables

No	Authors	Country	Demographics	Emergency Wayfinding	Normal Wayfinding	Wayfinding tools	Self-preparedness	Situational Awareness	Self-Awareness	Safety Awareness	Safety Delivery	Safety Rescue Equipment	Safety Behaviour	Safety Instructions	Safety Knowledge
				Wayfinding			Awareness			Safety Instrument					
1	Wang et al. (2021)	China	✓	✓		✓		✓		✓					
2	(Shiwakoti et al., 2019)	China, Australia		✓	✓			✓							
3	Shiwakoti et al., (2016)	China, Australia		✓	✓	✓			✓						
4	Abd Rahman et al. (2022)	Malaysia	✓			✓	✓		✓						
5	(Lau et al., 2020)	Hong Kong	✓							✓	✓		✓		
6	Chang & Liao (2009)	Taiwan	✓					✓		✓		✓	✓		✓
7	(Gohari et al., 2025)	Malaysia	✓				✓	✓		✓		✓		✓	
8	(Yang et al., 2023)	China	✓												✓
9	(Herno Della et al., 2020)	Indonesia	✓										✓		✓
10	(Hystad et al., 2016) Study 1	Norway	✓				✓					✓			✓
11	(Hystad et al., 2016) Study 2	Norway					✓							✓	✓

## 2.4.2 Literature review summary

Figure 2. 2 Literature summary



### 2.4.3 Synthesis of empirical study

The existing literature highlights the significant role of safety delivery, situational awareness, wayfinding and self-awareness in influencing passenger safety awareness across various transportation sectors. Previous studies, by Wang et al. (2021) and Shiwakoti et al. (2019) have consistently demonstrated the positive impact of effective safety communication, clear signage and situational awareness on passenger preparedness and safety behavior. Wayfinding especially in emergency situations, has been identified as a key predictor of safety awareness, with clear systems able passengers to navigate the safety equipment and exits. Self-awareness, which reflects passengers' internal preparedness and responsibility during emergencies, also significantly influences their responds. Four theoretical frameworks including the underpinning TPB by Ajzen, (1991) further support the understanding of how passengers perceive and respond to safety cues in their environment. Demographic characteristics, viz age, gender, education level, frequency and purpose using ferry able to recognized predictor in safety awareness. Empirical research by Gohari et al. (2025) and Shiwakoti et al. (2019) define that demographic factors shape individuals' safety behaviors, with younger passengers often exhibiting lower levels of safety compliance, while older passengers tend to demonstrate higher awareness levels. Understanding these demographic variations is crucial for developing targeted safety interventions that cater to the diverse needs of ferry passengers.

The significant gap in understanding how these factors influence ferry passengers' safety awareness in the context of Malaysia, particularly the high-traffic Georgetown–Butterworth, Penang ferry route. Existing studies have primarily focused on isolated

variables or limited settings, such as airports and train stations and not examined how multiple factors influence safety awareness in ferry travel, especially in high-demand environments. There is limited research on the influence of demographic characteristics, such as age, gender and education, on ferry passengers' safety awareness and behavior.

This study responds to these gaps by focusing on ferry passengers in Penang, specifically to identify demographic factors influence safety awareness and behavior in the context of the Georgetown–Butterworth ferry route. By integrating safety delivery, situational awareness, wayfinding and self-awareness predictors, this research provides a comprehensive analysis of the factors affecting passenger safety awareness. The study employs quantitative research methods, including regression analysis, to evaluate the impact influence of these variables on safety awareness, offering empirical data that can directly inform policy improvements and safety strategies. This research contributes to the understanding of ferry passenger safety in Penang, Malaysia and addresses the underexplored areas of demographic influence and the integration of multiple safety factors in high-density ferry routes.

## 2.5 Passengers' safety awareness

Safety awareness passenger's has become literature on transport safety, reflecting growing recognition that human behavior is as vital as technical controls in preventing accidents and ensuring effective responses to emergencies. In the context of ferry transportation, as conversed by Chang & Liao (2009) safety awareness refers to passengers' readiness to follow safety procedures and respond to risks or emergencies during the journey.

Safety awareness encompasses both cognitive and behavioral components. Cognitively, it includes the passenger's knowledge and understanding of safety protocols, the location and use of safety equipment, the meaning of safety signage and familiarity with emergency instructions. Safety awareness is a perception of emergency wayfinding tools along with demographic differences (Wang et al., 2021). Behaviorally, safety awareness is demonstrated when passengers pay attention to safety briefings, energetically seek safety information also prepare to follow instructions during normal operations or emergency situations (Shiwakoti et al., 2016).

The significance of passengers' safety awareness is acknowledged by maritime safety authorities and researchers. Studies have shown by Hystad et al., (2016) that older passenger have higher levels safety awareness knowledge than younger passenger . Similar research in the context of airline, found that older passenger has more cabin safety awareness compare to younger generation. It explained that older generation is more accurate, focus to instruction more likely to act decisively and appropriately during evacuations (Chang & Liao, 2009). This factors related with objective one, to identify demographic characteristic may impact the result.

The measurement of safety awareness varies across studies, but typically involves self-reported surveys (Academy, 2025), observational assessments or behavioral simulations. The indicators include passengers' ability to recall safety instructions, recognition of safety signage and equipment and confidence in responding to emergencies. Some research also incorporates scenario based assessments to measure practical knowledge and readiness.

In Malaysian, several domestic ferry incidents have highlighted the lack of passenger safety awareness as a key factor contributing to delayed and inappropriate responses during emergencies (Shiwakoti et al., 2016). Government agencies, ferry operators and port authorities have increasingly prioritized public education, safety campaigns to enhance the dissemination of safety information. The importance of effective safety communication in shaping passenger safety awareness is well established in transport safety literature. The application of structural equation modelling to examine the relationship between safety awareness and preventive behaviour offers a robust analytical approach (Lau et al. 2020).

By focusing on passengers' safety awareness as the dependent variable, this research findings to examine the correlation and evaluate impact of passenger safety awareness between the four predictors in Georgetown-Butterworth, Penang ferry route.

## 2.6 Safety delivery

Safety delivery may contribute to risk management and emergency preparedness in public transportation particularly in maritime sector (Lau et al., 2020). For domestic ferry operations situation, safety delivery is defined through an effectiveness of safety information, instructions and procedures are educating the passengers. This method cover a broader range in communication channels such as safety briefings, public announcements, signage, visual displays, printed materials and direct instructions from crew members (Hystad et al., 2016).

The scope of safety delivery encompasses all aspects of how safety-related content is designed, presented and reinforced during a passenger's journey. Starting from before boarding with clear signage and information at terminals, follow by on board, safety announcements, demonstration videos, visible signage demonstrating location of safety equipment and the conduct of safety drills (Shiwakoti et al., 2019). An effective safety delivery features viz passengers input to receive timely, accurately and easy understandable instructions especially on normal operation also responsiveness passengers' during emergency. The way to present with several formats and languages to align with the diversity of ferry passengers such as tourists, daily commuters, elderly and disabilities (Shiwakoti et al., 2016).

The role of effective safety communication in shaping passengers' safety awareness is well established in transport safety literature. Safety delivery acts as the primary mechanism with critical information is transferred from operators to passengers by bridging the gap between regulatory standards and passenger behaviour. Lau et al. (2020) stated that safety delivery was divided into two section viz safety facilities and the finding is positive relationship between safety delivery

and passengers' safety awareness underline that during emergency situations safety delivery supported compliance with safety procedures and behavior. Empirical research provide strong evidence of the impact of safety delivery on safety awareness and outcomes. Safety delivery known as safety promotions or knowledge can enhance passenger safety awareness especially in sea transport.

As stated by Lau et al. (2020) clarify that safety delivery initially from the idea of service delivery with involvement of how an organization offer services and products to meet the needs of target customers at the same time as reaching the organization goals. An effective safety delivery ensures that appropriate measures, procedures and resources are applied to enhance safety awareness to align with the organization overall objective. Other researchers such as by Gupta et al. (2008) advised that safety delivery refers to the process offer safe service to achieve goals of safety improvement and satisfying customers' wants.

This study examined safety delivery as one of the predictors and determine relationship between passengers' safety awareness and identify any areas of improvement in the domestic ferry context.

## **2.7 Situational awareness**

Situational awareness is widely recognized in safety-critical fields as an essential factor impact decision-making and response in dynamic environments. The perception of safety awareness is linked to situational awareness, which involves recognizing safety features and potential hazards within a specific environment, time and context as well as anticipating and responding to possible risks (Lau et al., 2020). A study by

Chang & Liao (2009) supports this perspective by identified situational awareness, regulatory requirements and effective communication channels for safety education as key factors influencing aviation safety education. These elements play a crucial role in enhancing passengers' understanding and preparedness for safety during air transportation.

The theoretical foundation for situational awareness is most notably provided by Endsley's Situational awareness theory, which describes situational awareness as comprising three key levels viz perception of elements in the environment, comprehension of their meaning and projection of their future status (Endsley, 1995). This framework is particularly relevant to maritime settings, where the environment is continuously changing and requires individuals to quickly process information and make decisions that affect their safety.

Gohari et al. (2025) research emphasize an importance of ferry personnel capabilities to comply with regulatory standards and maintain safe vessel operations. These standards help ensure that crew members are adequately prepared to manage both routine and emergency situations. By providing passengers' with clear safety instructions before departure is important to improve their understanding of emergency procedures. A positive approach is enables passengers to become familiar with the vessel's layout and respond promptly and effectively during emergencies. The capability and situational awareness of ferry personnel are critical in implementing safety measures and efficient responses in critical situations.

Other research Wang et al. (2021) claim that basic role of situational awareness in understanding ship evacuation is familiar with vessel's layout and evacuation alarms.

Chang & Liao (2009) recommends safety education programs focus on emergency equipment procedures, situational awareness, emergency response techniques also basic cabin safety regulations. This education knowledge significantly improves passengers' ability to react effectively during emergencies and enhancing overall safety on board.

The empirical research consistently shows a strong connection between situational awareness and effective safety behaviour. Passengers with high situational awareness tend to recall safety procedures more accurately and evacuate more efficiently during emergencies. Research in both maritime and aviation safety further indicates that situational awareness is formed by internal factors, such as prior experience and individual alertness. For external factors, involve the clarity of environmental signs besides the effectiveness of safety communication and systems (Chang & Liao, 2009).

In Malaysia's ferry sector, efforts to enhance situational awareness have included improving the visibility and accessibility of safety signage, providing regular safety drills and training crew to issue clear instructions during both normal operations and emergencies (Chang & Liao, 2009). Gaps still remain, particularly in reaching first-time passengers, tourists and vulnerable populations who may be less familiar with ferry environments or safety procedures.

This study positions situational awareness as a central independent variable by examine its correlation with passengers' safety awareness and evaluate the impact in shaping the an effective safety responses on the Penang ferry route. It contributes to a wider understanding and improve overall ferry safety outcomes including policies.

## 2.8 Wayfinding

Wayfinding as an element of passenger experience and safety, refers to the process by which individuals position themselves, navigate and move effectively within a built environment. Wayfinding encompasses a passenger's ability to recognize, interpret and act upon spatial cues, including signage, directions also visual landmarks, to locate critical safety equipment and evacuation routes both during normal operations and in emergency situations (Shiwakoti et al., 2019).

Wayfinding consists of several core components, the clarity and visibility of navigational signage. Shiwakoti et al. (2019) highlighted that proper crowd management planning with effective wayfinding tools are crucial for the safety of both passengers' and crew during evacuations. Tools such as emergency evacuation maps, clearly marked gathering areas and public address systems help to boost passengers' understanding of the evacuation process to enable faster evacuations. Many passengers are unsure about these emergency tools and procedures which can reduce the effectiveness of evacuations (Wang et al., 2021). Effective wayfinding also depends on the presence of clear, multilingual instructions and symbols, help to accommodate diverse passengers' backgrounds and language proficiencies.

The importance of wayfinding for passenger safety cannot be overstated. During emergencies, the ability to respond quickly and recognize accurately navigate to exits, muster stations or life-saving equipment can be the difference between safety and harm. Wang et al. (2021) highlights that confusion, panic and delay during evacuations are frequently caused by poor signage, inadequate lighting, or complex layouts that delay movement.

A review research on wayfinding in maritime public transport contexts reinforces its centrality to passenger safety. In maritime studies, Galea et al. (2014) underline that clear and standardized signage directly supports safer behaviors, while research by Shiwakoti et al. (2016) verified that improved visual communication significantly enhanced passenger confidence and response in simulated evacuations. To conclude, wayfinding was divided into three parts: normal wayfinding (Shiwakoti et al., 2016), emergency wayfinding and wayfinding tools (Wang et al., 2021).

By exploring existing literature on wayfinding systems and roles, this research objective to find correlation and impact between wayfinding and safety awareness in Georgetown- Butterworth, Penang ferry. The compliance with safety protocols in wayfinding will also foster a culture of preparedness and confidence among ferry passengers.

## **2.9 Self-awareness**

The effectiveness of evacuation procedures is connected to passengers' emergency protocols and readiness to respond during emergency situations. As an example, passengers lack awareness in emergency procedures or fail to recognize the urgency of an incident also evacuation delays. Such delays can significantly reduce survival chances especially in ferry environments whereas space constraints and time pressure demand fast evacuation.

Self-awareness has been widely identified as a key factor influencing individual behavior during emergencies. As define by Rahman et al. (2022) the levels of self-awareness on emergency equipment and evacuation procedures vary across demographic groups, as a result younger passengers and males showed higher

awareness. The differences support that self-awareness forms how individuals perceive risk and interpret safety information. The existing of evacuation routes does not ensure effective evacuation if passengers lack of awareness and readiness to act promptly.

This connection also supported by Mohammad-Pajoo & Aziz (2014) found that approximately 44% of victims hesitated to evacuate during emergency situations. The hesitation incur due to inconsistent interpretations of warning signals, varying levels of risk perception and insufficient preparedness. These findings indicate that self-awareness functions as a psychological mechanism that influences whether safety warnings are translated into timely action.

Evidence from transport environments also highlights the gaps in passenger awareness. Shiwakoti et al. (2016) research stated that train station users were familiar with general layouts but some passenger's unaware of emergency exit locations. The demographic trends were observed with younger passengers and males demonstrating higher levels of awareness. This findings support that age and gender might influence emergency preparedness across different transportation modes.

In passenger safety contexts, self-awareness can be defined as an individual's ability to recognize their own safety knowledge, assess personal limitations and regulate behavior in accordance with established safety procedures. For domestic ferry services, (Aga Marine, 2026) self-awareness includes familiarity with emergency equipment, understanding of evacuation routes and willingness to comply with crew instructions.

This research identify self-awareness as one of an independent variable influencing passengers' safety awareness on the Penang ferry route. Enhancing passenger self-

awareness is essential not only for improving compliance with safety procedures but also for empowering passengers to actively contribute to safer ferry operations.

### **2.10 Relationships among key variables**

Most of the research highlights the importance of understanding the relationships between safety delivery, situational awareness, wayfinding, self-awareness and passenger safety awareness within the context of maritime and public transportation. By exploring these interrelationship help to enhances theoretical understanding but also suggest practical strategies to improve safety instruments for ferry passengers.

Previous studies have examined the direct and indirect effects of safety delivery on passengers' safety awareness. Study by Yang et al. (2023) found that clear and frequent safety communications viz. effective briefings, visible signage and timely announcements may impact positive influence passenger act on safety procedures during emergencies. Rahman et al. (2022) research explain that safety delivery attributes to passengers' preparedness indirectly improving the safety awareness.

Situational awareness has established as a significant predictor of safety awareness. Lau et al. (2021) stated individuals with high situational awareness are good in interpreting environmental cues, recognizing hazards and adapting behaviours accordingly. This skill is important to adequate safety equipment use and executing an immediate good response to an emergency.

Wayfinding as explored in both maritime and broader transport literature, is related to safety awareness. Shiwakoti et al. (2016) claimed that wayfinding has been established to be poorly incident-limiting and to increase passengers' awareness of safety through

the provision of suitable navigation aids, clear signage and easy-to-access safety equipment. Similar findings by Wang et al. (2021) confirmed that passengers' find it easy to navigate their environment demonstrate better retention of safety information and more effective emergency responses.

Self-awareness has been recognized in promoting safety compliance and readiness. Empirical study by Herno Della et al. (2020) claim that strong correlations between self-awareness with adoption of safety behaviors, such as paying attention to safety briefings or locating emergency exits. In further explains that individuals with greater self-awareness are more prepared to listen to safety instructions and identify relevant safety aspects in emergencies.

Evidence of correlations and predictive impacts among these variables is strong. Multiple regression analyses in the literature often reveal that safety delivery and situational awareness are the strongest interpreters of passengers' safety awareness (Wang et al., 2021) while wayfinding and self-awareness also make significant, though sometimes smaller, contributions. Correlational studies (Sun et al., 2018) support the interdependence of these variables suggesting that improvements in each area such as wayfinding can reinforce gains in others independent variables.

Existing literature remains fragmented, evidence derived from aviation or general public transport contexts and inconsistent findings regarding the relative influence of safety-related variables in maritime settings. Methodological limitations including on single research approaches and limited consideration of demographic and cultural factors further constrain applicability. This study addressed these gaps by examine the predictive relationships between safety delivery, situational awareness, wayfinding and

self-awareness on passengers' safety awareness in Penang ferry route using a quantitative framework, offering practical implications for operators and policymakers.

### **2.11 Related theories**

A related theories applied for this study is built upon four connected theoretical perspective viz Situational awareness theory (Endsley, 1995), Spatial Cognition Theory (Kwon et al., 2025), SERVQUAL theory (Parasuraman et al., 1988) and TPB (Ajzen, 1991). It provided a conceptual base that guides this research process and interpretation of results (Creswell, 2009). This study employs four core theories to examine passenger safety awareness in the Georgetown-Butterworth ferry route. These theories offer a comprehensive lens through safety delivery, situational awareness, wayfinding and self-awareness as predictors of passengers safety awareness in the context of ferry operations.

These theories clarifies how passengers perceive safety information, interpret environmental signs and respond to safety delivery practices during ferry operations. Theory of situational awareness explained how each passenger individually recognized and acted on hazards (Endsley, 1995), Spatial cognition theory (Kwon et al., 2025) is driven by wayfinding to interpret and respond based on environmental cues. SERVQUAL theory (Parasuraman et al., 1988), highlighted on the quality in safety communication focusing in what service quality through theorizing it as customers overall evaluation of service performance in multiple dimensions and why customers shaped such evaluations. SERVQUAL model examined how service

quality was measured into 5 measurable dimensions using specific survey questionnaire items for empirical analysis. TPB (Ajzen, 1991) connecting passengers' attitudes, social expectations and perceived control to their safety awareness and compliance intentions.

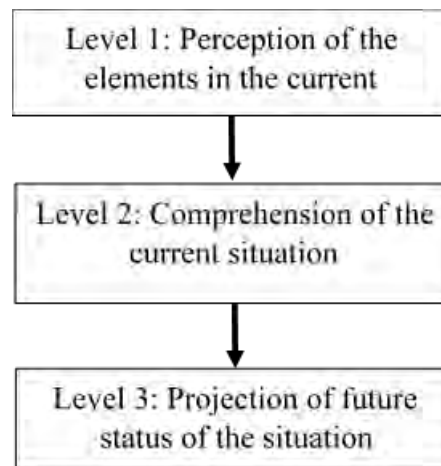
#### 2.11.1 Situational awareness theory

Situational awareness theory by Endsley (1995) serves as the primary theoretical framework for this study, as it explains how individuals recognize, interpret and respond to hazards in their environment. Consist of three-level model viz perception, comprehension and projection as illustrated in Figure 2.3 below. The first level 1 (Perception) involves detecting and recognizing elements in the environment that may influence performance or safety, such as safety signs, life jackets, or emergency exits. Level 2 (Comprehension) for this stage involves integrating the perceived information to understand the current situation. Level 3 (Projection) is known as final level is about predicting future events, such as potential hazards or emergency scenarios, based on the understanding gained from levels 1 and 2.

Situational awareness theory framework below illustrate how passengers' awareness to safety protocols, with their ability to process real-time environmental factors and respond effectively during emergencies. This theory underscores the importance of human cognition in high-risk environments like ferries, where passengers must be aware of their surroundings to make timely and effective decisions during emergencies. As previous empirical study identify that wayfinding as the most significant predictor

of safety awareness, it demonstrate how situational awareness plays a important role in preparing passengers for emergency situations.

Figure 2.3 Situational awareness theory



Source: Endsley (1995)

### 2.11.2 Spatial cognition theory

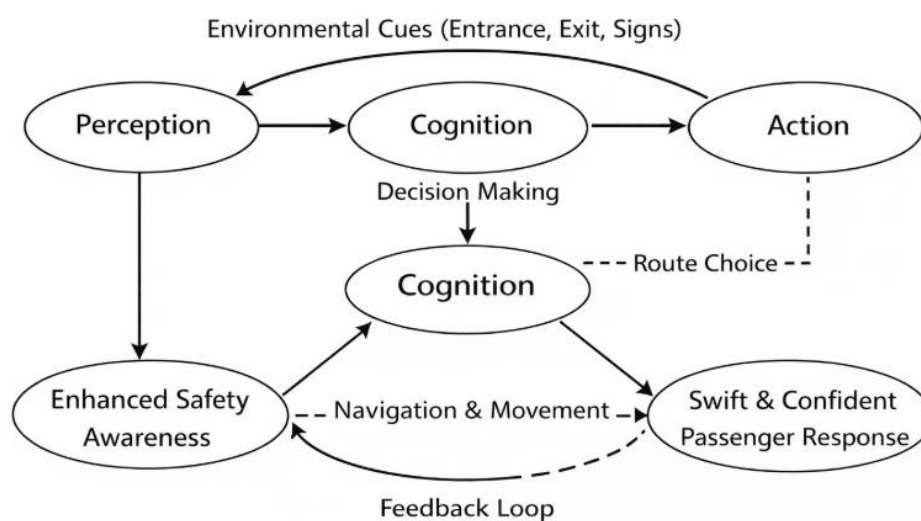
Spatial cognition theory (Kwon et al., 2025) as demonstrated in Figure 2.4 below driven by wayfinding provides a significant framework to understand how passengers navigate and perceive the environment also the safety awareness. This theory suggests that individuals rely on spatial cognition to interpret and respond to environmental cues, such as signs, landmarks and spatial layouts within ferry terminals. The effectiveness of these cues is to ensure that passengers able to navigate the environment efficiently especially during emergency situation. In the context of Penang ferry system, this theory underlines the critical role of structural wayfinding systems able to support passenger safety awareness. These systems consist of clear signage, intuitive spatial layouts and strategically placed emergency exits enable passengers to quickly respond

during evacuation. By enhancing wayfinding tools can boost passengers confidence and preparedness indirectly influence an effective responses during emergencies.

Empirical research has demonstrated that clear and standardized wayfinding significantly improves passenger safety awareness and decision-making, particularly during evacuation procedures (Shiwakoti et al., 2019). By improving the clarity of environmental cues and refining wayfinding systems on the Penang ferry route, operators help to strengthen passengers' safety responses especially during high-traffic routes where congestion and unfamiliar with the environment may reduce awareness.

In conclusion, wayfinding plays a crucial role in enhancing passenger safety awareness on the Penang ferry system. This aligns with the Spatial Cognition-Driven Wayfinding Theory, which underscores the importance of clear environmental cues in supporting passenger preparedness and decision-making during emergencies. By improving wayfinding systems, ferry operators can enhance safety awareness, enabling passengers to act swiftly and confidently in critical situations.

Figure 2. 4 Spatial cognition theory



Source : Kwon et al. (2025)

### 2.11.3 SERVQUAL theory

Service quality theory known as SERVQUAL model introduced by (Parasuraman et al., 1988) as a multidimensional theory including five dimensions, tangibles, reliability, responsiveness, assurance and empathy. As illustrated in Figure 2.5 shown below, directly relate to ferry transportation whereas passenger safety is linked to service quality. The conceptualizes service quality through five key dimensions viz tangibles, reliability, responsiveness, assurance and empathy. These dimensions have been widely applied in transport and service contexts to evaluate how service quality influences user perceptions and outcomes.

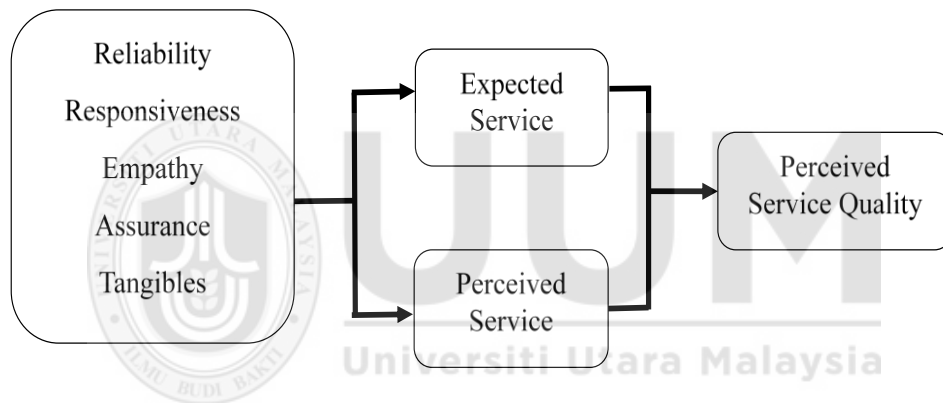
In the context of ferry transportation, tangibles can directly relate to physical safety features as the condition of vessels, life-saving equipment, signage also passenger facilities cover in passengers' perceptions of safety and comfort. Reliability matches to consistent of safety schedules and standards, to ensure the safety protocols are dependable and integrated into regular operations. Responsiveness define the capacity of ferry employees to react effectively and competently in both routine and emergency situations, which is essential in enhancing timely safety delivery. Assurance emphasizes staff competence and training in handling safety procedures, directly encourages passenger trust and confidence in the ferry service. Empathy highlights personalized attention to passengers' exclusive safety concerns, contribute to whole perceptions of safety throughout the journey.

By integrating these dimensions, ferry operators can strengthen safety delivery, in turn promotes boost passenger safety awareness and confidence in existing safety measures. Empirical research in passenger transport contexts showed that SERVQUAL

dimensions provides a valid framework for assessing service quality and its impact on user perceptions, including safety and satisfaction (Mikuličić et al., 2024)

The integration of these five dimensions, ferry operators can improve safety delivery to promote greater passenger awareness with confidence in the existing safety measures. SERVQUAL theory is a complete approach to evaluate service quality related to safety transport and highlights the need for an effective, communicate and responsive safety system in order to improve passengers' awareness (Parasuraman et al., 1988).

Figure 2. 5 SERVQUAL theory



Source: Parasuraman et al. (1988)

#### 2.11.4 Underpinning theory

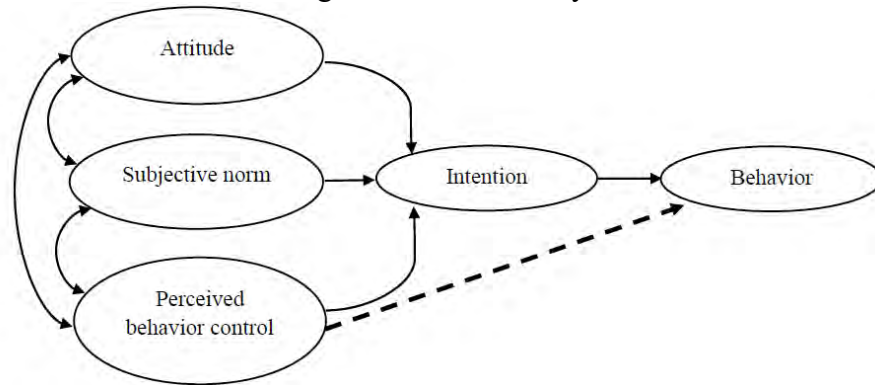
Sekaran & Bougie, (2010) define that underpinning theory as a fundamental basis to explain the relationship between variables for a study also presented a rational basis for understanding the findings. For this study, TPB, developed by Ajzen (1991) is applied as the underpinning theory, providing a comprehensive framework to understand how passenger safety awareness can be influenced by attitudes, social norms and perceived control. Figure 2.6 shows that the Theory of Planned Behaviour (TPB) is relevant to this research as it highlights the role of behavioural intention in predicting actual

behaviour. The theory posits that individual behaviour consists of three key factors viz attitude towards the behaviour, subjective norms and perceived behavioural control. All these factors cooperatively influence the passengers' safety awareness and preparedness to engage in safety related behaviors on ferry journeys.

In the context of ferry sector, attitude toward the behavior refers to passengers' perceptions of the importance and effectiveness of safety measures, for instance safety briefings and emergency evacuation procedures. Subjective norms explain the influence of social expectations, which is safety behaviors of passengers or the impact of ferry employees. Perceived behavioral control relates to passengers' perceived ability to act safely, influence by features such as clear signage, ferry employees support and emergency preparedness.

By applying TPB help this study to explores how these dimensions influence passengers' safety awareness and commitment to fulfill with safety procedures, especially in emergency situations. Understanding these relationships is a key for improving safety communication and involvement to promote positive safety behaviors. TPB as theoretical foundation for examine cognitive and social factors affect passenger safety awareness in ferry operations, guiding both the development of the conceptual framework and the analysis of this study's findings.

Figure 2. 6 TPB theory

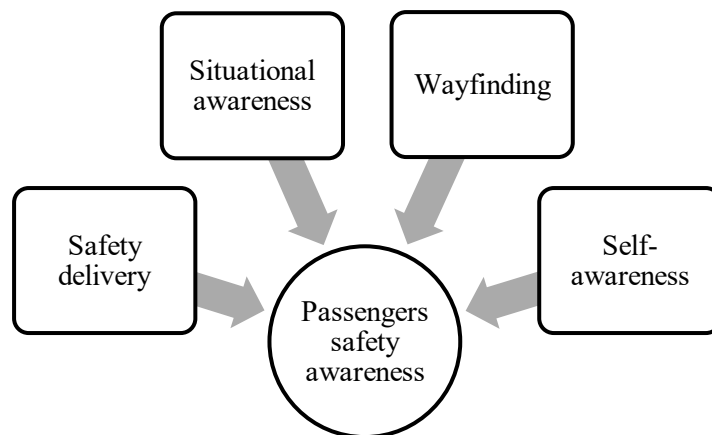


Source: Ajzen (1991)

## 2.12 Research framework

The research framework as shown in Figure 2.7 as below. Framework's core is the concept of passenger safety awareness, emphasizing that passengers must be engaged, informed, and capable of responding to any safety-related situation. All the surrounding components (situational awareness, wayfinding, self-awareness, and safety delivery) contribute to developing this awareness, ensuring that passengers are not only safe but also equipped to handle any situation they may face during their journey.

Figure 2. 7 Research framework



### 2.13 Hypothesis

The hypothesis referred to the problem statement in order to define the research questions and objectives on passenger safety awareness on domestic ferries in Penang. The study on influencing passenger safety awareness have been studied before. The independent variables applied to this study are safety delivery (Lau et al., 2020) wayfinding (Wang et al., 2021), situational awareness (Shiwakoti et al., 2019) and self-awareness (Rahman et al., 2022).

#### 2.13.1 Passenger safety awareness and safety delivery

H1: There is a positive relationship between safety delivery and passengers' safety awareness.

#### 2.13.2 Passenger safety awareness and situational awareness

H2: There is a positive relationship between situational awareness and passengers' safety awareness.

#### 2.13.3 Passenger safety awareness and wayfinding

H3: There is a positive relationship between wayfinding and passengers' safety awareness.

#### 2.13.4 Passenger safety awareness and self-awareness

H4: There is a positive relationship between self-awareness and passengers' safety awareness.

## **2.14 Research gaps for literature**

There are numerous gaps referred to the previous literature regarding passenger safety awareness in domestic ferries. Many researchers have been targeting aviation and general public transport but few studies focused on domestic ferry operations, particularly in places like Malaysia. Some studies report on singular variables such as situational awareness, wayfinding and self-awareness and seldom examined how these variables work together to advise passenger safety behaviour in ferry transport.

Self-awareness one of the independent variables apply for this study has not been adequately researched on its own, particularly in terms of how emergency procedures may influence the passengers' awareness. For wayfinding has been studied in different modes of transportation, but lack in maritime safety yet to be explore.

Addressing these gaps may contribute to the understanding of the factors affecting passenger safety awareness. This research will ultimately provide knowledge which help to improve safety practices for domestic ferry services in Penang.

## **2.15 Research gaps and justification for current study**

Existing literature increasingly recognises the importance of passenger safety awareness in enhancing emergency preparedness across transportation systems. Studies conducted in aviation, rail and urban public transport consistently identify safety delivery, situational awareness, wayfinding and self-awareness as key factors influencing passengers' ability to respond effectively during emergencies. Clear safety communication through signage, announcements and briefings has been shown to improve understanding and behavioural responses in critical situations (Shiwakoti et al., 2019). For situational awareness and wayfinding are commonly

acknowledged as supporting for timely decision-making, self-awareness has emerged as an important behavioural dimension related to compliance with safety procedures and responsible conduct.

Significant gaps remain towards domestic ferry transportation. Empirical research focusing on ferry passengers is limited, especially in developing countries such as Malaysia. Existing maritime studies tend to highlight technical safety systems, vessel operations or post-incident evaluations, with few attention given to the psychological, communicative and behavioural factors that form passengers' safety awareness before an emergency occurs.

As for now, no empirical study has examined the combined influence of safety delivery, situational awareness, wayfinding and self-awareness on passengers safety awareness in Penang ferry. The route's with high passenger turnover and reliance on both commuter and tourist traffic highlight the need for a context-specific investigation. Although agencies such as PPSB and PPC have introduced improvements in safety communication and technical standards, the effectiveness of these measures in promotion meaningful passenger safety awareness has not been systematically measured.

The gaps for this research by examine the predictive relationships between safety delivery, situational awareness, wayfinding and self-awareness on passengers' safety awareness within a Malaysian domestic ferry. Providing empirical study in a local operational context, the study offers practical insights for ferry operators, regulators and policymakers aimed at strengthening passenger preparedness and improving

overall maritime safety outcomes. By linking between theory, practice and context this study makes a contribution to the maritime safety in Malaysia especially in Penang.

### **2.16 Literature summary**

This larify comprehensive review of the existing literature related to passengers' safety awareness in domestic ferry transportation. The review began by creating the significance of safety awareness as a central outcome variable, highlighting behavioral components and its recognized role in shaping effective passenger responses during routine operations and emergencies.

Subsequent sections examined the core independent variables underpinning this study: safety delivery, situational awareness, wayfinding and self-awareness. The literature demonstrates that effective safety delivery through clear communication, comprehensive signage and accessible briefings forms the foundation for passenger understanding and preparedness. Situational awareness was shown as a key component that enables passengers to recognize hazards and respond appropriately, while wayfinding ensures that passengers can confidently navigate their environment and access critical safety resources when needed. Emphasis on self-awareness in the safety literature was also reviewed, with evidence suggesting that passengers who reflect on their own knowledge and readiness in safe and compliant attitude.

This chapter explored interrelationships among these variables, summarizing empirical findings for significant correlations and predictive effects and note for important research gaps with inconsistencies particularly within the context of Malaysian ferry operations in Penang route. Four theoretical frameworks viz Situational awareness theory (Endsley, 1995), Spatial cognition theory (Kwon et al., 2025), SERVQUAL

theory (Parasuraman et al., 1988) and TPB (Ajzen, 1991) were discussed as an essential guides for understanding how internal and external factors jointly shape safety awareness outcomes.

The literature review has highlighted a lack of context-specific research on the combined impact of safety delivery, situational awareness, wayfinding and self-awareness on passengers' safety awareness in domestic ferry settings. This gap highlights the necessity for the current study to underscore the gaps and focusing on the Penang ferry route also run the quantitative methodology.

In summary, the idea based on previous literature have directly highlight the formulation of the study's research objectives, the variables choice and methodological approach. By applied four theories and empirical evidence, this chapter provides a solid foundation for the following investigation, to ensure the study's findings was contextually relevant and practically meaningful for enhancing ferry passenger safety in Malaysia.

## **CHAPTER THREE : RESEARCH METHODOLOGY**

### **3.1 Introduction**

This chapter clarified the research methodology that was implemented to examine the predictors influencing passengers' safety awareness on domestic ferries between Georgetown and Butterworth in Penang. Guided by the research objectives and the preceding literature review, the methodology was designed to ensure a rigorous, systematic and contextually relevant approach to data collection, analysis and interpretation.

The study aimed to explore the demographic characteristics of ferry passengers, examine the relationships between the independent variables and the dependent variable and assess the predictive impact. A quantitative research design was used to address the objectives in order to collect reliable data and to test hypotheses regarding the relationships among the stated variables.

The methodology chapter followed the structure suggested by Queirós et al. (2017) and began with the research design followed by a detailed description of the study population, sampling strategy and data collection method. The section further elaborated on the development of the survey instrument, ensuring its alignment with the research objectives and conceptual framework. The procedures for pilot testing and ethical considerations were also outlined to ensure the integrity and credibility of the research process.

The chapter discussed the data analysis techniques used to address each research objective viz descriptive analysis for profiling demographic characteristics, correlation analysis for exploring relationships among variables and regression analysis for

evaluating the predictive effects of safety delivery, situational awareness, wayfinding and self-awareness on passengers' safety awareness. Each analytic method was justified in terms of its suitability for achieving the specific research goals and for drawing conclusions from the data.

Through the methodological choices adopted in this study, this chapter ensured that the research process was replicable, valid and capable of generating actionable insights for ferry operators, policymakers and safety educators. The subsequent sections detailed each component of the methodology, beginning with the research design and moving systematically through sampling, data collection, instrument development and data analysis.

### **3.2 Research design**

Research designs is plans and processes stated by Creswell (2009) that include overall ideas start from hypotheses to detailed techniques for analyzing the data. A good designed research proposal is important, compiling specific techniques, philosophical presumptions and analytical methodologies. This study employs a quantitative research approach to examine the factors influencing passengers' safety awareness on ferries in the Georgetown-Butterworth route. The primary research method is the survey questionnaire, using face-to-face methods at the Pangkalan Raja Tun Uda, Georgetown ferry terminal. This approach ensures a wide range of responses across passenger demographics. Descriptive analysis, correlational and regression research design applied for this research to determine the relationship between passenger safety awareness and four independent variables. Descriptive research design was used to examine passengers' demographic characteristics viz age, gender,

educational level and travel frequency also to identify factors influencing passengers' safety awareness on ferry in Penang.

### **3.3 Research strategy**

Function of a research strategy to identify the finding, conduct and monitor a particular research (Johannesson & Perjons, 2014) . Quantitative research approach use for this research in order to measure large quantity or amount (Queirós et al., 2017) and suitable to identify numerical relationships based on the aim for this study to examine the relationship between dependent variable and independent variables. (Creswell, 2009) stated that quantitative research method was used to explore the relationships among variables through numerical analysis, allowing for the evaluation of objective theories. This approach was suitable as it provided accurate measurements of the variables and enabled statistical testing, which helped identify patterns and relationships that aligned with the evaluation of the theory. A quantitative design was chosen for this study to determine relationship and impact of situational awareness, wayfinding, safety informatio and safety delivery toward passengers' safety awareness. The survey research followed a structured process, which included study design, sampling, instrument development, data collection, statistical analysis, and interpretation, all aimed at drawing conclusions about the target population.

### **3.4 Time horizon**

A cross sectional surveys was use as the time horizon to determine data from a population based on particular time frame. This approach suitable to hypothesis and can provide insights into the frequency of experiences and outcomes, which may inform the design of future studies (Wang & Cheng, 2020). The limitation of cross-sectional surveys is unable to capture changes at the individual level over time, as the same respondents cannot be tracked longitudinally (Dale et al., 2008). In this study, a cross-sectional design was used to compare different groups at a single point in time. This allowed to analyse f how safety awareness varies across passenger types, such as tourists and locals also different age groups. By collecting all data at once, this research examined the safety awareness levels of passengers without waiting for long-term changes. This approach help to understand the relationships between factors viz. situational awareness, wayfinding, safety delivery and self awareness at a specific moment in time. This research was taken between September 2025 until December 2025

### **3.5 Research setting**

Research setting is background of the study is a type of research setting methodology that contains info and observations in a natural setting and environment (Ven et al., 2002). This research field passengers ferry terminal at Pangkalan Raja Tun Uda, Georgetown Penang. Focus solely on the ferry route from Georgetown to Butterworth due to this route is one of the busiest and most significant in Penang, with a high volume of passengers, including both locals and tourists. By concentrating on just one route to ensure a more consistent and manageable data collection process, as this would minimize potential variability that might arise from studying multiple routes

with different operational characteristics. By limiting the study to the Georgetown-Butterworth route allowed for more focused analysis of safety awareness within a specific context, ensuring that the findings are directly relevant to the passenger experience on this particular ferry service. The decision to survey passengers only on this route helped simplify logistics, as it focused data collection at a single key ferry terminal in Georgetown, allowing for a streamlined and efficient research process.

### **3.6 Unit of analysis**

The unit of analysis in this study was the individual ferry passenger, as the research specifically aimed to assess their safety awareness and behaviors. Ferry workers and staff were intentionally excluded from the study to avoid any potential bias. By including passengers solely to ensure that the findings accurately reflect the perspectives of those who are directly affected by the safety measures on board, without being influenced by the operational responsibilities or familiarity of ferry staff with the safety protocols. This approach helped maintain the fairness of the study by focusing on the passengers' experience and awareness.

### **3.7 Research sampling**

As study by Turner (2020) research sampling refer to the range subset from the population of interest in particular research study. Two type of research sampling is probability and non-probability samplin. Probability sampling means each element identified and non-zero probability of being selected. Whereas for non-probability sampling, each element do not have equal probability to be selected. The research sampling in this study involved selecting a subset of ferry passengers from the Georgetown-Butterworth ferry route in Penang to assess their safety awareness. The

sampling method used was convenience sampling, where participants were chosen based on their availability and willingness to participate during the data collection period at the ferry terminal.

### 3.7.1 Population and sample size

The Star (2023) reported that the ferry service served approximately 8,000 passengers daily. The study population consisted of passengers travelling on the Georgetown–Butterworth ferry route in Penang, Malaysia. To ensure that the sample size was appropriate for statistical analysis, the sample size was determined using the Krejcie & Morgan (1970) sampling table, which provided a method for calculating sample sizes based on the total population and the desired confidence level. An additional allowance was included to increase the dependability of the outcomes by addressing the possibility of non-responses and incomplete responses.

For a population of 8,000 passengers, Krejcie and Morgan table suggested a sample size of 384 respondents assuming a 95% confidence level and a 5% margin of error. To enhance the accuracy and reliability of the study, 400 respondents were surveyed which exceeded the minimum required sample size. This helped to ensure that the sample was representative of the larger population, enabled more robust analysis and minimised sampling error.

The eligibility criteria for this study included passengers who were 18 years or older and had travelled on the Georgetown–Butterworth ferry at least once in the past six months. This ensured that participants had sufficient experience with the ferry service and its safety protocols. First-time users were excluded as they may not have had

adequate knowledge of the ferry's safety procedures. Ferry workers and staff were also excluded to avoid bias and to ensure that the responses reflected the perspectives of actual passengers.

### 3.7.2 Sampling technique

Convenience sampling apply for this research, it is not feasible to get all ferry passenger in Penang. For a non-probability convenience sampling technique was use to gather data from the respondents. Edgar & Manz (2017) explained that convenience sampling is a technique include particular selection of respondents based on their accessibility to the findings, without a exact sampling pattern. This method is commonly used in research due to its ease of use and efficiency, as it allows for quick data collection without the need for complex procedures. In this case, passengers were approached at the Georgetown ferry terminal solely during two different times which is morning and evening also different day Monday, Wednesday and Saturday to ensure a broad range of passengers were included.

The design is vulnerable to selection bias because it does not guarantee that every passenger has an equal chance of being selected. Since only those who were available at the time and willing to participate were included, certain passenger groups, such as those who travel at specific times of the day or those who are unwilling to engage in surveys, may remove. This could result in a sample that does not fully reflect the diversity of the entire passenger population, impact the generalizability of the findings. While convenience sampling was practical for this study, it is important to acknowledge the potential limitations in ensuring that the sample represents all passenger groups accurately.

### **3.8 Research instrument**

The research instrument used for this is a survey questionnaire which disbursed through passenger's via face-to-face method at Pangkalan Raja Tun Uda Ferry Terminal (Georgetown). The questionnaire split into two sections which is Section A in Table 3.1 inquired questions about demographics of the participants. For Section B in Table 3.2 to examine the correlation and impact of those independent and dependent variables as per survey aim is to align the research objectives and hypothesis.

#### **3.8.1 Questionnaire design**

Structured questionnaire are suitable for this research with clear, standardize questions with the same sequence for every single participant to maintain consistency. These questions are normally closed-ended or provide limited options said by Kothari (2008). The questionnaire divided by 2, Section A in Table 3.1 passengers demographics such as age, gender, race, education level, occupation, purpose and frequency travel trip. Section B in Table 3.2 showed four independent variables which is safety delivery, situational awareness, self-awareness and wayfinding, also a dependent variable that is safety awareness. The questionnaire was adopted and modified from previous studies and was given to academia for validation before we distribute.

## Section A: Demographic

Table 3.1 Measurement of variables

Variable	Measurement
Gender (Wang et al., 2021)	Nominal
Age (Wang et al., 2021)	Ordinal
Race (Wang et al., (2021)	Nominal
Education (Lau et al., 2020)	Nominal
Occupation (Chang & Liao, 2009)	Nominal
Purpose of the trip (Chang & Liao, 2009)	Nominal
Frequency (Chang & Liao, 2009)	Ordinal

## Section B: Passengers safety awareness on ferries

Table 3. 2 Questions for independent and dependent variable

No	Variables	Questions	Reference
1.	Safety delivery (Lau et al., 2020)	1. The life-saving equipment available on the ferry is sufficient.	Lau et al. (2020)
		2. The fire-fighting equipment on the ferry is adequate and well-maintained	Lau et al. (2020)
		3. Medical equipment on board is sufficient to handle emergencies.	Lau et al. (2020)
		4. The ferry crew actively provides clear safety guidance and alerts during the trip	Lau et al. (2020)
		5. The ferry crew provided a clear and understandable safety demonstration via video before departure.	Lau et al. (2020)
2.	Situational awareness Shiwakoti et al. (2019)	1. I am aware of the evacuation alarm and its procedures.	Wang et al. (2021)
		2. I will promptly report to the staff when I notice any suspicious items or behaviour from passengers.	Shiwakoti et al. (2019)
		3. I am aware that the ferry is overloaded.	Lau et al., (2020)
		4. I am aware if the ferry is exceeding its safe speed.	Lau et al., (2020)
		5. I am concerned about the appearance of the crews.	Lau et al., (2020)
3.	Wayfinding (Shiwakoti et al., 2019)	1. The emergency plan is visible to me.	Wang et al. (2021)
		2. The emergency exit signs are noticeable to me.	Wang et al. (2021)
		3. The emergency announcements are noticeable to me.	Shiwakoti et al., (2016)
		4. The alternative entrance/exit is noticeable to me	Shiwakoti et al., (2016)
		5. The emergency assembly point is noticeable to me.	Shiwakoti et al. (2016)

4. Self-awareness Abd Rahman et al. (2022)	1. I am aware of where the fire alarm call point is located	Abd Rahman et al. (2022)
	2. I know how to correctly wear a life jacket	Chang & Liao (2009)
	3. I need to fasten my seat belt for the entire duration of the trip	Chang & Liao (2009)
	4. I am aware of the position of lifeboats.	Lau et al. (2020)
	5. I pay attention to safety demonstration or announcement made by the crew before or during the trip.	Chang & Liao (2009)
5. Safety awareness (Dependent variable) Lau et al. (2020)	1. I am aware of the relevant safety regulation of the ferry while on board	Lau et al. (2020)
	2. I thoroughly read the information provided on the ferry's safety poster	Lau et al. (2020)
	3. I will respond correctly if an emergency happens on the ferry	Chang & Liao (2009)

### 3.8.2 Measurement of variables

In Section A, the respondents demographic characteristics were measured using nominal and ordinal scales. Kothari (2008) stated that nominal scale is used for categorizing data without implying any order or magnitude, such as gender and race, where numerical codes are used solely for identification. Sekaran & Bougie (2010) explained that the ordinal scale organizes variables into distinct categories that reflect differences in ordered levels suitable for variables that require ranking or hierarchical classification. For Sections B interval scale was used to measure the study variables. The interval scale combines the features of nominal and ordinal scales by providing classification and ranking while ensuring equal distances between consecutive numerical values. This enables meaningful comparison of response differences. Sekaran & Bougie (2010) highlighted that this scale allows for the interpretation of the magnitude of variation between responses, rather than just identifying categories or ranks. A 5-point Likert scale was used, ranging from 1 (strongly disagree) to 5 (strongly agree), to measure respondents' perceptions.

The study implemented rating scale method, where respondents indicate their level of agreement with each statement from a predefined set of response options. Kothari, (2008) claims that the rating scale assesses attitudes and perceptions through graded levels of agreement or disagreement, with the 5-point scale being the most commonly used, although 3- or 7-point scales are also applied in some research. For this study, the 5-point rating scale, from "strongly disagree" to "strongly agree," was used to measure respondents' levels of agreement.

### **3.9 Data Collection**

Effective data collection to ensure the validity and reliability of empirical research. Data collection is primary sources to be conducted among ferry passengers. Definition of primary data stated by Kothari (2008) is the original data collected for the first time, physically distribute the questionnaires by approaching the passengers and request them to fill in questionnaire at Penang ferry terminal. Questionnaire was generated using Google Forms. Conducted in-person at ferry terminals on board ferries also ferry museum, by distributing and collecting questionnaires before departure or upon arrival. Passengers was explain on the purpose of the study to clrafiy and seek for voluntarily.respondent. As informed consent prior to questionnaire completion. The data collection period with a range of days and times to capture the experiences of different passenger groups, daily commuters, tourists and irregular users.

A total of 400 completed questionnaires, in line with recommendations for robust statistical testing of relationships among multiple variables. The collected data converted into SPSS software to extract analysis with descriptive, correlation and regression techniques applied to tackle research objective.

By using this systematic approach to collect data, this study aims to gain a representative and reliable dataset that directly supports the exploration of demographic characteristics, examine relationships between variables and the assessment of the factors most strongly influencing passengers' safety awareness. This process ensures the integrity of findings and the overall contribution of the research to improving ferry safety in Malaysia.

### 3.9.1 Pilot test

A pilot test or known as pilot survey is a identical and practice run of the primary survey (Kothari, 2008) before full survey is adhere. This preliminary test help to identify any potential issues with the survey questions, response options or overall structure before the full-scale survey is run. The questionnaire was tested within 30 respondents Kothari (2008) from Penang ferry passengers and choose randomly base on the criteria. It identified as non-expert participants in face validity segment, respondents were asked to evaluate the clarity, relevance and comprehensibility of the items in the survey. The participants also encouraged to provide feedback of the questions or if any items were confusing. The reliability result for this pilot test is 0.863 considered good reliability.

### 3.9.2 Validity test

Validity is a critical factor in evaluating a research instrument, as it determines how accurately the instrument measures the intended construct (Kothari, 2008). Kimberlin & Winterstein (2008) stated that primary types of validity are three which commonly used which is content validity, construct validity and criterion validity. Content validity define the instrument adequately represents the intended construct

through expert judgment, while construct validity and criterion validity assess whether the instrument accurately reflects the theoretical construct and aligns with established measures by examining expected relationships and outcomes.

This study complied content validity following the procedure by Davis (1992). This process began with assessing interrater agreement based on the proportion of items rated within lower (1–2) or higher (3–4) relevance ranges. A panel of three subject matter experts, including an academic expert, a ferry operator and a passenger, was invited to evaluate the content validity of the survey questionnaire. Each expert independently reviewed the complete set of items to assess clarity, relevance and representativeness in relation to the study key variables viz situational awareness, wayfinding, self-awareness, safety delivery, and passenger safety awareness.

The experts rated each item using a 4-point relevance scale ranging from 1 ("not relevant") to 4 ("highly relevant") as suggested by Davis (1992). Based on their feedback and recommendations, adjustments were made to refine the wording and structure of the items before the questionnaire proceeded to the pilot testing phase. The questionnaire validation approval attached in Appendix C below.

### 3.9.3 Reliability test

Reliability tests was conduct to assess the internal reliability of each variables. (Roever & Phakiti, 2018) stated that to range high dependability in these tests is crucial for a particular research, as the results can be trusted and consistently trusted. Cronbach's Alpha is the most common statistics use to assessing the dependability of research tools. The coefficient assesses on how efficient a group of items cooperatively

captures by measuring the internal reliability as been study by Tavakol & Dennick, (2011). Referring to the Table 3.4 below, the Cronbach's Alpha value is between 0 to 1. To support study by Nunnally (1978) stated value of Cronbach Alpha below 0.6 is very poor, in the range of 0.6 to 0.69 is acceptable, 0.7 to 0.89 is measured good and 0.9 and above is excellent.

Table 3. 3 Cronbach's Alpha

<b>Cronbach's Alpha</b>	<b>Internal Consistency</b>
< 0.60	Poor
0.60 to 0.69	Acceptable
0.70 to 0.89	Good
> 0.90	Excellent

Source: Nunnally (1978)

### 3.10 Data analysis

In this research, SPSS version 27 was used for data analysis and result interpretation. Three main methods were used for analytical methods, which is descriptive statistics, Pearson correlation analysis and multiple linear regression analysis.

Descriptive statistics are crucial for summarizing data and presenting evidence-based findings on the population too. This method includes central measures such as mean, median and mode, which help to summarize the average scores of the data. Additionally, descriptive statistics encompass measures of variability, including variance, standard deviation, , minimum and maximum values, kurtosis and skewness, toward distribution and spread of the data (Runtime, 2024). These statistics were vital in present a clear description of the study sample.

Pearson correlation analysis is used to examine the relationships between two or more quantitative variables. The correlation coefficient, start with ranging from -1 to +1, quantifies the strong point and direction of the relationship. A coefficient of zero indicates no linear relationship, +1 signifies a perfect positive relationship and -1 explain a perfect negative relationship between those variables (Gothay,N & Thatte, 2017). For this study, Pearson correlation analysis was applied to examine the relationship between the independent and dependent variables. Multiple linear regression analysis is a statistical technique used to measure the relationship between one dependent variable and multiple independent variables. Different univariate regression, that examines the relationship between a dependent and independent variables, multiple linear regression measures how several independent variables collectively influence the dependent variable (Uyanık & Güler, 2013).

This research emphases on four independent variables and multiple linear regression analysis is applied to assess the strength of relationships between variables. These analytical methods provide a strong framework to examine the data, ensure comprehensive insights into the interrelationships among the study variables. This approach allows in-depth understanding of how multiple factors simultaneously impact the dependent variable.

### **3.11 Methodology summary**

This chapter outlines the research methodology, by implements a quantitative approach using a structured questionnaire. A cross-sectional design was employed, allowing data to be collected at a single idea in time within a real-world setting. The unit of analysis includes individual participants, focus on perceptions of safety awareness on ferries. Convenience sampling was applied used five-point Likert scale in the questionnaire in order to measure participants' levels of agreement or disagreement with safety awareness.

Data analysis was conducted via three primary methods: descriptive statistics, Pearson correlation analysis and multiple linear regression analysis. Descriptive statistics were used to summarize the demographic characteristics result. Pearson correlation analysis function to examine the relationships between the independent variables' safety delivery, situational awareness, wayfinding and self-awareness also dependent variable is passenger safety awareness. Multiple linear regression analysis was applied to determine the strength of these relationships, as well as variables influence on passenger safety awareness. This methodology is designed to provide reliable and statistically insights into the factors that affect passenger safety awareness in Penang,also supporting evidence-based recommendations for improving ferry safety practice.

## **CHAPTER FOUR : RESULTS**

### **4.1 Introduction**

This chapter presents the results derived from the data analysis conducted in the study. The first section explains a demographic profile of the respondents for the questionnaire given. Subsequent sections summarization of the findings from the descriptive analysis, correlation analysis and multiple regression analysis. The data analysis was performed using SPSS version 27.

### **4.2 Demographic analysis**

Descriptive analysis was used to analyse the demographic data from respondents. In this study, seven questions have been employed for gathering demographic information from the respondent which are gender, age, race, education, occupation, purpose of using ferry and the frequency of using ferry per year. The result for descriptive analysis has been extract in a frequency and percentage as shown in Table 4.1. There were 400 respondents participated in this survey.

The sample exhibits a near-equitable gender distribution, with female respondents 208 (52%) and males accounting for 192 (48%). In terms of age, the data reveals a concentration among younger adults, with the 18 -30 age forming the largest group at 136 (34%). The proportion declines systematically in older with the 31 - 40 group at 100 (25%) and the smallest segment being those aged 61 and above at 35 (9%).

The race composition of the sample reflects a diverse multi racial country. The Chinese group represents the largest segment at 186 (47%). Malay respondents follow as the

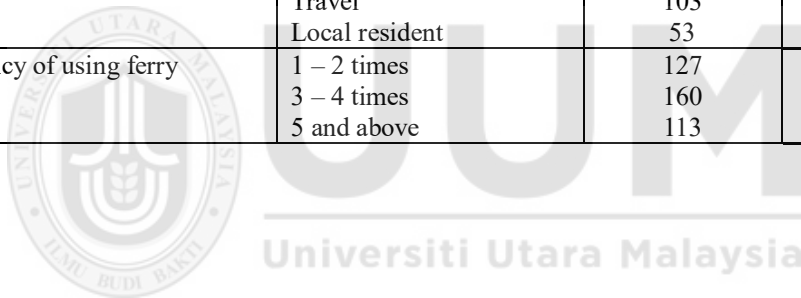
next major group at 151 (38%). Followed by Indian respondents 38 frequency with (10%), with other races result (6%). The substantial representation across these major groups enhances the study's relevance within a multicultural setting.

The highest score for educational group falls in secondary school 103 (26%), follow by Degree and Diploma holders (22 %). There were only 81 (20%) with pre-university qualifications and the least 41 (10%) with primary school education. In occupational profile is consistent with the result showed employees, making up 256 (64%). Students falls to the second largest at 105 (26%) and lastly unemployed is the least 39 (10%). For the purpose of using ferry, most of the respondents used ferry for work recorded the highest number, 151 (38%). The second highest is to travel 103 (26%). Followed by college 93 (23%) using ferry for the transportation to college and study purpose. Lastly the lowest stated is, local resident of Pulau Pinang with only 53 respondents (13%) used ferry.

Finally, the frequency of using the ferry per year indicates that most passengers' using ferry service 3–4 times annually at 160 (40%). Followed by 1-2 times frequency resulted 127 (32%). Lastly frequency of 5 and above times represent 113 (28%). This pattern indicates that perceived service quality is formed through separate and specific experiences, requiring the service provider to ensure consistency across all service encounters rather than depending on user familiarity or habitual use.

Table 4. 1 Profile of demographic

Demographic variables		Frequency	Percentage (%)
Gender	Male	192	48
	Female	208	52
Age	18 - 30	136	34
	31 – 40	100	25
	41 – 50	78	20
	51 – 60	51	13
	61 and above	35	9
Race	Malay	151	38
	Chinese	186	47
	Indian	38	10
	Other	25	6
Education	Primary school	41	10
	Secondary school	103	26
	Pre-university	81	20
	Diploma	86	22
	Degree and above	89	22
Types of occupation	Student	105	26
	Employee	256	64
	Unemployed	39	10
Purpose of using ferry	Work	151	38
	College	93	23
	Travel	103	26
	Local resident	53	13
Frequency of using ferry	1 – 2 times	127	32
	3 – 4 times	160	40
	5 and above	113	28



### 4.3 Descriptive analysis

In this study, descriptive statistics were used to examine the relationship between safety awareness as dependent variable and the four independent variables viz safety delivery, situational awareness, wayfinding and self-awareness. The sample consisted of 400 respondents from Penang, with varied demographic characteristics such as age, gender, educational background, and frequency of ferry use. These characteristics were considered to understand how different passenger profiles might influence their perceptions of safety awareness.

The analysis revealed several important insights. As per Table 4.2 shows descriptive analysis extracted from twenty-three questions. The mean scores for the variables ranged from 3.7460 to 3.8717, indicating generally positive perceptions of the study variables. Safety awareness had the highest mean score ( $M=3.8717$ ,  $SD=0.60691$ ), followed closely by wayfinding ( $M=3.8360$ ,  $SD=0.55522$ ). Self-awareness scored ( $M=3.7765$ ,  $SD=0.56970$ ), followed by safety delivery ( $M=3.8315$ ,  $SD=0.56436$ ) and situational awareness ( $M=3.7460$ ,  $SD=0.59242$ ). The relatively high mean scores suggest that respondents held positive perceptions about their safety awareness and related factors. Pallant (2020) reported these mean values indicate a general tendency toward a balanced self-assessment across the variables under investigation, reflecting typical central tendencies found in self-reported data. This suggested that the respondents rated themselves consistently across the different factors, providing a reliable reflection of their self-perception in the context of safety awareness and related skills.

The standard deviations for these variables ranged from 0.55522 to 0.60691, showing varying levels of dispersion in the data. Safety awareness had the highest standard deviation (SD = 0.60691), indicating a wider variation in respondents' opinions, with some passengers rating their safety awareness much higher or lower than others. This suggests that while most passengers view themselves as relatively aware of safety protocols, there are notable individual differences in how they perceive their awareness. Wayfinding showed the lowest standard deviation (SD = 0.55522), indicating more consistent perceptions of passengers' ability to navigate and find their way in the ferry environment.

Findings highlight that while the general trend shows high levels of safety awareness and related skills, individual differences particularly in safety awareness are significant. Demographic characteristics, such as age, gender and experience with the ferry service, may influence these perceptions. For instance, older passengers or frequent ferry users may perceive themselves as more knowledgeable about safety measures compared to younger passengers. These variations underscore the importance of further analysis to explore potential relationships between demographic factors and safety-related perceptions, which could offer deeper insights into passenger behavior and inform safety training initiatives.

Table 4. 2 Descriptive statistic

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
SAA	400	2.00	5.00	3.8717	.60691
SAD	400	1.80	5.00	3.8315	.56436
SIA	400	1.60	5.00	3.7460	.59242
WAY	400	2.00	5.00	3.8360	.55522
SEA	400	2.00	5.00	3.7765	.56970
Valid N (listwise)	400				

#### 4.4 Reliability analysis

To ensure the reliability of the research instrument, internal consistency analysis was conducted using Cronbach's alpha. As per below describe that Cronbach's Alpha value for each variables is within the range 0.774 to 0.844 and it is considered good result for internal consistency. As presented in Table 4.3 summarize result of all variables reveal acceptable to good reliability levels. Safety Awareness as dependent variable measured using three items, recorded a Cronbach's alpha value of 0.774, indicating satisfactory internal consistency. The independent variables safety delivery, situational awareness, wayfinding and self-awareness each measured using 5 items, reported Cronbach's alpha values of 0.835, 0.844, 0.833 and 0.839. These values exceed the commonly accepted threshold of 0.70, confirming the adequacy of the measurement scales. Based on these results, the questionnaire items are considered reliable and suitable for subsequent data analysis. This study proceeded to descriptive and inferential statistical analyses to address the research objectives.

Table 4. 3 Reliability test

<b>Variables</b>	<b>Cronbach's Alpha</b>	<b>No. of Items</b>
Safety awareness	0.774	3
Safety delivery	0.835	5
Situational awareness	0.844	5
Wayfinding	0.833	5
Self-awareness	0.839	5

#### 4.5 Normality analysis

Normality testing is to determine whether the sample data are drawn from a population that follows a normal distribution. This assessment is essential because many statistical procedures, particularly parametric techniques such as correlation and regression analyses, are based on the assumption of normality Ghasemi & Zahediasl (2012). When this assumption is desecrated, the validity and reliability of the statistical inferences may be compromised. For skewness and kurtosis values according to George & Mallery (2016) within the range of  $\pm 1.0$  indicate excellent normality for most psychometric data, while values within  $\pm 2.0$  are generally considered acceptable in applied research contexts. Normality can be reasonably assumed when these distributional indices fall within the recommended range.

To assess the normality of the data, several methods were employed, including the analysis of skewness, kurtosis, and the visual inspection of the Q-Q plot. Skewness indicates the asymmetry of the distribution, while kurtosis measures the “tailedness” of the data distribution. In this study, table 4.4 below showed the skewness values ranged from -0.327 to -0.112, and the kurtosis values ranged from -0.567 to 0.829. According to Pallant (2020) , skewness values between -1 and +1 and kurtosis values between -3 and +3 generally suggest that the data is approximately normally distributed. Since the skewness and kurtosis values fall within these acceptable ranges, it indicates that the data follows a normal distribution.

The Q-Q plot was examined to visually assess the normality of the data. The Q-Q plot revealed that the data points closely aligned with the diagonal line, indicating that the data closely approximates a normal distribution. This visual confirmation aligns with the results from the skewness and kurtosis analysis, further supporting the normality of the data. The Q-Q plot results are presented in Appendix H.

Based on these analyses, the data can be considered approximately normal, which justifies the use of parametric statistical methods, such as Pearson correlation and multiple linear regression, for further analysis.

Table 4. 4 Normality test

Descriptive Statistics							
	N	Minimum	Maximum	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
SAA	400	2.00	5.00	-.201	.122	-.290	.243
SAD	400	1.80	5.00	-.293	.122	-.227	.243
SIA	400	1.60	5.00	-.181	.122	-.248	.243
WAY	400	2.00	5.00	-.266	.122	-.236	.243
SEA	400	2.00	5.00	-.325	.122	-.151	.243
Valid N (listwise)	400						

#### 4.6 Pearson correlation analysis

The primary aim of this study was to examine the relationships between the independent variables viz safety delivery, situational awareness, wayfinding and self-awareness and the dependent variable safety awareness. To address this objective, Pearson correlation analysis was conducted. Correlation analysis assesses both the strength and direction of the linear association between pairs of variables. Cohen (1988) mentioned that scale of correlation coefficients is interpreted as follows, the values between 0.10 and 0.29

suggest a weak relationship, coefficients from 0.30 to 0.49 indicate a moderate relationship, and values from 0.50 to 0.99 indicate a strong relationship.

The results presented in Table 4.5 illustrate the Pearson correlation coefficients between safety awareness, safety delivery, situational awareness, wayfinding and self-awareness. All correlations were found to be statistically significant at the  $p < 0.001$  level, with a sample size of 400 respondents.

The analysis revealed that safety awareness is strongly positively correlated with all four independent variables. Specifically, safety awareness shows strong associations with safety delivery ( $r = 0.781, p < .001$ ), situational awareness ( $r = 0.801, p < .001$ ), wayfinding ( $r = 0.811, p < .001$ ), and self-awareness ( $r = 0.790, p < .001$ ). These correlations advise by Cohen (1988) indicated a strong relationship suggesting that improvements in these factors are linked to higher levels of safety awareness among passengers. The independent variables also demonstrate significant interrelationships. Safety delivery shows a strong positive correlation with situational awareness ( $r = 0.825, p < .001$ ) and wayfinding ( $r = 0.820, p < .001$ ), indicating that effective safety communication and procedures are closely related to passengers' ability to perceive safety cues and navigate the ferry environment. Similarly, situational awareness is strongly correlated with wayfinding ( $r = 0.850, p < .001$ ) and self-awareness ( $r = 0.838, p < .001$ ), highlighting the interconnectedness of these variables in contributing to overall safety awareness.

The consistently high correlation coefficients across the variables suggest a cohesive framework for understanding passenger safety awareness, where both operational factors and individual cognitive processing contribute to a comprehensive safety awareness system. These findings support theoretical frameworks such as Situational awareness theory and SERQUAL perspectives, which emphasize the interaction between system-level inputs and individual cognitive processes in shaping safety awareness.

To conclude, all the observed correlations are statistically significant at  $p < .001$ , indicating that the relationships observed are unlikely to have occurred by chance. While the strength of these relationships confirms the relevance of the selected variables, it is important to note that correlation does not imply causality. Regression analysis was conducted in subsequent sections to evaluate the relative influence of each independent variable on passenger safety awareness.

Table 4. 5 Pearson correlation analysis

		Correlations				
		SAA	SAD	SIA	WAY	SEA
SAA	Pearson Correlation	1	.781**	.801**	.811**	.790**
	Sig. (2-tailed)		<.001	<.001	<.001	<.001
	N	400	400	400	400	400
SAD	Pearson Correlation	.781**	1	.825**	.820**	.811**
	Sig. (2-tailed)	<.001		<.001	<.001	<.001
	N	400	400	400	400	400
SIA	Pearson Correlation	.801**	.825**	1	.850**	.838**
	Sig. (2-tailed)	<.001	<.001		<.001	<.001
	N	400	400	400	400	400
WAY	Pearson Correlation	.811**	.820**	.850**	1	.832**
	Sig. (2-tailed)	<.001	<.001	<.001		<.001
	N	400	400	400	400	400
SEA	Pearson Correlation	.790**	.811**	.838**	.832**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	
	N	400	400	400	400	400

\*\* Correlation is significant at the 0.01 level (2-tailed).

Notes: SAA: Safety awareness, SAD: Safety delivery, SIA: Situational awareness, WAY: Wayfinding, SEA: Self-awareness

#### 4.7 Multiple linear regression analysis

This section presents the results of the multiple linear regression analysis conducted to achieve research objective 3 which examines the impact of safety delivery, situational awareness, wayfinding and self-awareness on passengers' safety awareness on ferries in Georgetown terminal, Penang. Multiple linear regression was chosen as the most appropriate analysis method for this study, as it enables the examination of the combined and individual predictive power of multiple independent variables on a single dependent variable.

The model summary in Table 4.6 below explain that the regression model is overall strong, with a correlation coefficient ( $R = 0.853$ ) indicating a very strong positive relationship between the predictors and passengers' safety awareness. This reflected that a large portion of the variability in safety awareness is explained by the predictors. The coefficient of determination ( $R^2 = 0.727$ ) indicates that 72.7% of the variance in passengers' safety awareness is accounted for by the four independent variables. This is a substantial proportion of the total variance, highlighting the strong explanatory power of the model. The adjusted  $R^2$  value (0.724), which slightly reduces the  $R^2$  value to account for the number of predictors in the model, suggests that the model is stable and not overfitted, further supporting the validity of the findings. The standard error of estimate (0.31860) is relatively low, indicating that the predicted values of safety awareness are close to the observed values, thus reinforcing the reliability of the regression model in predicting passenger safety awareness.

Table 4. 6 Model summary

Model Summary <sup>b</sup>										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	Change Statistics			Sig. F Change	Durbin-Watson
						F Change	df1	df2		
1	.853 <sup>a</sup>	.727	.724	.31860	.727	263.210	4	395	<.001	2.012

a. Predictors: (Constant), SEA, SAD, WAY, SIA  
b. Dependent Variable: SAA

#### 4.8 Anova analysis

The analysis of variance (ANOVA) as shown in Table 4.7 below was conducted to assess the overall significance of the regression model. F-value of 263.210 with a significance level of  $p < 0.001$  indicates that the regression model is statistically significant. This result suggests that the combination of safety delivery, situational awareness, wayfinding and self-awareness collectively predicts passengers' safety awareness.

The null hypothesis, which states that the independent variables do not collectively influence passengers' safety awareness, is rejected. This outcome confirms that the model explains a substantial amount of the variance in safety awareness among ferry passengers. The significant F-value reinforces the suitability of the regression model for explaining the factors that contribute to passengers' safety awareness within the domestic ferry context.

The ANOVA results also provide further validation that the predictors included in the model are relevant and jointly contribute to enhancing passengers' safety awareness. Although multicollinearity could be a concern in models with closely related predictors,

the statistical significance of the model suggests that, despite potential correlations, the independent variables work together to explain safety awareness effectively

Table 4. 7 ANOVA

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	106.872	4	26.718	263.210	<.001 <sup>b</sup>
	Residual	40.096	395	.102		
	Total	146.968	399			

a. Dependent Variable: SAA

b. Predictors: (Constant), SEA, SAD, WAY, SIA

#### 4.9 Regression analysis

The results of the multiple regression analysis, as shown in Table 4.8 as below, highlight the individual contributions of the four independent variables safety delivery, situational awareness, wayfinding and self-awareness to passenger safety awareness while controlling for the effects of other variables. The regression coefficients show that all four predictors are statistically significant at the  $p < 0.001$  level.

Safety delivery has a positive and significant relationship with passenger safety awareness ( $B = 0.205$ ,  $\beta = 0.191$ ,  $p < 0.001$ ), indicating that more effective safety information delivery—such as clear safety briefings, visible safety instructions, and emergency demonstrations—leads to higher levels of safety awareness among passengers. Similarly, situational awareness is positively correlated with safety awareness ( $B = 0.225$ ,  $\beta = 0.220$ ,  $p < 0.001$ ). This suggests that passengers who are more aware of their surroundings, including emergency cues and the onboard environment, tend to have higher safety awareness. These findings are consistent with

situational awareness theory, which emphasizes the role of environmental awareness in shaping safety-related behaviors.

Among the independent variables, wayfinding (WAY) emerged as the strongest predictor of passenger safety awareness ( $B = 0.327$ ,  $\beta = 0.299$ ,  $p < 0.001$ ). This result shows that clear signage, easily identifiable emergency exits, and effective navigation systems significantly enhance passengers' ability to navigate the ferry and respond appropriately during evacuations, ultimately improving their safety awareness. Self-awareness also shows a positive and statistically significant effect on passenger safety awareness ( $B = 0.216$ ,  $\beta = 0.202$ ,  $p < 0.001$ ). This indicates that passengers who are more conscious of their personal responsibilities and preparedness during emergencies are more likely to exhibit greater safety awareness.

In conclusion, all four independent variables safety delivery, situational awareness, wayfinding and self-awareness significantly contribute to passengers' safety awareness, supporting the idea that both environmental and individual factors play a crucial role in shaping overall safety awareness. These findings suggest that a holistic approach, incorporating both system-level safety measures and individual cognitive factors, is essential for enhancing passenger safety awareness on ferries.

Table 4. 8 Regression analysis

		Coefficients <sup>a</sup>					Collinearity Statistics	
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Tolerance	VIF
		B	Std. Error	Beta				
1	(Constant)	.175	.117		1.500	.134		
	SAD	.205	.057	.191	3.624	<.001	.250	4.001
	SIA	.225	.060	.220	3.762	<.001	.202	4.947
	WAY	.327	.063	.299	5.223	<.001	.211	4.744
	SEA	.216	.059	.202	3.680	<.001	.228	4.380

a. Dependent Variable: SAA

#### 4.10 Multicollinearity and construct distinctiveness

To assess multicollinearity among the independent variables viz safety delivery, situational awareness, wayfinding and self-awareness, Variance Inflation Factor (VIF) was calculated. The VIF values for the independent variables ranged from 4.001 to 4.947 as shown in Table 4.8 regression analysis, which are below the threshold of 10, suggesting that multicollinearity is not a significant concern in this model (Ven et al., 2002). These values indicate that the independent variables are sufficiently distinct from each other and do not exhibit problematic levels of correlation that could distort the regression coefficients.

However, the relatively high correlations observed between certain predictors, particularly between wayfinding and situational awareness ( $r = 0.850$ ), suggest some overlap between these constructs. While VIF values are acceptable, these correlations indicate that 2 variables are conceptually similar and might be reflecting overlapping aspects of passengers' ability to navigate and perceive their environment. This could affect the interpretation of the individual contributions of wayfinding and situational awareness in the regression model.

Although multicollinearity is not a major issue, the potential overlap between wayfinding and situational awareness suggests that these variables are not entirely distinct. To further address these concerns, future research could benefit from using Structural Equation Modeling, which would allow for the modeling of latent variables and more accurately capture the relationships between these predictors.

In conclusion, while the VIF results indicate no severe multicollinearity, the high intercorrelations between some of the predictors should be acknowledged. These findings suggest that the wayfinding and situational awareness variables may be conceptually overlapping, and using methods like SEM could help further clarify their distinctiveness and better interpret their individual effects on passenger safety awareness.

#### **4.11 Hypothesis and relationship between variables**

The purpose of this section is to summarise the relationships between the independent variables and passengers' safety awareness, also the findings within the proposed conceptual framework. The regression analysis confirms that all four hypotheses proposed in this study are supported explain below. Safety delivery (H1), situational awareness (H2), wayfinding (H3) and self-awareness (H4) each demonstrate a positive and statistically significant relationship with passengers' safety awareness. These findings indicate that passengers' safety awareness is influenced by a combination of external system-related factors and internal cognitive and behavioural factors.

#### 4.11.1 Safety awareness for safety delivery

Hypothesis H1 proposed that there is a positive and significant relationship between safety delivery and passengers' safety awareness. The regression results safety delivery has a positive and statistically significant effect on passengers' safety awareness ( $p < 0.001$ ). H1 is supported, the finding suggests that the safety information is communicated to passengers plays a vital role in shaping their level of safety awareness.

An effective safety delivery, including clear safety briefings, demonstrations, announcements and visible instructional materials help to enhances passengers' understanding of safety procedures and emergency responses. The result is constant with previous maritime and transportation safety literature which underline that clear communicated safety information significantly enhance passenger awareness and compliance (Lau et al., 2020).

Based on theoretical perspective, this finding aligns with the Service Quality (SERVQUAL) framework, information delivery and assurance are main dimensions persuading users' perceptions and behavioural responses. When safety instructions are delivered in a clear, timely with understandable manner, passengers are likely to accept the information and alert to possible risks (Parasuraman et al., 1988). Similar findings by Rahman et al.,(2022), found that ineffective or technical safety communication often leads to passenger disengagement and reduce safety awareness.

In the context of domestic ferry operations in Malaysia the finding suggests that improvements in safety delivery practices can directly enhance passengers' safety awareness, supporting the acceptance of H1.

#### 4.11.2 Safety awareness for situational awareness

Hypothesis H2 showed situational awareness positively influences passengers' safety awareness. The regression results confirm a statistically significant positive relationship between situational awareness and passengers' safety awareness ( $p < 0.001$ ). H2 is supported. This finding indicates that passengers that alert to their surroundings, aware of emergency cues and capable of interpreting environmental signals tend to exhibit higher levels of safety awareness. This outcome is strongly supported by Situational awareness theory and safety awareness as a function of perception, comprehension and prediction of environmental elements (Endsley, 1995).

Empirical evidence from previous studies supports this relationship. As study by Wang et al., (2021) and Shiwakoti et al., (2019) claim found that passengers with higher situational awareness demonstrated quicker recognition of emergency conditions and safer decision-making behaviour during evacuation situations.

In context of ferry, situational awareness is influenced by vessel layout, visibility of safety features and passengers' familiarity with the environments. The significant relationship proposes by enhancing situational awareness through environmental design and informational cues can effectively improve safety awareness. The results confirm a significant positive relationship between situational awareness and

passengers' safety awareness ( $p < 0.001$ ) indirectly support H2. This proposes that passengers' ability to distinguish and interpret their environments plays an important role in robust safety awareness.

#### 4.11.3 Safety awareness for wayfinding

Hypothesis H3 stated that wayfinding has a positive and significant impact on passengers' safety awareness. The regression analysis exposes that wayfinding is the strongest predictor of passengers' safety awareness and is statistically significant ( $p < 0.001$ ). H3 is supported. This finding specifies that passengers' ability to easily locate exits, emergency equipment and escape routes significantly enhances the safety awareness. Literature by Shiwakoti et al., (2016) stated that clear signage, consistent symbols and spatial layouts enable passengers to map their environment, indirectly increasing confidence and preparedness during evacuation. This result is consistent with previous studies that identified wayfinding as a critical determinant of safety performance in transportation settings.

Previous research by Wang et al., (2021) advised building evacuation contexts has shown that inadequate wayfinding systems often lead to confusion, hesitation and also congestion during emergencies. An effective wayfinding enhances both cognitive understanding and behavioural readiness, allowing passengers to respond more efficiently to safety threats.

The importance of wayfinding in this study suggests that physical and visual design elements play an important role in shaping safety awareness than informational

delivery. In the domestic ferry context, the need for ferry operators to prioritise wayfinding design as a core safety strategy, by this means supporting the acceptance of H3.

#### 4.11.4 Safety awareness for self-awareness

Hypothesis H4 proposed a positive and significant relationship among self-awareness and passengers' safety awareness. The regression results demonstrate that self-awareness showed a statistically significant positive effect on passengers' safety awareness ( $p < 0.001$ ) which mean H4 is supported.

This finding shows that passengers' recognise their own responsibility, preparedness and behavioural role during emergency situations tend to show higher levels of safety awareness. Self-awareness reflects an internal perceptive where individuals acknowledge potential risks and responses appropriately, which is important for effective safety behaviour (Ajzen, 1991).

Earlier research have highlight that safety awareness is not only shaped by external systems but is also influenced by individual attitudes and psychological readiness. Rahman et al., (2022) found that passengers with high self-awareness are pay more attention to safety briefings and comply with safety instructions. In the same way, research by Griffin & Neal, (2000) demonstrated that individual safety awareness enables the relationship between safety systems and actual safety behaviour.

Self-awareness in this study possible influenced by prior travel experience and personal responsibility for safety. The significant relationship were suggests that (Chang & Liao, 2009) enhancing passengers' self-awareness through education or awareness campaigns help to complement structural safety measures indirectly strengthening safety awareness also supporting H4.

#### 4.12 Summary of hypothesis testing

As a result, table 4.9 below illustrated summary of hypothesis. Independent variable safety delivery, situational awareness, wayfinding and self-awareness each have a positive and statistically significant impact on passengers' safety awareness. Among these variables, wayfinding demonstrates the strongest influenced, followed by situational awareness, self-awareness and safety delivery. These findings collectively indicate that passengers' safety awareness on domestic ferries is shaped by both system-level factors, such as safety communication and environmental design and individual-level factor or perception and self-awareness. The results provide a strong empirical foundation for the discussion and recommendations presented in the subsequent chapter.

Table 4. 9 Summary of hypothesis

Hypothesis	Results
H1 There is a positive relationship between safety delivery and passengers' safety awareness.	Supported
H2 There is a positive relationship between situational awareness and passengers' safety awareness.	Supported
H3 There is a positive relationship between wayfinding and passengers' safety awareness.	Supported
H4 There is a positive relationship between self-awareness and passengers' safety awareness.	Supported

## **CHAPTER FIVE : CONCLUSION AND RECOMMENDATIONS**

### **5.1 Conclusion**

This study aimed to explore the factors influencing passenger safety awareness aboard domestic ferries operating between Georgetown - Butterworth, Penang, with a specific focus on the roles of safety delivery, situational awareness, wayfinding and self-awareness. The study employed various analytical techniques, including descriptive statistics, Pearson correlation, multiple regression analysis and ANOVA to evaluate the relationships between these variables and their collective impact on passengers' safety awareness.

The results indicate that all four independent variable safety delivery, situational awareness, wayfinding and self-awareness have statistically significant positive relationships with safety awareness. The regression analysis revealed that wayfinding was the strongest predictor, followed by situational awareness, self-awareness, and safety delivery. This confirms that effective safety measures and passenger preparedness, both cognitive and environmental, significantly enhance safety awareness. There is four theories applied viz Situational Awareness, TPB, Spatial Cognition theory and Service Quality theory as it demonstrate the importance of both individual cognitive factors such as self-awareness and environmental factors for example safety delivery and wayfinding in determining passenger safety awareness.

Resulting wayfinding emerged as the most influential factor, emphasizing the importance of clear signage, visible emergency exits, and effective navigation systems to help passengers respond to safety cues effectively, especially during emergencies. Situational awareness and self-awareness also contributed significantly, highlighting

the role of passengers' ability to perceive and interpret environmental cues, and their awareness of their personal responsibility in maintaining safety.

## **5.2 Implications of study**

This section outlines the implications of the study's findings, divided into three key areas viz theoretical implications, practical implications and policy implications. Each area highlights the significance of the results in advancing knowledge and guiding improvements in the ferry industry.

### **5.2.1 Theoretical Implications**

The relationship between situational awareness and passengers' safety awareness supports Endsley, (1995) framework, which emphasizes how awareness involves the processes of perception, comprehension and prediction of environmental information. The results of this study show that situational awareness is not only relevant in operational contexts but also plays a significant role in enhancing passengers' safety awareness. This emphasizes the importance of environmental cues and the passengers' ability to perceive and interpret these cues to respond effectively during emergencies.

The study also highlights the importance of wayfinding as a key factor in safety awareness, which relate with the concept of Spatial Cognition theory by Kwon et al., (2025). Wayfinding has emerged as the strongest predictor, supporting the idea that spatial clarity and environmental cues play a critical role in influencing passengers' awareness and interpretive processes. This theoretical contribution underscores the interaction between the physical environment and passenger cognition, aligning with previous research on wayfinding and safety cognition (Shiwakoti et al., 2019).

The significant effect of safety delivery on safety awareness provides empirical support for the SERVQUAL dimensions of assurance, responsiveness and tangibles (Parasuraman et al., 1988). This reinforces the idea that clear communication, visible safety equipment, and competent crew responses enhance passengers' understanding and confidence in their safety awareness. The study validates the theoretical assumption that service quality in safety delivery directly influences cognitive and behavioral safety awareness.

The significant part of self-awareness complements both the situational awareness framework and TPB by Ajzen, (1991) highlighting the importance of individual responsibility and psychological readiness in safety-related behaviors. This finding suggests that safety awareness is shaped by both service provision and passenger cognition with the integration of cognitive theories and environmental factors.

In conclusion, the integration of all theories provides a comprehensive theoretical explanation of passenger safety awareness. This contribution expands maritime safety literature by demonstrating that effective safety outcomes require a synergy between environmental design, service quality and individual cognitive engagement.

### 5.2.3 Practical Implications

The findings of this study offer several practical implications for ferry operators and maritime service providers. One of the key findings is that wayfinding is the most influential predictor of passenger safety awareness. This suggests that ferry operators should prioritize the improvement of wayfinding systems, including the use of clear signage, standardized safety symbols, and intuitive spatial layouts. Ensuring that passengers can easily locate emergency exits, assembly points and safety equipment is critical for improving safety awareness and facilitating effective evacuation. Previous studies have also emphasized the importance of wayfinding clarity in improving safety awareness and evacuation performance in transport environments (Wang et al., 2021).

Situational awareness is heavily influenced by environmental conditions on board ferry vessels. Adequate lighting, clear signage and emergency exits for safety features enhance passenger's ability to perceive and interpret safety cues. These environmental improvements align with the perception and comprehension stages of situational awareness Endsley, (1995) and can be applied without significant operational disruptions.

Safety delivery remains a crucial element in passenger safety management. Effective safety briefings, announcements and demonstrations should be distributed in a clear, concise and accessible manner. The use of visual aids, digital displays and multilingual communication is especially important for accommodating diverse passenger demographics. Consistent with SERVQUAL theory (Parasuraman et al., 1988) effective safety communication enhances passengers' confidence and attentiveness toward safety procedures, ultimately improving safety outcomes.

The importance of self-awareness suggests that ferry operators should consider safety awareness campaigns and visual reminders that emphasize personal responsibility. These initiatives are especially relevant for frequent passengers who may become complacent due to routine exposure to the service. Encouraging passengers to engage with safety information and take personal responsibility for their actions during emergencies can improve overall safety awareness

### 5.2.3 Policy Implications

At the policy level, the study suggests that maritime safety regulations should not only focus on technical compliance and equipment provision but also integrate human-centered design and cognitive considerations. Maritime authorities could consider incorporating wayfinding standards and situational awareness principles into vessel certification processes, such as safety audits and inspection guidelines. Requirements related to signage visibility and spatial layout would strengthen the effectiveness of existing regulatory frameworks, ensuring that the environmental design supports passengers' perception and comprehension of safety information (Endsley, 1995).

Policy initiatives encourage ferry operators to adopt consistent passenger safety communication strategies, as emphasized in the (IMO, 2025b) guidelines. This could include standardized safety briefings, visual communication and multilingual information delivery (Shiwakoti et al., 2019) to ensure consistency across domestic ferry services. These policies would improve passenger safety awareness by ensuring that safety measures are communicated clearly and effectively communication strategies through standardised guidelines for safety briefings, visual communication

and multilingual information delivery. These policies result in consistency in safety practices across domestic ferry services also improve passenger safety awareness.

The study also supports a policy approach that recognizes passengers as active participants in the safety system. By aligning regulatory requirements with environmental design, service quality and individual cognition, policymakers can improve safety awareness and strengthen overall safety outcomes in domestic ferry operations. This approach aligns with the TPB (Ajzen, 1991) which suggests that passenger safety awareness is influenced not only by external factors but also by individual cognitive and behavioral intentions.

### **5.3 Research contribution**

This study offers significant contributions to theory, practice and policy regarding passenger safety awareness in the ferry context. The contributions can be categorized into three primary areas.

#### **5.3.1 Theoretical contribution**

The theoretical contribution of this study lies in its integration of multiple theories to explain the factors influencing passenger safety awareness. This study integrates all four theories especially the underpinning TPB which together provide a comprehensive framework for understanding how both environmental factors viz wayfinding and safety delivery also cognitive processes which is self-awareness and situational awareness interact to shape passengers' safety behaviors.

Situational awareness theory (Endsley 1995) is extended by demonstrating that passengers' ability to perceive, comprehend and predict safety-related events is crucial not only in operational contexts but also in the ferry environment, where passengers must recognize and respond to safety cues effectively. The study contributes to TPB (Ajzen, 1991) by showing that attitudes, subjective norms and perceived behavioral control influence safety awareness and behavioral intentions in ferry settings. This extends TPB by showing how passenger cognition which is self-awareness and social influences viz safety delivery contribute to safety-related behaviors in a real-world setting.

This theoretical integration offers new insights into the factors that shape safety awareness in the maritime context and highlights the interplay between individual cognition and environmental design in promoting safety

### 5.3.2 Practical contribution

The practical contribution of this research was particularly valuable for ferry operators and maritime service providers because it identified the most influential predictors of passengers' safety awareness and translated them into actionable operational improvements. Since wayfinding emerged as the strongest predictor, operators were encouraged to prioritise upgrades to wayfinding systems by implementing clear and consistently placed signage, standardised safety symbols, intuitive spatial layouts and highly visible markings for emergency exits, assembly points and safety equipment so that passengers could navigate quickly and confidently during emergencies. The findings also highlighted the importance of situational awareness therefore operators were advised to strengthen environmental cues that supported passengers' perception

and interpretation of risk through adequate lighting, unobstructed sightlines, clear exit visibility, well maintained safety equipment locations and crowd management measures especially during peak periods. In addition the study reinforced the role of safety delivery therefore safety briefings, announcements and demonstrations needed to be delivered in a clear, concise and multilingual manner with consistent messages across trips and supported by visual aids such as posters, diagrams, onboard screens and digital displays to improve understanding and recall across diverse passenger groups. The results further indicated that self-awareness contributed to safety awareness therefore operators could promote personal preparedness through safety campaigns, reminders of individual responsibility, simple do's and don'ts messaging and where feasible short interactive elements such as QR linked videos or brief scenario based prompts that encouraged passengers to notice exits and safety equipment upon boarding. Collectively these practical measures strengthened routine safety practice, improved passenger readiness and increased the likelihood of appropriate responses during emergency situations.

### 5.3.3 Policy contribution

At the policy level, this study provided useful insights into how maritime safety regulations could be strengthened to enhance passengers' safety awareness and preparedness. The findings indicated that policy improvements were needed in three key areas. First wayfinding and environmental design standards should be embedded within vessel certification processes, operational licensing requirements and routine safety audits by mandating clear and consistent signage, high visibility emergency exits, universally understood symbols, adequate lighting and intuitive spatial layouts

that support passengers' navigation and decision making during emergencies. Second safety communication should be standardised across ferry operators through minimum regulatory requirements for safety briefings, onboard announcements and visual cues that were clear, consistent and accessible including multilingual delivery, passenger friendly wording and the use of visual and digital formats such as posters, videos and QR based safety information to improve comprehension and recall. Third policy frameworks should position passengers as active participants in safety by encouraging operators to implement engagement initiatives such as periodic awareness campaigns, reminders of personal responsibility, simple scenario based guidance and where feasible short interactive drills or demonstrations particularly during peak periods when crowding may increase risk. In addition stronger monitoring and enforcement mechanisms could be incorporated by requiring documented compliance checks, periodic assessments of signage and briefing quality and passenger feedback channels so that safety communication and wayfinding improvements remained consistent across routes and over time.

#### **5.4 Research gap**

While this study provided valuable insights into the factors influencing passengers' safety awareness, several research gaps remained and these gaps created opportunities for future studies to extend understanding of safety behaviours in the maritime context. First this study examined four predictors viz safety delivery, situational awareness, wayfinding and self-awareness yet other influential factors were not included such as ferry crew behaviour, organisational safety culture, enforcement practices and environmental conditions including weather, vessel design and overcrowding which may shape passengers' attention, decision making and compliance during routine

operations and emergencies. Second the study relied on a cross-sectional design which captured safety awareness at a single point in time and did not reflect how awareness and behaviour might evolve with repeated ferry use, exposure to safety messages or changes in operating conditions therefore longitudinal designs could provide stronger evidence of change over time and improve causal inference. Third the study used self-reported questionnaire responses which were vulnerable to recall error and social desirability bias therefore future studies could strengthen validity by incorporating objective or behavioural measures such as observation of passenger responses during briefings, compliance checks, scenario based assessments or triangulation using operator records and qualitative interviews. In addition the study focused on a single ferry route and sampling approach which may have limited generalisability to other routes, terminals or regions hence future research could adopt broader multi-site sampling and comparative designs across different ferry services. Finally future studies could apply latent variable modelling such as Structural Equation Modelling including PLS-SEM or AMOS SEM to test the measurement properties of the constructs and to examine more complex relationships including mediating and moderating effects which may offer deeper insight into how multiple factors jointly influence passengers' safety awareness.

### **5.5 Recommendation for future research**

Several recommendations for future research are proposed. Future studies could employ Structural Equation Modelling (Sarstedt et al., 2014) to examine relationships between latent variables more comprehensively as this approach would provide more precise estimates of the effects of cognitive factors such as self-awareness and environmental factors such as wayfinding on passengers' safety awareness. SEM would

also enable the testing of both direct and indirect relationships including potential mediating and moderating effects. In particular the use of advanced SEM techniques such as Partial Least Squares SEM (PLS-SEM) and covariance-based SEM using AMOS is recommended as these methods allow simultaneous assessment of measurement and structural models (Sarstedt et al., 2014). PLS-SEM may be especially suitable for predictive or exploratory models with complex relationships and non-normal data while AMOS SEM may support stronger theory confirmation and model fit evaluation when the theoretical framework is well established. In addition future research could extend beyond the Penang ferry context to other regions in Malaysia or international settings to compare the effectiveness of safety practices across different ferry services and to identify common factors influencing safety awareness. Further studies could also incorporate ferry crew behaviour as crew actions such as conducting safety drills and assisting passengers during emergencies may significantly influence passengers' safety awareness and safety outcomes. Future research could examine contextual and environmental conditions such as weather, ferry design and overcrowding as these factors may affect passengers' situational awareness and their ability to respond appropriately during emergency situations.

## **5.6 Chapter summary**

This chapter concluded the study by summarising the key findings, contributions and implications. The study examined factors influencing passengers' safety awareness on ferries with specific attention to safety delivery, situational awareness, wayfinding and self-awareness. The findings showed that all four variables contributed significantly to passengers' safety awareness with wayfinding emerging as the strongest predictor,

indicating that clear navigation cues and effective spatial guidance played a critical role in supporting safe behaviour. The study contributed theoretically by integrating Situational awareness theory and TPB to provide a more comprehensive framework for explaining how cognitive processing, behavioural intention and environmental cues influenced safety-related behaviour in ferry settings. Practically the study offered actionable implications for ferry operators including strengthening wayfinding systems through clearer signage and layout design, improving the clarity and consistency of safety delivery and promoting self-awareness initiatives to encourage preparedness and compliance. From a policy perspective the results supported the need for more standardised safety communication and stronger integration of wayfinding principles into maritime safety guidelines and operational requirements. Finally this chapter highlighted remaining gaps and directions for future research including the use of longitudinal designs to capture changes in safety awareness over time and the application of advanced modelling approaches such as PLS-SEM and AMOS to examine direct and indirect effects as well as potential mediating and moderating relationships. Future studies were also encouraged to broaden the research context beyond Penang to other ferry routes, to examine ferry crew behaviour and emergency response practices and to consider additional environmental conditions such as weather, vessel design and overcrowding that may shape passengers' situational awareness and overall safety outcomes.

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### **DECLARATION**

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; and any editorial work, paid or unpaid, carried out by a third party is acknowledged.

### **DECLARATION OF COMPETING INTEREST**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## APPENDICES

### APPENDIX A: TURNITIN REPORT

FACTORS INFLUENCING PASSENGERS' SAFETY AWARENESS ON DOMESTIC FERRIES IN PENANG			
ORIGINALITY REPORT			
12%	10%	8%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS
PRIMARY SOURCES			
1	<a href="http://hdl.handle.net">hdl.handle.net</a> Internet Source		1%
2	<a href="http://coek.info">coek.info</a> Internet Source		<1%
3	<a href="http://etd.aau.edu.et">etd.aau.edu.et</a> Internet Source		<1%
4	Yui-yip Lau, Chin-Shan Lu, Hsiang-Kai Weng. "The effects of safety delivery and safety awareness on passenger behaviour in the ferry context", Maritime Policy & Management, 2020 Publication		<1%
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## **APPENDIX B: QUESTIONNAIRE**



### **SURVEY QUESTIONNAIRE ON SAFETY DELIVERY, SITUATIONAL AWARENESS, WAYFINDING AND SELF-AWARENESS PREDICTION OF FERRY PASSENGER SAFETY AWARENESS IN PENANG**

Dear Respondent.

I am Fathin Nabilah Jelani, Final Year Students of MBA Logistics and Transportation at University Utara Malaysia (UUM). I am conducting a research titled “Safety delivery, situational awareness, wayfinding and self-awareness prediction of ferry passenger safety awareness in Penang ”

This research aims to examine how various factors, such as safety delivery, situational awareness, wayfinding and self-awareness influence the passengers’ safety awareness on domestic ferries in Penang. I’m pleased to invite you to participate in this survey. This questionnaire takes approximately 5-10 min to complete.

Your feedback and perspectives are crucial for attaining the goals of this research. The information remains confidential and utilized solely for academic reasons. Your contribution to the success of this research was highly valued. Thank you.

<b>Section A – Demographic information</b> <b>Bahagian A- Maklumat demografi</b>		<b>Any comment/s?</b>
Gender <i>Jantina</i>	1. Male <i>Lelaki</i>	
	2. Female <i>Perempuan</i>	
Age <i>Umur</i>	1. 18 - 30	
	2. 31 - 40	
	3. 41 - 50	
	4. 51 - 60	
	5. 61 and above <i>61 dan ke atas</i>	
Race <i>Bangsa</i>	1. Malay <i>Melayu</i>	
	2. Chinese <i>Cina</i>	
	3. Indian <i>India</i>	
	4. Others <i>Lain-lain</i>	
Education <i>Pendidikan</i>	1. Primary school <i>Sekolah rendah</i>	
	2. Secondary school <i>Sekolah Menengah</i>	
	3. Diploma <i>Diploma</i>	

	4. Pre-University (E.g: Foundation,Matrikulation,STPM)  <i>Pra Universiti (Cth Asasi,Matrikulasi,STPM)</i>	
	5. Degree and above <i>Ijazah sarjana dan ke atas</i>	
Occupation <i>Pekerjaan</i>	1. Student <i>Pelajar</i>	
	2. Employee <i>Pekerja</i>	
	3. Others <i>Lain-lain</i>	
Purpose of the trip <i>Tujuan perjalanan</i>	1. Working <i>Urusan pekerjaan</i>	
	2. College/University <i>Belajar kolej/Universiti</i>	
	3. Travel <i>Melancong</i>	
Frequency of using ferry (per year) <i>Kekerapan menggunakan feri (dalam setahun)</i>	1. 1-2 times	
	2. 3-4 times	
	3. 5 and above	

<b>Section B: Predictors influencing passengers' safety awareness on ferry in Penang</b>						
<b>Bahagian B: Peramal-peramal yang mempengaruhi kesedaran keselamatan penumpang feri domestik di Pulau Pinang</b>						
Likert scale 1-5 1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly Disagree						
<b>Safety awareness Kesedaran keselamatan</b>						
No.	Questions	1	2	3	4	5
1.	I am aware of the relevant safety regulations of the ferry while on board. <i>Saya sedar di mana peraturan keselamatan semasa berada di atas feri.</i>					
2.	I thoroughly read the information provided on the ferry's safety poster. <i>Saya telah membaca dengan teliti maklumat yang diberikan pada poster keselamatan feri.</i>					
3	I will respond correctly if an emergency happens on the ferry. <i>Saya akan bertindak dengan betul sekiranya berlaku kecemasan di atas feri.</i>					

<b>Situational awareness Kesedaran Situasi</b>						
No.	Questions	1	2	3	4	5
1.	I am aware of the evacuation alarm and its procedures. <i>Saya tahu di mana butang kecemasan dan prosedur.</i>					
2.	I will promptly report to the staff when I notice any suspicious items or behaviour from passengers. <i>Saya melaporkan kepada kakitangan apabila saya melihat sebarang atau tingkah laku yang mencurigakan daripada penumpang.</i>					
3.	I am aware that the ferry is overloaded. <i>Saya sedar sama ada feri telah terlebih muatan.</i>					
4.	I am aware if the ferry is exceeding its safe speed. <i>Saya sedar jika feri melebihi had laju yang di tetapkan.</i>					
5.	I am concerned about the appearances of the crew. (Ex: Fatigue, Sleepy). <i>Saya bimbang tentang penampilan anak kapal. (Contoh: keletihan, mengantuk)</i>					

<b>Wayfinding Pandu arah</b>						
No.	Questions	1	2	3	4	5
1.	The emergency plan is visible to me <i>Saya perasan pelan kecemasan kelihatan pada saya.</i>					
2.	The emergency exit signs are noticeable to me. <i>Saya tahu di mana pintu keluar kecemasan berada.</i>					
3.	The emergency announcements are noticeable to me. <i>Pengumuman kecemasan ketara pada saya.</i>					
4.	The alternative entrance/exit is noticeable to me. <i>Pintu keluar/ masuk alternatif ketara pada saya.</i>					
5.	The emergency assembly point is noticeable to me. <i>Saya tahu di mana titik perhimpunan (assembly point) berada.</i>					

<b>Self-awareness Kesedaran diri</b>						
No.	Questions	1	2	3	4	5
1.	I am aware of where the fire alarm call point is located. <i>Saya dimana lokasi panggilan penggera kebakaran berada.</i>					
2.	I know how to correctly wear a life jacket. <i>Saya tahu bagaimana cara memakai jaket keselamatan dengan betul.</i>					
3.	I need to fasten my seat belt for the entire duration of the trip <i>Saya perlu memasang tali pinggang keledar sepanjang perjalanan.</i>					
4.	I am aware of the position of lifeboats. <i>Saya sedar kedudukan bot keselamatan.</i>					
5.	I pay attention to safety demonstration or announcement made by the crew before or during the trip. <i>Saya memberi perhatian kepada demonstrasi keselamatan atau pegumuman yang di buat oleh krew sebelum atau semasa perjalanan.</i>					

<b>Safety delivery <i>Penyampaian keselamatan</i></b>						
No.	Questions	1	2	3	4	5
1.	The life-saving equipment available on the ferry is sufficient <i>Saya percaya bahawa peralatan menyelamatkan yang mencukupi di atas feri.</i>					
2.	The fire-fighting equipment on the ferry is adequate and well-maintained <i>Saya percaya bahawa peralatan memadam kebakaran mencukupi di atas feri dan diselenggara dengan baik.</i>					
3.	Medical equipment on board is sufficient to handle emergencies. <i>Saya percaya bahawa peralatan perubatan di atas feri mencukupi apabila berlaku kecemasan.</i>					
4.	The ferry crew actively provides clear safety guidance and alerts during the trips. <i>Krew feri secara aktif memberikan pengumuman keselamatan yang jelas dan maklum semasa perjalanan</i>					
5.	The ferry crew provided a clear and understandable safety demonstration via video before departure. <i>Saya perhati bahawa krew feri memberikan demonstrasi keselamatan yang jelas dan difahami melalui video sebelum berlepas.</i>					

## APPENDIX C: QUESTIONNAIRE VALIDATION

Content Validate Version

Further comments (If any):

Proceed with the questionnaire.

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Content validation evaluated by, (Name, signature and stamping)



Date: 01 Oct 2025

Content Validate Version

Further comments (If any):

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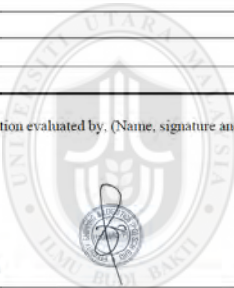
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Content validation evaluated by, (Name, signature and stamping)



Eileen Ng

Date: 05 OCT 2025

Content Validate Version

Further comments (If any):

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Content validation evaluated by, (Name, signature and stamping)

A handwritten signature in black ink.

Naim Yusli (Penang ferry passenger)

Date: 28/10/25

## APPENDIX D: DESCRIPTIVE ANALYSIS OF RESPONDENTS'

### DEMOGRAPHIC PROFILES

#### **Gender**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	192	48.0	48.0	48.0
	Female	208	52.0	52.0	100.0
	Total	400	100.0	100.0	

#### **Age**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 – 30	136	34.0	34.0	34.0
	31 – 40	100	25.0	25.0	59.0
	41 – 50	78	19.5	19.5	78.5
	51 – 60	51	12.8	12.8	91.3
	61 and above	35	8.8	8.8	100.0
	Total	400	100.0	100.0	

#### **Race**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Malay	151	37.8	37.8	37.8
	Chinese	186	46.5	46.5	84.3
	Indian	38	9.5	9.5	93.8
	Others	25	6.3	6.3	100.0
	Total	400	100.0	100.0	

### Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary School	41	10.3	10.3	10.3
	Secondary School	103	25.8	25.8	36.0
	Pre-University (E.g. Foundation, Matrikulasi, STPM)	81	20.3	20.3	56.3
	Diploma	86	21.5	21.5	77.8
	Degree and above	89	22.3	22.3	100.0
	Total	400	100.0	100.0	

### Frequency of using ferry per year

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 – 2 Times	127	31.8	31.8	31.8
	3 – 4 Times	160	40.0	40.0	71.8
	5 and above	113	28.2	28.2	100.0
	Total	400	100.0	100.0	

### Purpose of using ferry

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Work	151	37.8	37.8	37.8
	College	93	23.3	23.3	61.0
	Travel	103	25.8	25.8	86.8
	Local Resident	53	13.3	13.3	100.0
	Total	400	100.0	100.0	

### Types of Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Student	105	26.3	26.3	26.3
	Employee	256	64.0	64.0	90.3
	Unemployed	39	9.8	9.8	100.0
	Total	400	100.0	100.0	

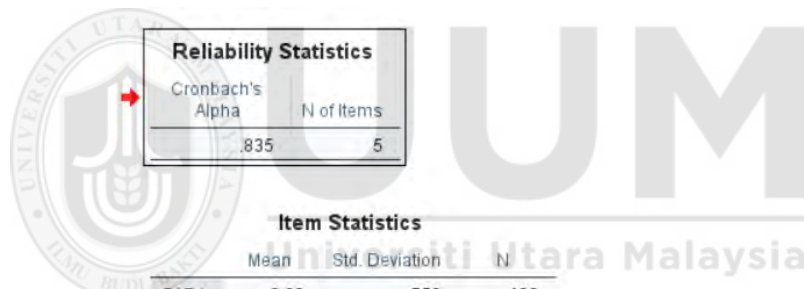
## APPENDIX E : DESCRIPTIVE STATISTICS OF THE VARIABLE

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
SAA	400	2.00	5.00	3.8717	.60691
SAD	400	1.80	5.00	3.8315	.56436
SIA	400	1.60	5.00	3.7460	.59242
WAY	400	2.00	5.00	3.8360	.55522
SEA	400	2.00	5.00	3.7765	.56970
Valid N (listwise)	400				

## APPENDIX F: RELIABILITY TEST

### 1. Safety delivery



**Reliability Statistics**

Cronbach's Alpha	N of Items
.835	5

**Item Statistics**

	Mean	Std. Deviation	N
SAD1	3.60	.750	400
SAD2	3.68	.715	400
SAD3	4.06	.728	400
SAD4	3.98	.716	400
SAD5	3.85	.727	400

**Item-Total Statistics**

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SAD1	15.56	5.280	.616	.807
SAD2	15.48	5.358	.633	.802
SAD3	15.10	5.308	.633	.802
SAD4	15.18	5.256	.668	.792
SAD5	15.31	5.331	.626	.804

## 2. Situational awareness

Cronbach's Alpha	N of Items
.844	5

	Mean	Std. Deviation	N
SIA1	3.80	.740	400
SIA2	3.80	.724	400
SIA3	3.51	.756	400
SIA4	3.75	.777	400
SIA5	3.87	.778	400

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SIA1	14.93	5.913	.643	.814
SIA2	14.93	5.837	.689	.802
SIA3	15.22	5.856	.641	.814
SIA4	14.98	5.759	.646	.813
SIA5	14.86	5.810	.629	.817

## 3. Wayfinding

Cronbach's Alpha	N of Items
.833	5

	Mean	Std. Deviation	N
WAY1	4.30	.680	400
WAY2	3.92	.696	400
WAY3	3.61	.711	400
WAY4	3.55	.758	400
WAY5	3.81	.737	400

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
WAY1	14.88	5.316	.615	.805
WAY2	15.26	5.185	.642	.797
WAY3	15.58	5.122	.646	.796
WAY4	15.63	4.990	.633	.800
WAY5	15.38	5.077	.628	.801

#### 4. Self awareness

Reliability Statistics	
Cronbach's Alpha	N of Items
.839	5

Item Statistics			
	Mean	Std. Deviation	N
SEA1	3.50	.725	400
SEA2	3.78	.742	400
SEA3	3.37	.751	400
SEA4	4.25	.704	400
SEA5	4.00	.729	400

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SEA1	15.39	5.425	.640	.807
SEA2	15.11	5.364	.640	.807
SEA3	15.51	5.328	.640	.807
SEA4	14.64	5.500	.641	.807
SEA5	14.89	5.393	.647	.805

#### 5. Safety awareness

Reliability Statistics	
Cronbach's Alpha	N of Items
.774	3

Item Statistics			
	Mean	Std. Deviation	N
SAA1	4.13	.715	400
SAA2	3.90	.724	400
SAA3	3.59	.754	400

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SAA1	7.49	1.689	.600	.706
SAA2	7.71	1.659	.607	.699
SAA3	8.03	1.571	.622	.682

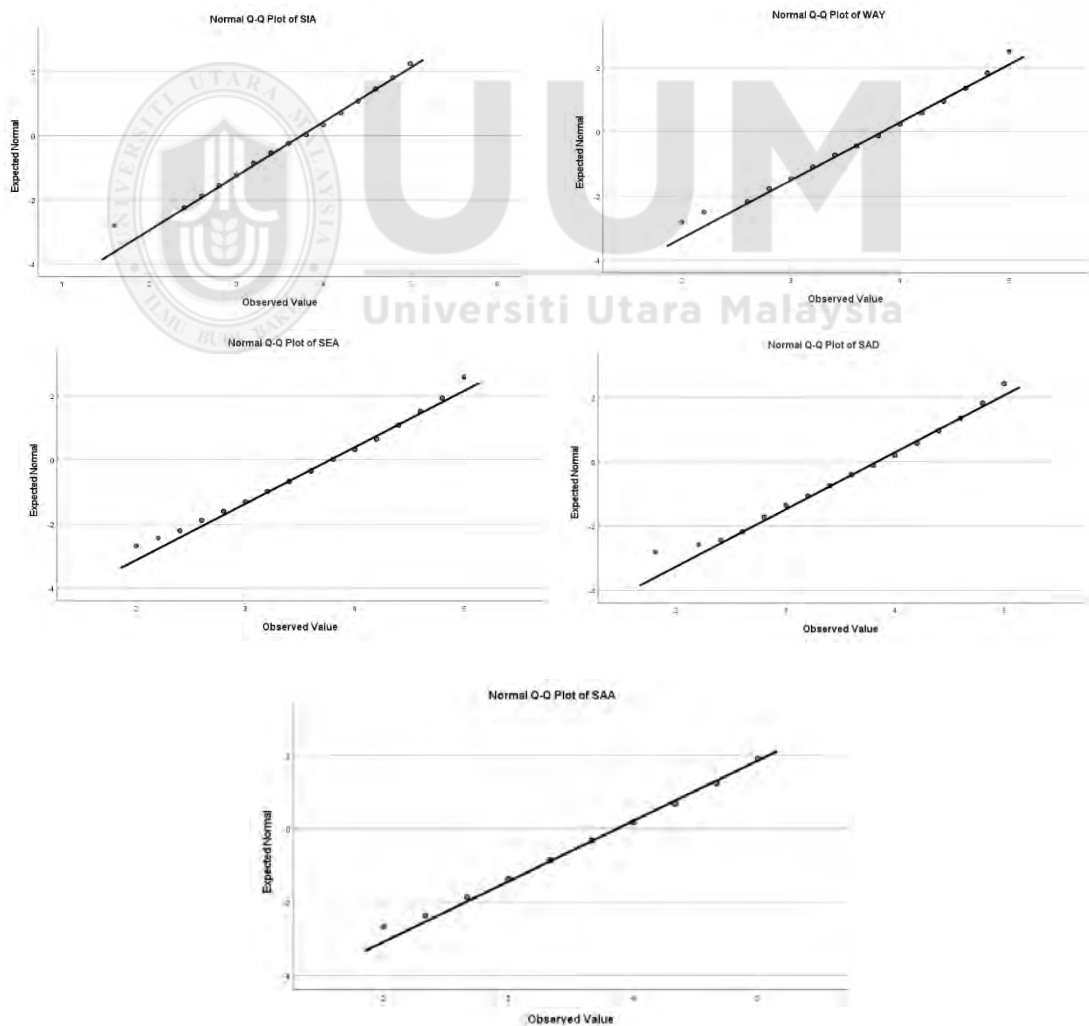
## APPENDIX G: NORMALITY TEST

### Tests of Normality

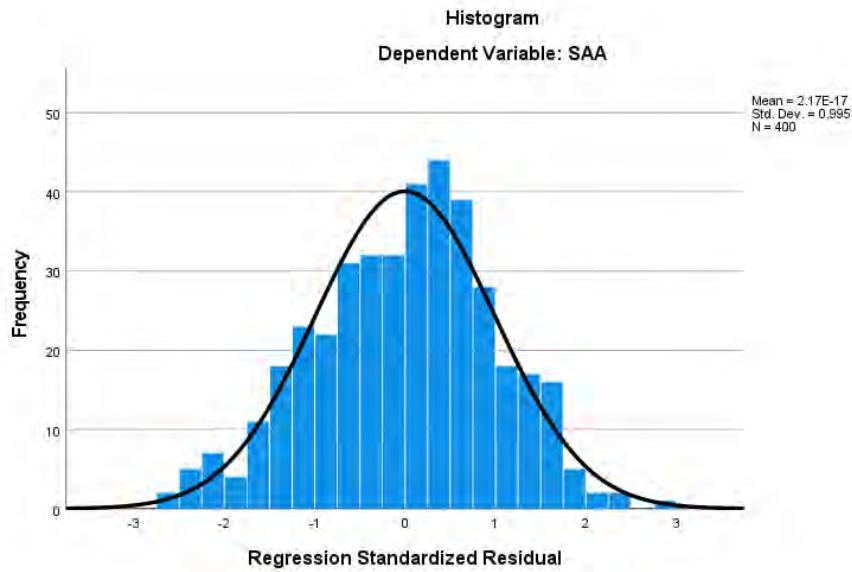
	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SIA	.101	400	<.001	.983	400	<.001
WAY	.094	400	<.001	.980	400	<.001
SEA	.096	400	<.001	.979	400	<.001
SAA	.114	400	<.001	.965	400	<.001
SAD	.105	400	<.001	.979	400	<.001

a. Lilliefors Significance Correction

## APPENDIX H: Q-Q PLOT



## APPENDIX I: REGRESSION STANDARDIZED RESIDUAL



## APPENDIX J: MULTIPLE LINEAR REGRESSION ANALYSIS

**Model Summary<sup>b</sup>**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.853 <sup>a</sup>	.727	.724	.31860	2.012

a. Predictors: (Constant), SAD, SEA, WAY, SIA  
b. Dependent Variable: SAA

**ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	106.872	4	26.718	263.210	<.001 <sup>b</sup>
	Residual	40.096	395	.102		
	Total	146.968	399			

a. Dependent Variable: SAA

b. Predictors: (Constant), SAD, SEA, WAY, SIA

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.175	.117		1.500	.134
	SIA	.225	.060	.220	3.762	<.001
	WAY	.327	.063	.299	5.223	<.001
	SEA	.216	.059	.202	3.680	<.001
	SAD	.205	.057	.191	3.624	<.001

a. Dependent Variable: SAA

## APPENDIX K : DATA COLLECTION PROCESS



