Safety behavior model based on safety competence, culture, and awareness

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Article Info

ABSTRACT

Safety behavior is crucial to reducing the potential for ship accidents. Therefore, the research focuses on investigating and finding an empirical model of the influence of safety competence and safety culture on crew safety behavior through safety awareness. The research uses a quantitative approach with survey methods and causal design. The sample was 250 crew members. The research instrument used was a questionnaire designed as a Likert scale with five options for responses. The questionnaire was distributed in Google Form format via the WhatsApp application. The data were analyzed using structural equation modeling (SEM). The research results show that safety competence, safety culture, and safety awareness have a significant effect on safety behavior; safety competence and safety culture have a significant effect on safety awareness; and safety competence and safety culture significantly affect safety behavior through safety awareness. These findings promote a new empirical model of the effect of safety competence and safety culture on crew safety behavior through safety awareness. This new model deserves critical discussion by researchers, academics, and practitioners before being adopted, adapted, or modified for their future work in the future.

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Introduction

Optimal safety performance is urgent for the shipping industry. However, the fact is that the national shipping system needs to show adequate safety and security conditions. As an illustration, until now, there have still been frequent ship accidents, whether sinking, burning/exploding, colliding, running aground, or in other forms. During the 2019-2023 period, at least 75 ship accidents occurred, with details of ship collisions (39%), burning/exploding (24%), sinking (20%), running aground (8%), and other accidents (9%) (Investigation satistics of KNKT, 2023). Statistical analysis reveals that ship accidents at sea and illegal fishing are the most frequent incidents, occurring on average 421.6 times per five years (Apriantara et al., 2023). Human error is the leading cause of ship accidents.According to Bowdler et al. (2023),approximately 80-85% of work accidents are caused by unsafe behavior (Uyun & Widowati, 2022; Permana & Handayani, 2022). Participate in all workplace safety activities to avoid, minimize the possibility of, or prevent accidents at work (Riadi, 2021).

Based on empirical evidence, prior research indicates that safety competency, safety culture, and safety awareness all have an impact on safety behavior. The Chinese study by Li et al. (2020) demonstrates how

safety behavior is influenced by safety competency. One sort of talent that employees require in order to perform their jobs safely is safety competence. Workers' knowledge, abilities, and experience are strongly correlated with these skills (Li et al., 2020). Then, safety behavior is positively impacted by safety culture, as demonstrated by Aytacand Dursun's (2018) study. Employee attitudes, values, and perceptions of safety are reflected in the safety culture.

Therefore, safety culture reflects a construct that explains how the social environment in the organization directly influences the risk of organizational practices that may lead to personal injury or process safety disasters (Cooper et al., 2019). The study by Uzuntarla et al. (2020) showed a significant relationship between safety awareness and safety behavior. Wang et al. (2018) also proved that safety awareness affects safety behavior. Safety awareness is an individual's awareness of safety issues (Wang et al., 2018), which involves cognitive abilities concerning safety issues and potential hazards in the workplace (Korkmaz & Park, 2019). Several other studies have shown that safety awareness not only affects safety behavior, but is also influenced by safety competence (Jones, 2013) and safety culture (Song et al., 2019). However, other empirical facts show inconsistent research results. The results of Chung and Noh's (2021) research prove that safety awareness significantly affects safety competence, while Hussain et al. (2019) revealed that behavioral-based safety affects safety awareness. This condition suggests an area of unmet scientific need that needs to be filled with additional research. This study aims to identify the research gap and provide a unique model of seafarer safety behavior based on safety competency, safety culture, and safety awareness in response to this pressing need.

Safety Behavior
Zin and Ismail (2012) define safety behavior as the conduct that upholds the safety procedures and activities that workers must adopt in accordance with occupational, safety, and health regulations in order to prevent accidents at work. According to Marynissen et al. (2014), safety behavior refers to how an individual behaves or acts in the face of dangers or risks, knowing the procedures that must be followed in order to reduce or eliminate those risks. According to Seo et al. (2015), safety behavior also includes acts taken by individuals as a means of self-defense, such as following safety guidelines to prevent harm. Safety behavior is also explained by Winarsunu (2018) as individual behavior in interacting with the work environment which is specifically related to the formation of safe behaviors that can improve occupational safety and health and the formation of safe behaviors at work that can cause work accidents. Safety awareness refers to the level of knowledge and understanding individuals have regarding safety practices and procedures in various settings. It is crucial for organizations to prioritize safety awareness to prevent accidents and promote a safe working environment (Chakrabarty, 2018). Safety awareness is not limited to workplaces but also extends to other areas of life, such as driving behavior (Zhang et al., 2016). Safety awareness plays a vital role in ensuring the well-being of individuals and preventing accidents in different environments.

There are a number of steps and preparations made towards safety engineering, namely: (1) correspondence with project leaders and safety coordinators, aiming to discuss the causes of accidents occurring in utility organizations and implementation procedures with respect to management commitments; (2) pure safety technical persons delegated to the subject area to address issues and employee safety training; (3) conducting thorough preparation for innovative employees, monitoring and auditing; and (4) training on work and risky behaviors provided to operators (Hussain et al., 2019). Neal and Griffin (2006) mentioned that safety behavior can be divided into two. First, safety compliance, which refers to maintaining workplace safety by carrying out basic safety activities determined by work. Second, safety participation, which refers to facilitating the development of an environment that supports safety. Meanwhile, Li et al. (2020) identified a number of dimensions or factors that can influence safety behavior, namely: (1) task, (2) situational behavior, (3) safety participation, (4) safety compliance, (5) people's perspectives and opinions on safety, (6) safety culture, (7) safety psychology, and (8) employee satisfaction with safety on the job.

Safety Competence
Safety competence is the capacity to reduce the risk of hazards through individual performance and efficient system implementation (Cronenwett et al., 2007). Understanding the fundamentals of safety competence is essential to achieving high standards of safety competence. Safety competence, according to Li et al. (2020), is a talent that employees require in order to perform their jobs safely. This ability is directly tied to the experience, expertise, and abilities of the workforce.According to Langari et al. (2017), developing safety competence (knowledge), preventing safety incidents (attitude), and intervening if something goes wrong (skills) are the three components that make up safety competence. Zwell (2012) states that the following variables can influence competence: corporate culture; motivation; emotional intelligence; skills; experience; beliefs and values; and motivation. Seafarer safety competencies may include: (a) emergency and accident response systems, provisions and plans; (b) systems and plans, which should include the correct use of life-saving equipment and fire-fighting equipment; (c) handling potential emergency situations on board; and (d)

effectively coordinating crew and company actions with external parties (International Labor Organization - ILO, 2015). On the other hand, Mangkunegara (2016) lists several indicators of occupational safety and health, including: work environment, which is the social, psychological, and physical aspects of the organization that influence employees in performing their duties; air arrangements, which involve monitoring air circulation, temperature, and cleanliness to prevent dust, dirt, and odors in the workspace; lighting arrangements, which involve controlling and utilizing the appropriate light source to prevent eye strain; use of work equipment, which can involve utilizing machines, electronic devices, and other equipment with good security; as well as mental and physical situations, which refers to protecting workers' sensory organs from harm while also preserving their emotional stability. Safety competence can be measured through several indicators: (1) emergency and accident response systems, provisions and plans; (2) life-saving equipment and fire-fighting equipment systems and plans; (3) handling potential emergency situations on board; (4) effectively coordinating crew and company actions with external parties, and (5) preventing accident incidents (ILO, 2015; Langari et al., 2017).

Safety Culture
Schein (2010) claims that safety culture and organizational culture are nearly identical. These include shared values about what matters to the organization, beliefs about how things should be done there, and the ways in which work units, organizational structures, and systems interact with these values and beliefs to create norms of behavior within the organization. Yet, safety culture is more focused on safety (i.e., promoting safety) and highlights the part that interpersonal, work unit, and organizational contributions play in forming people's fundamental beliefs inside the business, which gradually shift toward safety. According to Antonsen (2017), safety culture is a concept that describes how internal organizational social contexts have a direct impact on organizational risk behaviors that have the potential to cause catastrophic process safety disasters or personal casualties. Safety culture also refers to the collective, acquired meanings, experiences, and interpretations of work and safety that influence people's behavior toward risks, accidents, and prevention—sometimes in a symbolic way. Safety culture is influenced by individuals in social networks and organizational structures both inside and outside the business (Richter & Koch's, 2004). According to Naevestad et al. (2019), safety culture may also be described as common, safety-relevant ways of thinking or behaving that are (re)created through people's cooperative negotiating in social circumstances. In order to foster a commitment to safety and long-term efforts to reduce hazards, individuals' and groups' perceptions, beliefs, values, attitudes, and behavior patterns contribute to the development of an organization's safety culture (Ayu et al, 2020). Lutchman and colleagues (2012) have identified several facets of safety management that can be employed to gauge safety culture. These include: (1) Engineering, where risks and hazards are incorporated to safeguard workers during the design phase; (2) Enforcement, where policies and procedures are implemented to safeguard the well-being and safety of workers; and (3) Education, where workers receive training to guarantee their proficiency in completing assigned tasks. (4) Emotion: Put forth a lot of effort and show employees that you care about their safety; (5) Emphaty: Show employees that you value them by giving them special attention. Getting to know each employee and exhibiting sincere concern for their unique situation; (6) Empowerment: giving employees the freedom to stop risky work at any time without worrying about facing repercussions. They must always be capable of taking responsibility for their own health and safety; (7) Engagement: Including employees in the process of creating workplace safety solutions. Participation in the execution of safety procedures and systems must also be a part of this engagement. Various factors such as fatalism, employee involvement, safety awareness, safety priorities, safety communication, and safety training affect safety culture (Gurbuz&Ibrakovic, 2017).

Safety Awareness
According to Dursun (2011), a worker's degree of safety awareness influences their viewpoint, evaluation of their own ability, and duties to reduce risks at work. According to Kiani and Khodabakhsh (2014), a person's personal awareness of safety concerns is referred to as safety awareness. Both the cognitive and behavioral domains are affected by this awareness. Cognitive safety awareness refers to the mental awareness of one's own work-related safety as well as the behaviors that support operational safety. From a behavioral perspective, safety awareness promotes actions that support operational safety. According to Fung et al. (2016), safety awareness is the understanding of the significance of safety issues, thus businesses make a greater effort to raise worker safety awareness (Bossema, 2014). According to Liao et al. (2014), safety awareness refers to a worker's cognitive capacity regarding potential risks and safety-related difficulties at work. In a business or organization, it is crucial that every person understands the importance of safety. Safety performance can deteriorate due to ignorance. According to Mohammadfam et al. (2021), accident reports frequently remark a lack of situation awareness or its slender presence. Yilmaz and Celebi (2015) explain that lack of awareness can be a problem or factor affecting safety performance. According to Mohammadfam et al. (2021), various factors that can affect situation awareness, both personal and organizational, are detailed,

precise, and real information about an event; sufficient knowledge; experience; attitude; place of security control; fatigue; and sleep disturbance. Organizational ones include: system design, system-operator relationship, workload, leadership style, person-organization relationship and mutual support. Therefore, safety awareness reflects a person's condition of understanding the rights and obligations he/she must carry out in relation to safety issues and potential hazards in the workplace, which is measured based on indicators: cognitive, behavioral, and judgment.

Safety Competence and Safety Behavior
Empirically, safety competence affects safety behavior awareness. When safety behavior is reinforced by safety competency components, it can be developed effectively. Widyanty et al. (2021) and Li et al. (2020) have demonstrated that safety competence has a noteworthy and favorable impact on safety behavior. This means that the higher the safety competence of employees, the higher their safety behavior will tend to be. Thus, to realize employee safety behavior, it is necessary to support safety competence which is reflected in the ability to minimize the risk of hazards that occur through their performance and effective application of the system with the support of a number of characteristics such as building safety competence (knowledge), preventing safety incidents (attitude) and acting after mistakes occur (skills) (Langari et al., 2017). When employee safety competence is high, it can have an impact on high safety behavior, namely employee actions with safety and promoting safety programs related to accidents and unsafe situations in the workplace which are manifested in safety compliance and safety participation (Neal & Griffin, 2006). Thus, the first hypothesis (H) can be formulated as follows:

H1: Safety competence affects safety behavior.

Safety Culture and Safety Behavior
Safety culture also has an impact on safety behavior in addition to safety competence. This is consistent with studies by Faizah et al. (2020), Asmani (2020), and Aytac and Dursun (2018), which demonstrate the substantial impact that safety culture has on safety behavior. This implies that employee safety behavior will generally be better the stronger the safety culture. Thus, the creation of safety behavior can be supported by safety culture which is manifested in the construction used to explain how the internal social environment of the organization can directly affect the risk of practices in the organization that can cause catastrophic processes to personally injure with indicators of engineering, enforcement, education, emotion, empathy, empowerment, and engagement (Lutchman et al., 2012). In other words, if the safety culture in the company can be conditioned properly, it can affect safety behavior. Thus, the second hypothesis can be proposed as follows:

H2: Safety culture affects safety behavior.

Safety Awareness and Safety Behavior
Safety behavior is also influenced by safety awareness This is evidenced in the research of Osman et al. (2015), Wang et al. (2018), Uzuntarla et al. (2020), Hussain et al. (2019), Li et al. (2021), and Saetrevik and Hystad (2021) that safety awareness has a significant effect on safety behavior. This means that when employees' safety awareness increases, it will have the opportunity to improve their safety behavior. Thus, adequate employee safety awareness can trigger better employee safety behavior. Therefore, the third hypothesis can be promoted as follows:

H3: Safety awareness affects safety behavior.

Safety Competence and Safety Awareness
Safety competence in addition to influencing safety behavior also makes a positive contribution to safety awareness. This can be seen from the results of Jones' (2013) research which proves that safety competence affects safety awareness. This means that the higher the safety competence of employees, the higher their safety awareness will tend to be. Thus, to realize employee safety awareness requires the support of safety competence, namely the ability to minimize the risk of harm that occurs through its performance and effective application of the system, which is manifested in a number of characteristics: building safety competence (knowledge), preventing safety incidents (attitude) and acting after something goes wrong (skills) (Langari et al., 2017). If employee safety competence is high, it can have an impact on high safety awareness, which is reflected in the condition that a person understands the rights and obligations that must be carried out in connection with safety issues and potential hazards in the workplace through cognitive and behavioral aspects (Kiani&Khodabakhsh, 2014). Thus, the fourth hypothesis can be proposed as follows:

H4: Safety competence affects safety awareness.

Safety Culture and Safety Awareness

In addition to safety behavior, safety culture also has a positive effect on safety awareness. The study findings of Song et al. (2019) demonstrate that safety awareness is significantly impacted by safety culture. This suggests that safety awareness can be promoted if the safety culture is in a supportive environment. Safety culture, which is reflected in engineering, enforcement, education, emotion, empathy, empowerment, and engagement, is a concept used to explain how the internal social environment of the organization can directly affect the risk of practices in the organization that can cause catastrophic processes to cause personal harm (Lutchman et al., 2012). When an organization's safety culture is favorable, it will affect safety awareness, which is the state in which an individual knows his rights and responsibilities regarding potential workplace risks and safety difficulties. So, the following is how the fifth hypothesis might be stated:

H5: Safety competence affects safety awareness.

Mediating Role of Safety Awareness

The results of previous research indicate the unique position of safety awareness as a mediator for the influence of safety competence and safety culture on safety behavior. The results of Jones' (2013) study show that safety competence has a significant influence on safety awareness. Then, the studies of Song et al. (2019) showed that safety culture has a significant influence on safety awareness. Meanwhile, the results of research by Wang et al. (2018), Uzuntarla et al. (2020), Li et al. (2021), and Saetrevik and Hystad (2021) prove that safety awareness has an effect on safety behavior. That means that when safety competence and safety culture are in adequate condition, it can have an impact on increasing safety awareness and then have implications for increasing safety behavior. However, so far, based on a search for previous research, no research results have been found on the effect of safety competence and safety culture on safety behavior with the mediation mechanism of safety awareness. Thus, the causal relationship between safety competence and safety culture with safety behavior with the mediation of safety awareness is a new thing that requires empirical justification through research. Based on previous studies and the above arguments, the following hypothesis can be proposed:

H6: Safety competence affects safety behavior with the mediation of safety awareness.

H7: Safety culture affects safety behavior with the mediation of safety awareness.

Method

Approach, Method, and Research Design

This study employs a positivistic quantitative methodology (Neuman, 2014). By starting with theoretical studies, deducing them into hypotheses, and then conceptualizing them into an analytical model, the quantitative approach seeks to understand the relationship between variables. In order to determine the incidence, distribution, and relative interrelation of variables, this strategy uses a survey method that involves selecting and analyzing samples from both large and small populations (Kerlinger, 2006; Widodo, 2021). In these circumstances, structural equation modeling (SEM), a causal design, is used in the study. Explanatory and descriptive research was done to fulfill this design. Explanatory research elucidates the causal relationship between research variables, whereas descriptive research describes the conditions of each research variable.

Research Participants

The population of this study was 662 passenger ship crew from seven shipping companies with more than five ships operating and stopping at three ports in the Batam area (BatuAmpar, Sekupang, and TelagaPunggur). Meanwhile, the sample of research participants was 250 crews, determined based on the Slovin formula with an error margin of 5%. Sample determination was carried out using proportionate random sampling, namely sample selection, where each member of the population has the same opportunity to be selected as a sample based on the proportion of the population in each company (Ahmad & Octavian, 2022; Widodo, 2021). As presented in Table 1, the majority of them were men (93.2%), aged 31-40 years (60%), had ANT III (60.4%) and ANT IV (39.6%), were married (86.4%), and had worked 6-10 years (53.2%) (Table 1).

Procedure and Materials

A Likert scale questionnaire with five options—strongly disagree/never (score = 1), disagree/rarely (score = 2), neutral/sometimes (score = 3), agree/often (score = 4), and strongly agree/always (score = 5)—was used to gather data. Google Forms was used to conduct the online survey, and WhatsApp can be used to share the results. Based on the experts' theoretical dimensions or indicators, researchers developed the questionnaire. The indicators of safety competence indicators include systems and plans for life-saving and firefighting equipment, handling potential emergency situations on board; and effectively coordinating the actions of ship crews and companies with external parties and preventing accident incidents (ILO, 2015; Langari et al., 2017);

safety culture: engineering, enforcement, education, emotion, empathy, empowerment, and engagement (Lutchman et al., 2012); safety awareness: cognitive, behavioral, and judgment (Kiani&Khodabakhsh, 2014; Dursun, 2011); safety behavior: safety compliance and safety participation (Neal & Griffin, 2006). Ten items of safety competencies are included, such as "I understand how to prevent accidents" and "I understand the systems, provisions, and emergency response plans." With an alpha coefficient (AC) of .862, its corrected item-total correlation coefficient (CI-TCC) score falls between .457 and .705 on the scale. There are fourteen components that makeup safety culture, such as "The company has a pattern of occupational safety protection" and "The company shows a way of working that prioritizes work safety." Its AC is .885, and its CI-TCC ranges from .398 to .806. There are eight components to safety awareness, such as "I actively evaluate different elements that can cause ship accidents" and "I actively seek out new information to find more effective safety assurance patterns." It has an AC of .784 and a CI-TCC of .430 to .622. Seven criteria are included in safety behavior, such as "I participate in ship safety maintenance activities" and "I continuously ensure the ship's safety until it reaches its destination." The range of its CI-TCC is .392 to .623, and its AC is .775. Every item has a CI-TCC of > .361, and every variable has an AC of >.70, making it a valid and reliable research tool (Widodo, 2021).

Table 1. Profile of the Research Participants

Profile	Amount	Percentage
Gender		
1. Male	233	93.20
2. Female	17	6.80
Age		
1. ≤ 30 years	17	6.80
2. 31 – 40 years	150	60
3. 41 – 50 years	58	23.20
4. > 51 years	25	10
Education		
1. ANT I	0	0
2. ANT II	0	0
3. ANT III	151	60.40
4. ANT III	99	39.60
Status		
1. Married	216	86.40
2. Unmarried	34	13.60
Job Experience		
1. ≤ 5 years	42	16.80
2. 6 – 10 years	133	53.20
3. 11 – 15 years	17	6.80
4. 16 – 20 years	33	13.20
5. > 21 years	25	10

Data Analysis
Structural equation modeling (SEM), handled by LISREL version 8.8, was used to examine the data obtained from distributing the questionnaires. Descriptive and correlational analysis were also performed.Thirty trial samples were tested in order to assess the questionnaire's validity and reliability. After completing validity and reliability tests, 250 research samples' data were collected using questionnaires. The data were analysed using SPSS software version 22's descriptive and correlational statistics to help define the research variables and clarify their relationship. The student (t) test formula is used to test direct influence, and the Soble (Z) test formula is used to test indirect influence.

Results and Discussions

Descrivtive and Correlational Analysis
The results of the descriptive and correlation analyses carried out using SPSS are shown in Table 2. The mean values, which typically range from 31.24 to 60.21, are larger than the standard deviation (SD), which varies from 2.557 to 6.365. As such, it offers a respectable summary of the data and is worthy of further research. The results of the correlation analysis between the variables taken together are significant at p <.05. The correlation coefficient value range for the variables is.548–.652. It illustrates the interdependence of every variable on

every other variable. However, since all correlation coefficients are less than .8, it does not manifest as a multicollinearity issue.

Table 2. Results of Descritive and Correlational Analysis

Variabel	Mean	SD	1	2	3	4
Safety competence (X_1)	42.48	4.083	1.00			
Safety culture (X_2)	60.21	6.365	.548*	1.00		
Safety awareness (Y_1)	34.69	3.655	.593*	.593*	1.00	
Safety behavior (Y_2)	31.24	2.557	.621*	.621*	.652*	1.00

*p = .05

The Measurement Model

Table 3 displays the estimated measurement model from confirmatory factor analysis. Validity is shown by factor loading values of all indicators and items that are equal to or greater than .5. It implies that there are different factors. The construct reliability (CR), variance extracted (VE), and alpha (α) values were used to evaluate reliability together. All variables show strong dependability and acceptable convergence, with velocities better than .50 and CR and α values greater than .70, respectively (Hair et al., 2018).

Table 3. Result of the Measurement Model

Constructs	Indicators	Factor Loading	CR	VE	α
Safety competence (X_1)	$X_{1.1}$	.76	.857	.550	.862
	$X_{1.2}$	.81			
	$X_{1.3}$	.76			
	$X_{1.4}$	.81			
	$X_{1.5}$	.53			
Safety culture (X_2)	$X_{2.1}$	.51	.830	.517	.885
	$X_{2.2}$	.61			
	$X_{2.3}$	.54			
	$X_{2.4}$	.63			
	$X_{2.5}$	.67			
	$X_{2.6}$	.82			
	$X_{2.7}$	.69			
Safety awareness (Y_1)	$Y_{1.1}$	.76	.827	.616	.784
	$Y_{1.2}$	.84			
	$Y_{1.3}$	.75			
Safety behavior (Y_2)	$Y_{2.1}$	.85	.809	.857	.775
	$Y_{2.2}$	.69			

Goodness of Fit

As shown in Table 4, the goodness of fit (GOF) test results showed nine indices: two indices P(2) and RMSEA) were classified as not fit, one index (IFI) as marginal fit, and six indices (GFI, AGFI, NFI, NNFI, CFI, and RFI) as good fit. The test's results indicate that a greater number of indices are classified as having a good fit, indicating that the empirical model explaining how safety competence and safety culture affect safety awareness and safety behavior fits the theoretical model.

Table 4. The Results of Goodness of Fit Test

No	Index	Cuf of Value	Results	Information
1	P(2)	> 0,05	0,00000	Poor (Not fit)
2	RMSEA	< 0,08	0,163	Poor (Not fit)
3	GFI	> 0,90	0,91	Good Fit
4	AGFI	> 0,90	0,91	Good Fit
5	NFI	> 0,90	0,94	Good Fit
6	NNFI	> 0,90	0,93	Good Fit
7	CFI	> 0,90	0,96	Good Fit
8	IFI	> 0,90	0,86	Marginal Fit
9	RFI	> 0,90	0,91	Good Fit

Hypothesis Testing

Table 5 shows a summary of the hypothesis test results presented in Figures 1 and 2. Every hypothesis, ranging from H1 to H7, was supported (significant) with t value exceeding the t table at α = .05. Safety competence had a direct influence on safety behavior (γ = .50), as well as safety culture (γ =.22), and safety awareness (β = .34). Additionally, safety competence and safety culture affect safety awareness (γ = .32 and .50). Safety competence had the strongest influence on safety behavior than others. However, safety culture had dominant impact on safety awareness than safety competence. In addition, safety competence and safety culture indirectly (mediation) influence affect safety behavior through safety awareness (β = .11 and .17). Safety culture has a slightly stronger indirect influence on safety behavior compared to safety competence.

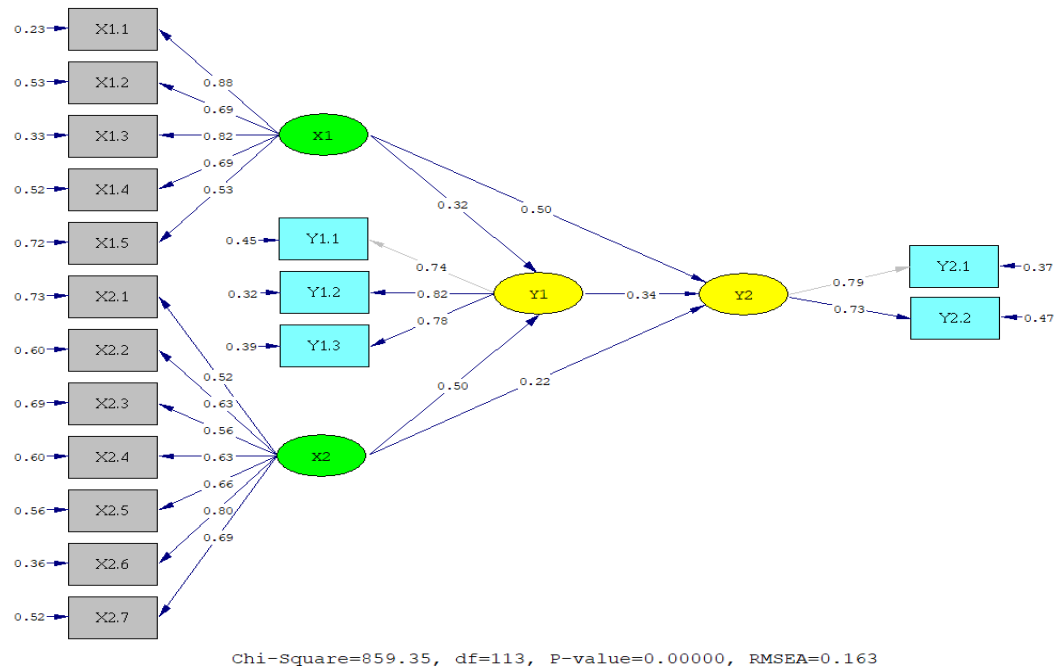Chi-Square=859.35, df=113, P-value=0.00000, RMSEA=0.163
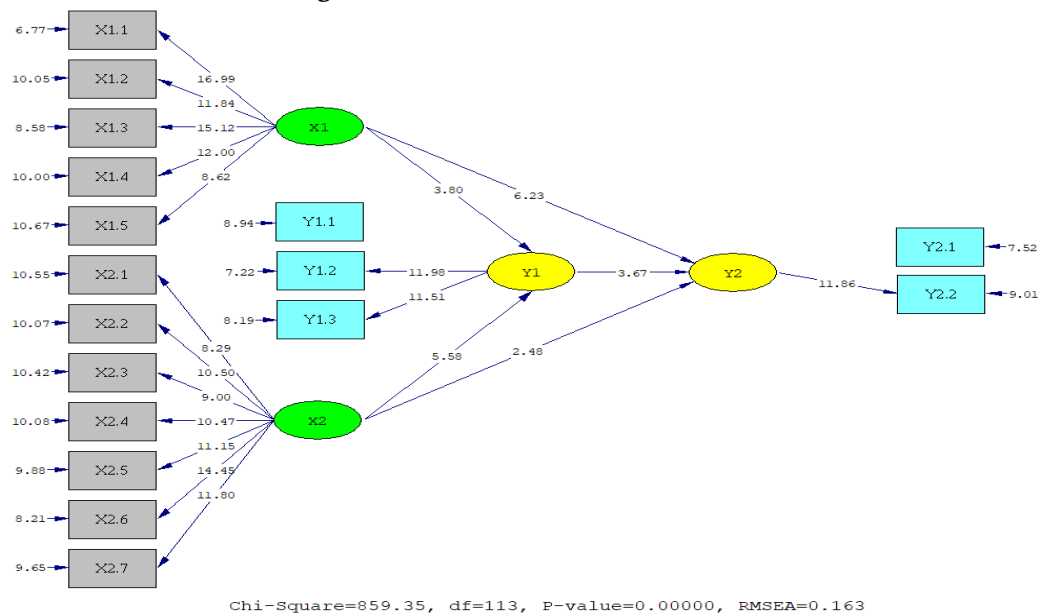
Figure 1. Standardized Structural Model

Chi-Square=859.35, df=113, P-value=0.00000, RMSEA=0.163

Figure 2. Tvalue Structural Model

Table 5. Hypothesis Testing Results

Path	Path coefficient	t/Z_{value}	Decision
H$_1$: Safety competence(X$_1$) on safety behavior (Y$_2$)	0,50*	6,23	Supported
H$_2$: Safety culture (X$_2$) on safety behavior (Y$_2$)	0,22*	2,48	Supported
H$_3$: Safety awareness (Y$_1$) on safety behavior (Y$_2$)	0,34*	3,67	Supported
H$_4$: Safety competence (X$_1$) on Safety awareness (Y$_1$)	0,32*	3,80	Supported
H$_5$: Safety culture (X$_2$) on Safety awareness (Y$_1$)	0,50*	5,58	Supported
H$_6$: Safety competence (X$_1$) on safety behavior (Y$_2$) through safety awareness (Y$_1$)	0,11*	8,395	Supported
H$_7$: Safety culture (X$_2$) on safety behavior (Y$_2$) through safety awareness (Y$_1$)	0,17*	8,826	Supported

* $p = .05$

The research results also produced two structural equations: structural equations for the variables safety awareness (Y1) and safety behavior (Y2). The structural equation for the safety awareness variable (Y1) is Y1 = 0.32*X1 + 0.50*X2, Errorvar. = 0.43. R2 = 0.57. These findings indicate a safety competencevariable with a structural coefficient = 0.32 and safety culture = 0.50. The structural coefficient value is positive, indicating that the influence of safety competence and safety culture on safety awareness is linear, which means that improving safety competence and safety culture can increase safety awareness. The safety competence and safety culture variables can explain the variation in changes in the safety awareness variable of 0.57 (57%).

The structural equation for the safety behavior variable is Y2 = 0.34*Y1 + 0.50*X1 + 0.22*X2, Errorvar. = 0.11. R2 = 0.89. These findings indicate the safety awareness variable with a structural coefficient = 0.34, safety competence = 0.50, and safety culture = 0.22. The structural coefficient value is positive, indicating that the influence of safety awareness, safety competence, and safety culture on safety behavior is linear, which means that improving safety awareness, safety competence, and safety culture can increase safety behavior. The safety awareness, safety competence, and safety culture variables can explain the variation in safety behavior variables by 0.89 (89%). Meanwhile, the remaining 11% is determined by other variables not involved in this research.

The results of this study show that safety competence has a positive and significant effect on seafarers' safety behavior. This indicates that safety competence is an important determinant of seafarers' safety behavior on passenger vessels. Therefore, improvements in safety competence include the ability to minimize the risk of harm through mastery of safety knowledge, prevent safety incidents (attitude), and act after mistakes occur (skills). When seafarers' safety competence is high, it can have an impact on the high safety behavior reflected in safety actions and promoting safety programs related to accidents and unsafe situations in the workplace manifested in safety compliance and safety participation. This result is in line with and validates the findings of other research (Widyanty et al., 2021; Li et al., 2020; Mohamed, 2002) which showed that safety competence has a positive and significant impact on safety behavior.

This research also discovered a strong and favorable relationship between safety culture and sailors' safety behavior. This indicates that safety culture is a crucial antecedent to the safety behavior of passenger ship seafarers. It means that a conducive safety culture can increase seafarers' safety behavior. Thus, the safety culture manifested in the construct is used to explain how the internal social environment of the organization can influence the risk of practices in the organization that can lead to disasters or accidents and can affect seafarers' safety behavior reflected in safety compliance and participation. These findings are consistent with previous studies conducted by Aytac and Dursun (2018), Faizah et al. (2020), and Asmani (2020), which prove that safety culture has a significant influence on safety behavior.

This study also show that safety awareness has a positive and significant effect on seafarers' safety behavior. This indicates that safety awareness is an important predisposition for the safety behavior of passenger ship seafarers. Therefore, improving safety awareness can help the process of improving safety behavior. Safety awareness is a condition in which a person understands the rights and obligations that he/she must carry out in relation to safety issues and potential hazards in the workplace, which is seen in cognition, behavior, and judgment (Kiani & Khodabakhsh, 2014; Dursun, 2011). If seafarers' safety awareness is adequate, it can encourage better safety behaviors, especially those related to safety compliance and participation. This finding is in line with and affirms previous studies claiming that safety awareness has a significant influence on safety behavior (Osman et al., 2015; Wang et al., 2018; Uzuntarla et al., 2020; Hussain et al., 2019; Kim, 2015; Li et al., 2021; Saetrevik & Hystad, 2021).

This study also revealed that safety competence also has a positive and significant effect on safety awareness among seafarers. This indicates that safety competence is an essential predictor of safety awareness among seafarers on passenger vessels. As a consequence, when safety competence is improved, it can spur an increase in seafarers' safety awareness. That is, the higher the safety competence of seafarers, the higher their safety awareness will tend to be. Thus, to realize seafarers' safety awareness, it is necessary to support safety competence, namely the ability to mitigate the possibility of hazard or accident risk. This finding is consistent with the results of Jones' (2013) research which proves that safety competence has an influence on safety awareness.

This study also indicated that safety culture also has a positive and significant effect on seafarers' safety awareness. This indicates that safety culture is one of the good determinants of seafarers' safety awareness on passenger vessels. Consequently, when safety culture is improved, it has the potential to increase seafarers' safety awareness. This confirms the meaning that safety culture is essential for companies, including shipping companies. Safety culture is a construct used to explain how an organization's internal social environment can influence the risk of organizational practices that could lead to disasters or accidents. When the safety culture is in a conducive (adequate) condition, it will impact safety awareness, both cognitively, conative (behavior), and assessment. This is in line with previous studies conducted by Song et al. (2019), who found that safety culture significantly influences safety awareness.

This study also found a significant effect of safety competence on safety behavior with the mediation of safety awareness. Empirically, this finding positions safety awareness as a mediator for the causal relationship between safety competence and safety behavior. That means that when safety competence is in a high condition, it can positively impact increasing safety awareness and then has implications for improving seafarers' safety behavior. This finding not only confirms the results of previous research that was used as a reference in developing the hypothesis of this study that safety competence has a significant effect on safety awareness (Jones, 2013) and safety awareness affects safety behavior (Osman et al., 2015; Wang et al., 2018; Uzuntarla et al., 2020; Hussain et al., 2019; Kim, 2015; Li et al., 2021; Saetrevik & Hystad, 2021) but also found a new empirical fact that safety awareness mediates the effect of safety competence on safety behavior with the database of seafarers of passenger ships operating and stopping at three ports in Batam area (Batu Ampar, Sekupang, and Telaga Punggur).

Finally, this study also found a significant influence of safety culture on safety behavior with the mediation of safety awareness. Empirically, this finding positions safety awareness as a mediator for the causal relationship between safety culture and safety behavior. That means that when safety culture is in a conducive condition, it can positively contribute to safety awareness and have implications for improving seafarers' safety behavior. This finding not only affirms several previous studies that were used as the basis for developing research hypotheses that safety culture has a significant influence on safety awareness (Song et al., 2019) and that safety awareness affects safety behavior (Osman et al., 2015; Wang et al., 2018; Uzuntarla et al., 2020; Hussain et al., 2019; Kim, 2015; Li et al., 2021; Saetrevik & Hystad, 2021) but also revealed a new empirical fact that safety awareness mediates the effect of safety culture on safety behavior with the database of seafarers of passenger ships operating and stopping at three ports in Batam area (Batu Ampar, Sekupang, and Telaga Punggur).

Thus, this study found novel empirical facts on the influence of safety competence and safety culture on safety behavior with the mediation of safety awareness with the database of seafarers of passenger ships operating and stopping at three ports in Batam area (Batu Ampar, Sekupang, and Telaga Punggur). The findings may have practical implications for the safety behavior of passenger ship seafarers, especially those operating and stopping at ports in the Batam area (Batu Ampar, Sekupang, and Telaga Punggur) from the perspectives of safety competence, safety culture, and safety awareness and provide theoretical contributions to the development of transportation management studies, especially those related to the mediating role of safety awareness in the constellation of causal relationships between safety competence and safety culture with seafarers' safety behavior.

Conclusions

Safety behavior is crucial for shipping companies, primarily to mitigate the possibility of ship accidents. Therefore, this study investigated the influence of safety competence and safety culture on crew safety behavior through safety awareness. The results show that safety competence, safety culture, and safety awareness significantly influence safety behavior; safety competence and safety culture significantly influence safety awareness; and safety awareness significantly mediates the influence of safety competence and safety culture on safety behavior. These findings are not only consistent with and affirm various previous studies that

were used as the basis for building the theoretical model and hypotheses of this study, but also promote a new empirical model of the effect of safety competence and safety culture on crew safety behavior through safety awareness. This new model deserves to be critically discussed by researchers, academics, and practitioners before it is adopted, adapted, or modified for further research in the future without ignoring the limitations of this study, such as using only a single data source (crew members) obtained through a self-report type survey, not accommodating all theoretical indicators/dimensions available in various literatures, and only involving respondents (participants) limited to crew members in three ports in the Batam area, Indonesia.

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