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ORGANIZATIONAL FACTORS AND SAFETY CULTURE MATURITY AMONG SEAFARERS: TOWARDS MARITIME SAFETY

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Abstract: The lack of quality of seafarers accessible to shipowners is the main problem the maritime industry is facing in order to minimise losses. A shipping company's safety and effectiveness depend on competent officers and a key component of safety performance is safety culture. Due to market pressures, there are times when seafarers who are hired lack the expertise, experience or attitude necessary to adopt business preferences, alter their conduct or make wise decisions. However, the evolution of safety culture among seafarers or the interrelation between the safety culture maturity level antecedents has only been exposed to a limited number of studies. A total of 286 respondents answered Microsoft Forms questionnaires. Using reliability, explanatory factor, normality, correlation, regression analysis and descriptive statistics in SPSS version 23, the data was quantified using a 5-point Likert scale. The analysis attested that the region's seafarers are at a "calculative" maturity level. Information, organisational learning, communication, commitment and involvement were the organisational factors directly influencing the safety culture maturity. This study, is novel in the region and adds to the body of knowledge on seafarers' level of safety culture maturity.

Keywords: Safety culture, maturity level, maritime safety, seafarers, organizational factors.

Introduction

The global economy relies on the maritime industry 'to transport 90% of the world's trade (OECD, 2022), resulting in an estimate of over one million seafarers employed. Through education, training, and exposure, a seafarer acquires technical competency and the lucrative terms of employment influence dedication and conduct. The competence of seafarers refers to the abilities and experience that are acquired each year in addition to the possession of technical credentials and knowledge. According to Nævestad and Phillips (2023), occupational injuries and work-related accidents are demanding in any industry, including maritime. As a result, shore-based management and shipboard management teams should ensure that formally prescribed competence is in place and be inspired to develop the appropriate frame of mind towards achieving a safety culture.

Seafarers' mindset must have a positive operating assumption that safety is the most effective strategy to avoid human errors. Human errors can be avoided if all seafarers maintain an elevated safety awareness level and establish an organisational safety culture. In addition to prioritising safety, consistently monitoring seafarers' safety culture behaviour is more proactive method to avoid mishaps in the shipping and maritime domain. Hence, it is necessary to use an appropriate method that can examine quantitatively, using realistic indicators, seafarers' safety culture (Adumene *et al*., 2022).

Safety performance, including safety compliance and participation is significantly influenced by safety culture. There are particular criteria and obstacles to safety in many businesses. Therefore, research is needed to pinpoint industry-specific elements that have an impact on safety culture and create specialised solutions. Although safety culture is frequently discussed at the organisational level, more may be learned about the specific organisational elements that help or hinder the growth of

a healthy safety culture. This may take into account elements like management techniques, communication procedures, organisational climate and leadership philosophies. Consequently, investigating the safety culture among seafarers, given the risks involved, is a primary concern for owners and managers. However, it is not quite evident that everyone takes this seriously, as out in the open sea things are well out of sight. This analysis intends to explore seafarers' safety culture maturity level in the maritime environment and categorise its antecedent components in order to verify this research gap.

Typically, the safety maturity models have two distinct components. The first component is the safety culture maturity stages which fit into the Pathological, Reactive, Calculative, Proactive, and Generative levels (Hudson, 2001). Secondly, the safety maturity indicators (Goncalves Filho & Waterson, 2018) were provided in the empirical models employed in this analysis. The dimensions of information, communication, organisational learning, commitment, and involvement are organisational factors that may affect the evaluated objects, i.e., seafarers.

In light of this, theoretical maturity model framework begins with a short explanation of the maritime safety concept as it pertains to safety culture maturity. Secondly, using two theoretical perspectives, functional and interpretive notions corporate culture is offered as a component of safety culture maturity. Thus, to analyse the safety culture maturity level among seafarers, the first defines the safety culture maturity levels and the second defines their antecedent variables, as proposed in the literature. Descriptive statistics and regression methods were utilised in order to complete the study.

Literature Review

Maritime Safety

The International Maritime Organization (IMO), a governing organization under the United Nations, is in charge of ensuring that ships operating globally adhere to international standards for safety, security, and the reduction of marine and atmospheric pollution caused by ships. The primary responsibility of the IMO is to develop a just and efficient regulatory system for the shipping sector that will be universally accepted and put into practice.

After the shipyard has delivered a ship, the shipping business will be active 365 days a year, trading throughout the world's rivers, canals, seas, and oceans. The global population of seafarers as reported by the 2022 International Chamber of Shipping is 1,647,500, meaning that shipboard incidents and ship accidents can happen anytime. The ship is constrained by a strict schedule and it must comply with the charterer contract's requirements for port allocation and cargo readiness, etc. The effort to meet these demands may lead the ship to violate and compromise safety regulations.

Despite the established norms and regulations, there are still many crew and ship incidents in the maritime and shipping business. The agreed rules for maritime safety and security are known as maritime standards. Seafarers come from various parts of the globe and some of them have less concern about the potential risk that might occur on board. Hence, it is evident that interpreting the current stage of the seafarers' safety culture maturity level, including the dimensions that affect safety culture maturity, is essential. If properly managed, it will have the possibility of averting accidents and significantly raise the bar for maritime safety. In today's increasingly competitive environment, the factors influencing safety culture maturity are studied with increasing depth, impacting the organization and diverse organizational habits.

Safety Culture

The term 'Safety Culture' first appeared in the investigation report for the Chernobyl nuclear disaster 1986. After more than 30 years of studies by academics from different scientific backgrounds and disciplines, the term still lacks a widely accepted definition and an assessment method to gauge an organisation's safety practices (Pinto *et al*., 2018).

From the studies reviewed, the interpretation of safety culture has been articulated most comprehensively by the Advisory Committee on the Safety of Nuclear Installations (ACSNI) (Guldenmund, 2010; Reason, 2016). The safety programs implemented by an organization will result in a safety culture towards individual and group values in relation to competencies, attitudes, perceptions, and behaviour that determine the style, proficiency, and commitment to managing safety. Positive safety culture in organizations is characterized by mutually trusted communications, the seriousness of safety consensus, and the determination to advocate control measures.

Theoretical Framework

Safety Culture Maturity Model

Safety culture study is highly established and prolific in corporations with elevated hazards and risks in workplace safety such as construction, healthcare, energy, transport, and oil and gas (Gong, 2019; Salazar-Escoboza *et al*., 2020). Conversely, there is less attention and limited studies conducted on safety culture in the education industry (Vallinkoski & Koirikivi, 2020).

Based on procedures in which organizations process information, Westrum (1993) initially developed a model to differentiate between various types of organizational culture characterization. The model consisted of a three-stage grading scale of culture: Pathological, Bureaucratic and Generative. Reason (2016) improved the three-stage grading scale by suggesting supplementing the Westrum (1993) model with two new stages; Reactive and Proactive, that should fall between Pathological and Bureaucratic, and Bureaucratic and Generative, respectively.

Hudson (2001) went on to develop a safety culture maturity model following Reason's (2016) suggestions established on the original proposed by Westrum (1993) to include two additional stages in the transformation of safety culture from the ground up, where the Calculative level was used to replace the Bureaucratic stage. The following are explanations of the 5 stages of advancement in safety culture according to Hudson (2001):

Pathological - The issue of safety is the fault of the workforce. The key importance is the business and a desire to avoid being discovered by the enforcer.

Reactive - Only after incidents, organisations start to consider the seriousness of safety.

Calculative - Safety is predominantly guided and imposed by management structures, with much data collection rather than workforce accountability.

Proactive - With performance improvements, unprecedented events are a threat. The involvement of the workforce starts to move away from the purely top-down approach.

Generative - At all levels, there is active cooperation in safety. Safety is an essential aspect of the workplace. Organisations' sense of security in anticipating complacency is plagued with chronic unease.

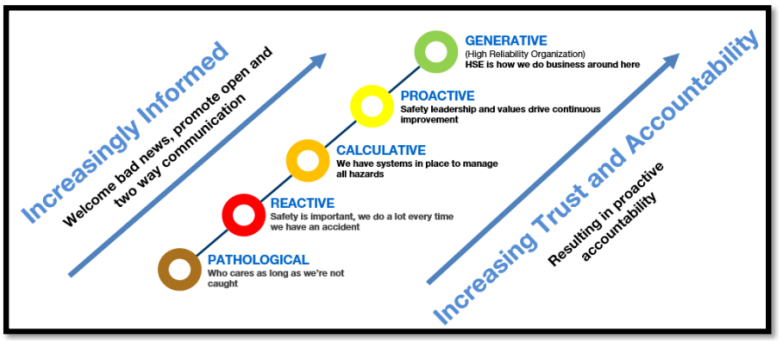

Figure 1: Safety culture maturity ladder (adapted from Westrum (1992), Reason, (1997), and Parker *et al*. (2007) published by Energy Institute 2018

Safety Culture Elements

Parker *et al*. (2006) created an 18-element framework as well as a series of questions relevant to each safety factor and maturity level. This resulted in the development of measures that organizations may use to assess their safety culture maturity. These 18 elements were divided into two categories: concrete elements (11 in total) and abstract elements (7 in total) linked to attitudes and behaviours. Unlike Flemings' model (2000), this categorization of elements could be integrated with weaker safety management systems. Moreover, it is also one of the utmost extensively used strategies in the literature. From this viewpoint, this study offers a compromise between analytical flaws and the application of the models' realistic potential, demonstrating that it can be used as a foundation for a management tool to conduct the study.

Table 1: Elements *within* Hudson's model of safety culture maturity

"Concrete" Elements	"Abstract" Elements
Benchmarking, trends, and statistics	Who causes accidents in the eyes of management?
Audits and review	What happens after an accident? Is the feedback loop being closed?
Incidents/accidents reporting, investigation, and analysis;	How do safety meeting feel?
Hazard and unsafe act reports	Balance between HSE & profitability?
Works planning including PTW, journey management	Is management interested in communication HSE issues with the workforce?
Contractor management	Commitment level of the workforce and level of care for colleagues.
Competency/training	What is the purpose of procedures?
Work-site job safety techniques	
Who cheeks safety on a day to day basic?	
What is size and status of the HSE department?	
What are the rewards of good safety performance?	

Selection of Safety Maturity Dimensions

The safety culture dimensions are determined and measured using criteria that define it or indicate its maturity; nevertheless, no standardised set of factors may be used as standards or referenced in this study. According to Ismail *et al*. (2021), numerous studies on safety culture have tried to figure out which dimensions are the most typical and may be used to evaluate or characterise it.

Goncalves Filho and Waterson (2018) undertook 41 literature reviews to arbitrate the maturity indicators specified in the safety culture model described in this study. Table 2 lists the five indicators that are most frequently used in safety culture maturity models, their definitions, and the research that demonstrates the connection between the independent variables (IV) and dependent variables (DV) dimensions.

Table 2: Safety culture maturity indicators

Year and Authors	Data and Sample	Independent Variables (IV) and Dependent Variables (DV)	Key Descriptions
Hudson, (2001) IAEA, (2002) Reason, (2016)	Case study	Information (IV) Safety culture (DV)	Characterised by the staff's confidence in the company to disclose errors, mishaps, and incidents—A crucial component of building an informed culture. Indicators created by the company to track workplace safety performance are also included.
IAEA, (2002) Reason, (2016)	Case study	Organizational Learning (IV) Safety culture (DV)	Characterised by the organisation's handling of the information it receives, how incidents and accidents are investigated, whether improvement actions are put forth and carried out, whether the staff is informed of the said actions and whether an ongoing effort is made to enhance occupational safety procedures.
Choudhry *et al*. (2007) Gordon *et al*. (2007)	Case study Case study	Involvement (IV) Safety culture (DV)	Characterised by staff involvement in safety issues, including a study of incidents and accidents involving them, identification of risks at the workplace, improving workplace safety with recommended actions and implementation, working procedures revision and creation, workload planning and participation in safety meetings, committees, and so on.

Glendon and Stanton, (2000) Mearns *et al*. (2003) Westrum, (2004)	Research Case study Research	Communication (IV) Safety culture (DV)	Characterised by the ease and promptness with which communications about occupational safety issues are carried out, by the presence or absence of a clear line of communication among subordinates and superiors. It also has to do with whether the information is communicated to the company's staff, whether they comprehend it and whether the organisation evaluates its success.
Flin *et al*. (2000) IAEA, (2002) Hill and Finster, (2013) Jabonete and Conception, (2016) Saunder *et al.* (2017)	Case Study Report Publication Case Study Case Study	Commitment (IV) Safety culture (DV)	Characterized by the resources (personnel, time, and money) and overall management backing of occupational safety at the existing state of workplace safety versus production and availability of a management system on occupational safety that includes the organization's goals and vision, defined roles, its requirement in training policy, procedures, sanctions, and rewards. Trusted commitment entails more than decent verbal commitment and passing significant references to workplace safety in speeches. What is mentioned and done must be consistent throughout.

Conceptual Framework and Hypothesised Model

An academic study sponsored by Shell, the Hearts and Minds program started from collaborative efforts between the University of Leiden in the Netherlands and the University of Manchester and Aberdeen University in the United Kingdom. The 20-million-pound study was conducted in 1980, the 1990s, and 2000s and is still running. Shell has given the non-profit Energy Institute the responsibility of expanding and updating the toolkit by sponsoring research and development aimed at assisting businesses in enhancing their administration in terms of occupational safety and health. This program has been widely adopted by the oil and gas industry and recognised by the International Association of Oil and Gas Producers (IOGP) (Hudson, 2007).

By comparing an organisation's culture to the safety culture ladder model, the model offers a mechanism to assess safety culture maturity (see Figure 1). It provides descriptors on 'how a company behaves' at 5 different levels of safety culture maturity, whereas the latest version uses 18 cultural dimensions as listed in Table 1 (Energy Institute, 2018). The dimensions included in the questionnaire is an accurate representation of the five unique levels and common factors that most businesses might use to measure their culture.

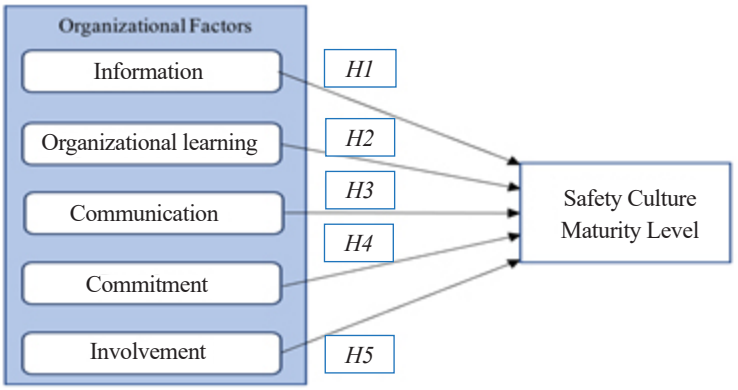

Figure 2: Conceptual framework and hypothesised model

To measure the relationship between the variables, a conceptual model was adopted (Figure 2) based on the theoretical framework. While the safety culture ladder's five-stage scale identifies the various levels of safety cultural maturity, the various organizational predictor variable levels assist in finding the gaps between the seafarer's current to the aspired level of safety culture maturity.

Methods

Questionnaire and Measures

The questions were adapted from the Hearts and Minds – 'Understand your culture' toolkit (Energy Institute, 2018). The adapted questionnaire, which was originally in English, was translated into Bahasa Melayu as it is the national language of Malaysia. The purpose of the translation is to assist respondents who are not fluent in English to complete the questionnaire. This is in line with the recommendation from (Saari & Judge, 2004; Sekaran & Bougie, 2016), who indicated that the research questions should be translated into the participant's local language as well.

For this study, the back-to-back translation was executed to maintain the original concept, thoughts and meanings of the questions. This was processed with the assistance of two translators with a high degree of proficiency in Bahasa Melayu and English language. The first translator translated it from English to Bahasa Melayu and the other verified it by translating it back from Bahasa Melayu to English.

Twenty-five 25 questions were adapted and 3 had to be dropped due to low loading factors. The individual questionnaire from the safety culture model was mapped against the safety culture maturity indicators that investigated how each of the five dimensions was perceived by the seafarers. The final number of 22 questions (Table 3) make up the five safety predictor indicators, with each indicator having between 3 and 8 questions. Each questionnaire's answers were represented by Likert 5-point scales (Batterton, 2017) to evaluate the variables from [1] - Strongly disagree, [2] - Disagree, [3] - Neutral, [4] - Agree and [5] - Strongly agree. The final 22 items, listed in Table 3 illustrate the questionnaire's 5 dimensions.

Table 3: Questionnaire adapted from the Hearts and Minds Toolkit (Energy Institute, 2018)

No.	Questions	Dimension
INF1	There is a formal system that allows seafarers to report any incidents, including accidents and serious ones, that occurred in the company.	Information
INF2	Only serious accidents are reported by seafarers.	
INF3	The seafarers do not feel comfortable enough to inform the incidents that occurred in the company.	
INF4	The only performance indicators of safety at work are serious accidents occurred in the company.	
ORL1	Only incidents that resulted in serious accidents are analysed by the company.	Organizational learning
ORL2	The analysis of incidents made by the company is restricted to identifying the incident's immediate causes.	
ORL3	Only when serious accidents occur improvements in the workplace be made by the company.	
ORL4	The company informs the results of the analysis of the incidents to only the seafarers involved.	
COM1	The company communicates to seafarers' safety-related issues only when serious accidents occur.	Communication
COM2	There is an open channel of communication between the company and seafarers only when serious accidents occur.	
COM3	The company checks if communication about safety-related issues is effective only when serious accidents occur.	
CMT1	Planning for safety at work is focused only on what went wrong in the past.	Commitment
CMT2	The company audits safety at work only when after serious accidents occur.	
CMT3	The company invests in safety at work only after serious accidents occur.	
CMT4	The company provides resources so that specific training program in safety at work can take place only after serious accidents occur.	
CMT5	The company has a small team to give support in safety at work.	
CMT6	The company considers safety at work important only when serious accidents occur.	
CMT7	The procedures for safety at work are written only in the face of serious accidents that occur.	
CMT8	The company worries about safety at work in relation to contractors only when serious accidents occur.	
INV1	The seafarers are invited to participate in safety-related issues only when serious accidents occur.	Involvement
INV2	The seafarers are interested in participating in safety-related issues only when serious accidents occur.	
INV3	The seafarers do not participate in matters of occupational safety in the company.	

Survey and Sampling Method

Data from selected respondents among seafarers were gathered using a quantitative, non-probability, snowball and convenience sampling strategy from a fleet of Liquified Natural Gas (LNG) vessels. Through the assistance of social media and HR departments of several shipping corporations and e-questionnaire was distributed to seafarers. To carefully examine the effect of demographics on seafarers' safety culture maturity, demographic parameters were adopted.

Referencing the statistical size suggested by (Dillman, 2007; Salant & Dillman, 1994), which was supported by the Roasoft online calculator, the sample size determination was made. The settings were limited to an 80/20 distribution split, a 95% confidence level and a sampling error of 5%. Theoretically, the outcome should be biased in the direction anticipated by the built-in questionnaire, consistent with the expected results. The sample size calculation was done using a sample size of 246 and the number of Malaysian seafarers is 123,628 (Marine Department of Malaysia, 2021).

Reliability and Exploratory Factor Analysis (EFA) Test

Three EFA tests were conducted: the suitability test, also known as the Kaiser Mayor Olkin (KMO) and Bartlett (BURT) tests; the eradication test, also known as the Principle Component Analysis (PCA) test; the consolidation of the Kaiser's criteria and the Scree test; and the rotation test, also known as the Direct Oblimin test. Utilizing Cronbach's Alpha, the questionnaire's consistency and reliability were evaluated (Cronbach, 1951). When an eigenvalue, which is the square of the loading variable's total sum of a particular factor is equal to or more than 1.0, it is regarded as significant and a loading factor value of 0.4 or higher will be used as a benchmark.

Table 4: Reliability and explanatory factor analysis

Variable	Organizational Factor	EFA				Reliability		
		Factor Loading	Kaiser Mayer-Olkin (KMO >0.6)	Eigen Value (≥ 1)	Bartlett Test (p <0.5)	Cronbach's Alpha (>0.7)	Mean	Standard Deviation
INF1	Factor 1: Information	0.852	0.684	2.320	.000	0.751	4.19	0.970
INF2		0.833					3.98	1.113
INF3		0.701					3.40	1.346
INF4		0.640					3.60	1.228
QRL1	Factor 2: Organizational learning	0.798	0.714	2.218	.000	0.728	2.53	1.120
QRL2		0.780					2.66	1.048
QRL3		0.743					2.96	1.179
QRL4		0.649					2.21	1.141
COM1	Factor 3: Communication	0.873	0.721	2.229	.000	0.827	2.62	1.243
COM2		0.856					2.83	1.274
COM3		0.856					2.79	1.232

CMT1	Factor 4: Commitment	0.932	0.841	5.386	.000	0.927	2.45	1.039
CMT2		0.916					2.23	1.108
CMT3		0.873					2.38	1.190
CMT4		0.872					2..66	1.273
CMT5		0.860					3.11	1.026
CMT6		0.765					2.21	1.122
CMT7		0.751					2.19	1.096
CMT8		0.516					2.34	1.166
INV1	Factor 5: Involvement	0.731	0.682	2.026	.000	0.759	2.53	1.248
INV2		0.886					2.45	1.059
INV3		0.878					2.34	1.166

Dependent Variable

The seafarer's safety culture maturity level is the Dependent Variable (DV). A single study question about the current position of the outcome variable was used in measuring the seafarers' safety culture maturity level. The average for each response was calculated after the data were analysed and the construct's overall averages were divided by the total number of respondents. The statistical average, mean and standard deviation were obtained.

Independent Variables

The Organizational factors which consist of the following predictor variables of Information (INF), Organisational Learning (ORL), Communication (COM), Commitment (CMT) and Involvement (INV) were the independent factors (IV) that were measured individually from the average of the questions.

Results and Discussion

Respondents' Demographics

The statistics collected in Table 5 indicated that there were 234 Malaysians and 52 non-Malaysian seafarers who responded to the study. There were primarily males (97.2% men and 2.8% women). Additionally, 221 respondents worked on ships that traded internationally which contributed adequately to the study findings because ships that trade internationally potentially encounter different incidents from maritime to environmental, inspections by different authorities and their multinational crews frequently face challenges due to cultural differences, all of which could have an impact on safety procedures and harmonisation onboard. Table 5 displays a summary of the sample's characteristics.

Table 5: Respondents' demographic data (N = 286)

Category	Sub-Category	Frequency	Percentages (%)
Experience	Seafarer	221	77.3
	Ex-seafarer	65	22.7
Total			**100**
Gender	Male	278	97.2
	Female	8	2.8
Total			**100**

Marital status	Single	64	22.4
	Married	222	77.6
Total			**100**
Age	Below 20 years	4	1.4
	21 – 29 years	54	18.9
	30 – 39 years	120	42.0
	40 – 49 years	83	29.0
	Above 50 years	25	8.7
Total			**100**
Nationality	Malaysian	234	81.8
	Non-Malaysian	52	18.2
Total			**100**
Ranks	Deck rating	4	1.4
	Engine rating	3	1.1
	Deck officer	81	28.3
	Engine officer	130	45.5
	Chief engineer	27	9.4
	Master	33	11.5
	Others	8	2.8
Total			**100**
Department	Deck	121	42.3
	Engine	162	56.6
	Catering	2	0.7
	Others	1	0.3
Total			**100**
Working experience (years)	1 – 5	48	16.8
	6 – 10	82	28.7
	11 – 15	67	23.4
	16 – 20	38	13.3
	More than 20	51	17.8
Total			**100**

Diagnosis of Seafarer's Safety Culture Maturity Level

The average score of the seafarers' safety culture maturity is 3.55. Figure 3 displays the Organisational factors diagnosis in standardised intervals between zero and five. The "Calculative" stage, which defines the current seafarers' level of safety maturity culture, is represented by the average rating for all Organisational factors. Hence, management systems with extensive data collection drive seafarers' safety culture maturity level. The seafarers still do not actively seek safety culture maturity; instead it is forced by management.

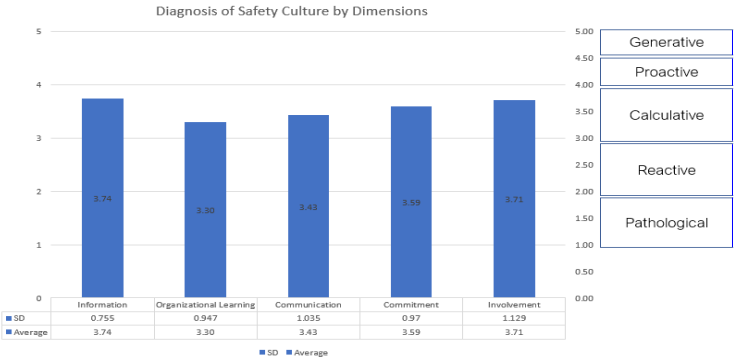

Figure 3: Diagnosis of seafarers' safety culture maturity level

Descriptive Analysis

The reliability of the seafarers' safety culture maturity level questionnaire was established with the aid of Cronbach's Alpha, also known as the internal consistency coefficient. The dependability of the survey in this study met the criteria for the evaluation because Cronbach's Alpha coefficient value for the questionnaire's 22 items was 0.929. The Cronbach's Alpha coefficient value if closer to 1.0, meant the scale's items were more consistent internally.

Table 6: Cronbach's Alpha value

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.929	.927	22

For a large sample size (N > 100), the statistics were tested for normality, skewness and kurtosis Z scores. The Q-Q plots show that the statistics were normal and symmetrically distributed. The histogram displays a pattern of varied bell shapes, most of which were regarded as normal. In contrast to the Kolmogorov-Smirnov (K-S) test result, which indicated that the statistics were abnormal, the box plot suggested that there was no outlier and that the statistics were considered normal. According to Ghasemi and Zahediasl (2012), violation of normality is not a significant problem, especially in a substantial sample size of 100 or more, providing a solid rationale to carry out parametric statistical analysis.

Table 7 shows the statistic correlation matrix results, as the values stayed below the crucial level of 0.9; it shows no evidence of a multicollinearity issue for the constructs (Hair, J. F., *et al.,* 2010). Safety culture maturity level has a significant relationship with all variables and Organizational Learning indicates the highest score ($p < 0.05$).

Table 7: Pearson Correlation analysis between constructs (N = 286)

Constructs	1	2	3	4	5	6
Mean	3.53	3.74	3.30	3.43	3.59	3.71
Standard deviation	0.775	0.755	0.947	1.035	0.970	1.129
Maturity	1.00					
Information	.639	1.00				
Organizational learning	.770	.437	1.00			
Communication	.786	.355	.571	1.00		
Commitment	.884	.485	.524	.592	1.00	
Involvement	.835	.449	.442	.503	.869	1.00

Note: * p<.05 (one tailed), **p<.01 (two-tailed)

Hierarchical Linear Regression

Table 8 summarises the generated hierarchical regression models, from 1 to 5, with safety culture maturity level as the dependent variable. Models 1 through 5 depict the connections between the independent variables.

Table 8: Hierarchical regression summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.639[a]	.408	.406	.59724	.408	195.485	1	284	.000
2	.840[b]	.706	.704	.42155	.298	287.061	1	283	.000
3	.921[c]	.848	.847	.30324	.142	264.883	1	282	.000
4	.989[d]	.977	.977	.11726	.129	1604.823	1	281	.000
5	.998[e]	.997	.996	.04612	.019	1536.718	1	280	.000

a. Predictors: (Constant), INF
b. Predictors: (Constant), INF, ORL
c. Predictors: (Constant), INF, ORL, COM
d. Predictors: (Constant), INF, ORL, COM, CMT
e. Predictors: (Constant), INF, ORL, COM, CMT, INV

Analysis from Table 8 indicates that the rise in r-square caused by all five predictors is statistically significant, as shown by the "Sig. F Change" column: F(5,280) = 1536.718, p = 0.000. The r-square does considerably improve with the addition of each predictor. The R2 = .996 implies 99.6% affection of IV's towards DV. In summary, this table advises that we select Model 5 as a good model fit.

Both tests (Hair, J. F., *et al.,* 2010), Variance Inflation Factor (VIF) and Tolerance, reported in Table 9, demonstrate that each independent variable's capacity to predict the dependent variable is intact and conclusively rules out the possibility of multicollinearity. The maximum value for VIF is 10, which equates to a tolerance of 0.1, according to Myers (1990). Menard (2011) warned against the VIF average rising noticeably above one and said tolerance values below 0.2 may present problems.

Table 9: Hierarchical regression of the effect of IV and DV

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.081	.179		6.054	.000		
	INF	.655	.047	.639	13.982	.000	1.000	1.000
2	(Constant)	.457	.131		3.484	.001		
	INF	.383	.037	.373	10.408	.000	.809	1.236
	ORL	.497	.029	.607	16.943	.000	.809	1.236
3	(Constant)	.143	.096		1.483	.139		
	INF	.320	.027	.312	11.988	.000	.792	1.262
	ORL	.301	.024	.369	12.425	.000	.611	1.636
	COM	.348	.021	.464	16.275	.000	.660	1.515
4	(Constant)	-.026	.038		-.687	.492		
	INF	.188	.011	.183	17.331	.000	.719	1.391
	ORL	.228	.010	.279	23.845	.000	.589	1.699
	COM	.204	.009	.273	22.701	.000	.556	1.799
	CMT	.389	.010	.488	40.060	.000	.543	1.843
5	(Constant)	-.023	.015		-1.591	.113		
	INF	.175	.004	.171	40.980	.000	.715	1.399
	ORL	.234	.004	.286	62.142	.000	.588	1.702
	COM	.207	.004	.277	58.470	.000	.556	1.800
	CMT	.195	.006	.244	31.054	.000	.202	4.954
	INV	.193	.005	.281	39.201	.000	.243	4.121

a. Dependent Variable: MATURITY

The standardised Beta (ß) coefficients provide a response to the question of which independent variable (IV) has a higher impact on the dependent variable (DV). The ß value can be interpreted like the Pearson coefficient from a scale of -1 to 1. Hence, from the results in Table 9, [1] ORL has the uppermost score and is subsequent by [2] INV, [3] COM, [4] CMT, and [5] INF. However, establishing which predictor variable is more crucial requires input from maritime technical safety experts in the maritime field.

To approach the question of what effect each of the independent variables affects the seafarers' safety culture maturity level, a hierarchical linear regression test was performed to assess the predictor variables as presented in Table 8 based on Model 5:

i. The rise in r-square caused by the Information (INF) predictor is statistically significant, as shown by the "Sig. F Change" column: F(1,284) = 195.485, p = 0.000. The r-square considerably improves the variation of the seafarers' safety culture maturity level by 40.8% as a predictor.

ii. The rise in r-square caused by the Organizational Learning (ORL) predictor is statistically significant, as shown by the "Sig. F Change" column: F(2,283) = 287.061, p =

0.000. The r-square considerably improves the variation of the seafarers' safety culture maturity level by 770.6% as a predictor.

iii. The rise in r-square caused by the Communication (COM) predictor is statistically significant, as shown by the "Sig. F Change" column: F(3,282) = 264.883, p = 0.000. The r-square considerably improves the variation of the seafarers' safety culture maturity level by 84.8% as a predictor.

iv. The rise in r-square caused by the Commitment (CMT) predictor is statistically significant, as shown by the "Sig. F Change" column: F(4,281) = 1604.823, p = 0.000. The r-square considerably improves the variation of the seafarers' safety culture maturity level by 97.7% as a predictor.

v. The rise in r-square caused by Involvement (ORL) predictor is statistically significant, as shown by the "Sig. F Change" column: F(5,280) = 1536.718, p = 0.000. The r-square considerably improves the variation of the seafarers' safety culture maturity level by 99.7% as a predictor.

Thus, model 5 demonstrates that the organizational factors of INF, ORL, COM, CMT, and INV factors are significant and accounted for 99.7% (R2=0.997) variation in the change of seafarers' safety culture maturity level. Therefore, the seafarers' safety culture maturity level is statistically significant between the five dimensions of organizational factors (F(5, 280) = [1536.718], p = 0.00).

For the hypothesis analysis, Model 5 postulates that all the organizational dimensions have a relationship that impacts the seafarer's level of safety culture maturity:

H1: Information factor has a positive relationship with seafarers' safety culture maturity level. The analysis indicated that INF positively influenced the seafarers' safety culture maturity level (ß = 0.171, p < 0.05), which was found to be significant to the contended hypothesis. Hence, H1 was supported.

H2: Organizational learning factor has a positive relationship with seafarers' safety culture maturity level. The analysis indicated that QRL positively influenced the seafarers' safety culture maturity level (ß = 0.286, p < 0.05), which was found to be significant to the contended hypothesis. Hence, H2 was supported.

H3: Communication factor has a positive relationship with seafarers' safety culture maturity level. The analysis indicated that COM positively influenced the seafarers' safety culture maturity level (ß = 0.277, p < 0.05), which was found to be significant to the contended hypothesis. Hence, H3 was supported.

H4: Commitment factor has a positive relationship with seafarers' safety culture maturity level. The analysis indicated that CMT positively influenced the seafarers' safety culture maturity level (ß = 0.244, p < 0.05), which was found to be significant to the contended hypothesis. Hence, H4 was supported.

H5: Involvement factor has a positive relationship with seafarers' safety culture maturity level. The analysis indicated that INV positively influenced the seafarers' safety culture maturity level (ß = 0.281, p < 0.05), which was found to be significant to the contended hypothesis. Hence, H5 was supported.

Limitations

There are several limitations to this survey. Firstly, this study is conducted within Malaysia. Hence, the results cannot be profiled throughout the community of seafarers outside of Malaysia. Secondly, the study results are based on respondents' self-reporting data which may be influenced by a certain degree of bias, i.e., active or retired seafarers, mood, the time factor, etc. Thirdly, the respondents were from the LNG fleet of vessels only.

This research concentrates on the organization safety culture segment, the remote and isolated nature of maritime operations makes it challenging due to limited access to participants, especially when studying seafarers at sea, coupled with a diverse workforce,

language barriers and cultural differences. The maritime industry operates under a highly regulated framework. Hence, to obtain the necessary approvals and permissions within the organization to conduct this study introduced time constraints. By acknowledging these challenges and adopting appropriate approaches, the study provides a starting point for future research on maritime safety culture.

Engineers, Deck Officers, Ratings, etc., with varying perspectives on shipboard safety make up the study's sample of seafarers from various backgrounds. The size of the company, the seafarers work for will also have some bearing on the responses, as large shipping companies may have a more sophisticated shipboard management system than smaller companies. The answer will be somewhat influenced by how much exposure do seafarers have to the current safety standard on board the ship. Even though the disclaimer states that responses must remain anonymous, some respondents might withhold their personal information rather than provide a truthful response.

Conclusion

This study accomplishes a number of goals. Firstly, the region's seafarers' safety culture maturity level was determined at the "Calculative" stage in all five dimensions. Safety is much driven by the data and the management system. Second, ORL was recognised as a factor in determining the seafarers' safety culture maturity level. Through incidents, safety culture maturity has produced thousands of recorded learning opportunities, e.g. All Learning Events Reported Today (A.L.E.R.T) networks. Thirdly, the hierarchy of how the five independent variables affect the seafarers' safety culture maturity level was achieved and significantly confirmed. Lastly, all five hypotheses were positively confirmed and supported as each had a relationship to the seafarers' safety culture maturity level.

There is no substitute for shipping sector today to move freight around the world, despite the obstacles and problems the seafarers and the industry must overcome. The data provides information about seafarers' safety attitudes, awareness and behaviours in the region despite certain limitations. It supports creating programs and policies to eliminate the root causes and enforces a safety culture, potentially reducing the number of maritime accidents. A mature safety culture is often characterised by a high level of trust and collaboration among seafarers and a shared commitment to safety across the maritime domains.

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