



Original article

## A Perspective of Malaysian Marine Training Providers and Shipowners on Communication Issues Onboard Merchant Vessels<sup>☆</sup>

N. H. M. SALLEH<sup>a\*</sup>, N. A. ALIAS<sup>b</sup>, J. JEEVAN<sup>c</sup>, R. M. HANAFIAH<sup>d</sup>, A. H. NGAH<sup>e</sup><sup>a\*</sup> School of Maritime Business and Management, Universiti Malaysia Terengganu, Malaysia, haqimin@umt.edu.my, Corresponding Author<sup>b</sup> CMA CGM Malaysia Sdn Bhd, Malaysia, kua.nualias@cma-cgm.com<sup>c</sup> School of Maritime Business and Management, Universiti Malaysia Terengganu, Malaysia, jagan@umt.edu.my<sup>d</sup> School of Maritime Business and Management, Universiti Malaysia Terengganu, Malaysia, rudiah@umt.edu.my<sup>e</sup> School of Maritime Business and Management, Universiti Malaysia Terengganu, Malaysia, hafaz.ngah@umt.edu.my

### Abstract

The IMO Standard Marine Communication Phrases (SMCP) has been established purposely to enhance the greater safety of vessel's navigation by standardizing the language used among seafarers. However, accidents are still occurred due to communication failures among onboard merchant vessels' crews. It is worth mentioning that the major cause of marine accidents is human error (80%) where one-third from it was due to communication failures. Ineffective communication, different culture and language among seafarers onboard are some instigators of human error that lead to accidents in marine operations. Therefore, the primary aim of this paper is to investigate and evaluate the causal factors that contributes to communication failures onboard merchant vessels. Then, this paper recommends possible solutions for minimizing the communication failures among seafarers. To achieve this research objectives, two decision-making tools which are the Analytical Hierarchy Process (AHP) and Evidential Reasoning (ER) was applied. Data and judgments are obtained from domains experts from four marine training providers and eight shipowners in Malaysia. The result has shown that lack of SMCP knowledge, prejudice and dialect varieties are the most significant factors that contribute to the communication failures onboard merchant vessels. Few suggestions and opinions from the experts are proposed in this paper. This research can assist marine training providers and shipowners to identify and evaluate the causal factors of communication failures thus corrective action can be taken.

*Keywords: Human error, IMO Standard Marine Communication Phrases (SMCP), vessel navigation, Analytical Hierarchy Process (AHP) and Evidential Reasoning (ER).*

---

Copyright © 2017, International Association of e-Navigation and Ocean Economy.

This article is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/3.0/>).  
Peer review under responsibility of Korea Advanced Institute for International Association of e-Navigation and Ocean Economy

<https://doi.org/10.52820/j.enavi.2019.11.033>

## 1. Introduction

80% of world commodities by volume is carried by maritime transportation. As a result, it is noteworthy to mention that the maritime transportation is the backbone international trade and global economy. In this maritime transport, vessels act as an important mean of transport where seafarers ranging from captain, officers, engineers, cook, and others are work onboard. There are multinational, multilingual and multi-cultural seafarers onboard. Consequently, it is a challenge for seafarers to communicate among them effectively, and sometimes miscommunication problems occur among them. To reduce miscommunication between ships to shore and vice versa, ship to ship and among onboard ship's seafarers, the communication must be designed to be simple, unambiguous and precise. Therefore, a standard language for merchant vessel is crucial to standardize the language to make it easier and at the same time, to reduce the number of accidents caused by human error.

Communications problems were some of the factors highlighted as causes of human error (Hetherington *et al.*, 2006). Many accidents were caused by human error, where one-third from the 80 percent of the accidents are caused by miscommunication problems (Ahmed, 2013). Yanchunas (2007) claimed that the accident of tanker at Mississippi in United States was caused by miscommunication. Pyne and Koester (2005) mentioned that the accidents caused by communication failures among seafarers are related to their different culture and languages. Therefore, the primary aim of this paper is to investigate, prioritize and evaluate the causal factors of communication failures onboard merchant vessels. Then, this paper recommends possible solutions for minimizing the communication failures among seafarers.

## 2. Literature Review

Accidents are still occurred even most vessels nowadays are equipped with various modern equipment and advanced technology to prevent the collision. In recent trend, the shipping companies prefer to invest more money on vessels' equipment and technology rather than sending their seafarers for

training although they aware that the financial loss due to the collision and grounding over the year are higher compared to the training cost (The Swedish Club, 2011). Berg *et al.* (2013) stated that 80% of the accidents are caused by human error where one-third of these events are due to communication problems. Due to this, seafarers are trained with several marine courses (e.g. Human Element, Leadership and Management & Marine Radio Communication) and conventions are established by the IMO such as the 1978 *Standards of Training, Certification and Watchkeeping for Seafarers (STCW)* and The Standard Marine Communication Phrases (SMCP) (IMO, 2018a; IMO, 2018b).

Rijeka (2000) claimed that the standard language is important to avoid any errors during communication and it must be precise, simple and unambiguous. In 1973, the IMO Maritime Safety Committee has agreed that the English language as a common language to be used onboard merchant vessel, then the Standard Marine Navigational Vocabulary (SMNV) was developed in 1977 and amended in 1985. Later in 1992, the IMO Standard Marine Communication Phrases (SMCP) was adopted by the IMO in 2001 (IMO, 2018b). The SMCP was required for the certification to watchkeeper on vessels of 500 gross tonnages and more under the Convention on STCW (IMO, 2018b).

Generally, the establishment of SMCP is purposely to enhance safety of navigation. Secondly, this establishment is to standardize the language used in communication for navigation at sea in port approaches, in waterways, harbors and onboard vessels with multilingual seafarers. Thirdly, to assist maritime training institutions in meeting these purposes (IMO, 2018b). This convention also explained the position of SMCP in Maritime Education and Training (MET), basic communicative features, spelling, message marker, correction, readiness, repetition, number, position, bearing course, distance, speed, time, geographical names and other standardization in communication to avoid any accidents or incidents (IMO, 2018b).

Rosedi (2015) discussed the significant of the SMCP for the seagoing professional which mentioned the maritime English is high standard at

the sea and its priority on vessel safety operations. He also explained that maritime English covers vessels operations and other related operations, such as marine transportation, port state control, harbour authority etc. Besides that, he also differentiated the usefulness of English towards navigation officers, marine engineer and English for ship administration officers. The English for navigation is used to handle and lead the situation. While English for a marine engineer deal with onboard engine crew and communication between bridge and engine room but not involve communication with external parties, like shore station or other vessels. English for administrative officers is used for documentation, report and letter. The administration officers need to communicate with many parties onboard as well as inland. However, they need to be excellent in Basic Marine Vocabulary for vessel orientation then, proceed to write, reporting and editing skills.

Communication problems are remained major obstacles among seafarers. Badawi and Halawa (2003) mentioned that the cultural differences among seafarers affected their communicative skill and style, and it is also giving impact on the safety and efficiency of vessel operations. Also, Badawi and Halawa (2003) stated that most MET providers focused on the vocabulary and grammar instead of learning the importance part of communication, such as utterance, speed of delivery and nuances of the body language. This is because of Meta-messages and nuances are the barriers to the cross-culture communication while one-tenth of vessel were operated with five or more nationalities (Kahveci *et al.*, 2001).

Due to the multicultural and multi-language, it is suggested that the necessary of MET providers to address these issues and the same time promoting better communication for seafarers. On the other hand, Ziarati *et al.* (2011) stated that English language proficiency among seafarers is very low. This low proficiency led to the ineffective communication that contributed to the major factor in many accidents.

The 'CAPTAINS' Project (i.e. EU Leonardo Captains Project, 2010-2012) was developed to reduce miscommunication problems at sea (Ziarati *et*

*al.*, 2011). This project provides the simulation of real-life communication situation including the real accident, incident and near-miss. This research also shown the result that seafarers expressed that when there is more than one language used in an emergency, it will lead to the worst situation. As a result, it might be a danger to them due to miscommunication or misunderstanding. In a time during emergency, the crew need to leave his station at the control room and go to meet that person just to speak face-to-face for clear understanding. In emergency, most of the crews were in panic situation where they react and report differently and it will even worst when they lack maritime English as well as improper use of the SMCP.

### *2.1. Causal Factors of Miscommunication*

There are four main causal factors of communication problems that are identified in this paper. These factors are multicultural issues, lack of training, lack of teamwork and leadership skills, and misinterpretation. Horck (2008) stated that shipowner aware about the multicultural problem's onboard vessel. Lack of culture awareness leads to the misunderstanding or miscommunication among seafarers and create further emotional response. Dialect varieties, multilingual and racist are issues that discussed in multicultural problems (Halid and Genova 2011; Badawi and Halawa, 2003).

Lack of training is claimed as one of the causal factors of miscommunication problems among seafarers. Lack of SMCP knowledge, lack of fluency in English, and lack of signage interpretation are the result of lack or improper training among seafarers. The preliminary study of SMCP is important to seafarers and cadets where this study could not be simply studied on theory, but it also needs a practical test (Rosedi, 2015). Many seafarers do not take serious about the maritime English education. It also mentioned that poor communication between crew members contribute almost 40% collision at sea (Ziarati *et al.*, 2011). According to May (2004), the signage studies are about the best technical support for finding ways in the maritime domain. It is stated that there are three types of signs. Firstly, symbols for naming the objects; secondly, maps for locating object; and thirdly, network of graphical to indicate

the direction. Seafarers need to learn and practice, otherwise, it could be a danger to them especially when an emergency occurs.

According to Cooke *et al.* (2001), to perform tasks in a group, the criteria that need to be measured is team knowledge, performance and team behavior, as well as their ability to predict team performance and reflect skills acquisition. So, if there is prejudice, reticent and conflict among them, they do not have a good teamwork. Conflict is one of the causal factors of communication problems (Halid and Genova, 2011). If there is a conflict among the seafarers, it is hard for them to work as a team, and an individual crew will stand on their own opinion. As a result, it is time consuming to get one decision, and finally, they do not find any solutions or the accurate decisions. Reticent is a habit when someone who prefer to be silent than talking or asking (Soo and Goh, 2013). The crew will reluctant to communicate with others when they are from higher ranking position and lack of English skills. They prefer to make their own solution or assumption rather than asking other people. Prejudice occurs when the uncomfortable feeling existed, or they have negative thinking towards other crews (Halid and Genova, 2011). For example, prejudice against the culture differences and body odor, drunk people, eating habits, the ways of others thinking, and it can be opinion as well. Once they have that feeling, it will be a communication barrier between them, because they avoid talking with them and it is hard to accept another opinion.

According to Halid and Genova (2011), the varieties of the medium in delivering ideas, speaking fast, using difficult words can cause the misinterpretation during conveying the information. Each person may have a different way of understanding and different way of expressing the idea. For example, the speed and rhythm of communication, the tone of voice, pausing speech gestures and eye contact, an organization of information, direct and indirect communication, and varieties of dialect also play important role in effective communication (Halid and Genova, 2011). The information that the last person will get will not the same as the original ones because it depends on the person understanding level and the way that the person delivers the message to another person. While body language is become an extra

factor for better communication, lack of this skill can also contribute to the miscommunication problem. Body language is the major significant factor to the communication for better understanding (Badawi and Halawa, 2003). In some cases, during an emergency the crew need to leave his station in the control room and go to meet that person just to speak face-to-face for clear understanding and watching that person's body language to communicate.

## 2.2. Methods

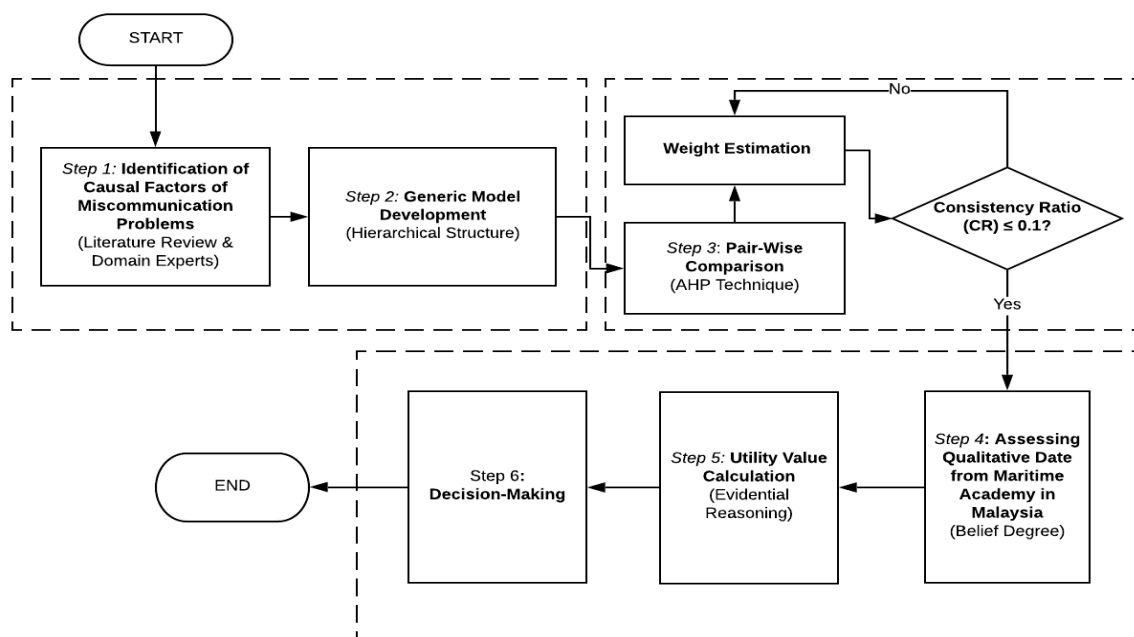
In order to identify the factors that contributes to communication issues onboard merchant vessels and further evaluate these causal factors, two mathematical factors are used which are the Analytical Hierarchy Process (AHP) and Evidential Reasoning (ER). An AHP was created by Thomas Saaty with the purpose to make an accurate decision based on pair-wise comparison analysis (Saaty, 1980). The complex decision can be simplified by using pair-wise comparison and after that, weight for each factor can be established. As result, weight will indicate how important of such factor compared to other factors in the given attributes. To ensure that the judgments made by experts are consistent, consistency ratio can be calculated. In addition, an AHP can deal with multiple criteria and sub-criteria in a hierarchical structure. A calculation process of an AHP will be explained in Sub-section 3.3.

The ER algorithm was first developed by Yang and Singh (1994), later modified by Yang (2001) and further improved by Yang and Xu (2002). This approach consists of hierarchical evaluation model and synthetic rules of Dempster-Shafer theory of evidence. The concept of degree of assurance is proposed by an ER approach. The degree of prediction of expected outcome through standard can be interpreted as the degree of assurance of degree of belief (Yang and Xu, 2002). To deal with uncertain knowledge, Multiple Attribute Decision Making (MADM) is embedded in an ER approach where alternative of the decision can be compared in the calculation. A calculation process of an ER will be elucidated in Sub-section 3.4.

### 3. Methodology

In this section, to identify, prioritize and assess the impact of causal factors on miscommunication problem, the research methodology is developed as illustrated in Figure 1. Firstly, the causal factor of miscommunication problems will be identified based on literature review. Secondly, the generic model will be developed based on the identified factors in a hierarchical structure. Thirdly, pair-wise comparisons will be conducted to priorities the causal factors of miscommunication. From this, weight for each causal factor will be established to represent which one is the highest contributor to the miscommunication

problems. Fourthly, qualitative assessment will be conducted to all the sub-causal factors by using subjective judgments under fuzzy environment. This assessment is conducted to obtain the critical value of each causal factors on the miscommunication problems. Then, the utility value will be calculated by using expected utility approach to obtain a single crisp number. This result can be used for decision-making by related agencies. Finally, decision-making can be made by recommending possible solutions on the targeted causal factors of miscommunication problems. Further explanation of these steps is discussed in Sub-section below.



**Figure 1: Import Meta File**

Source: Author(s)

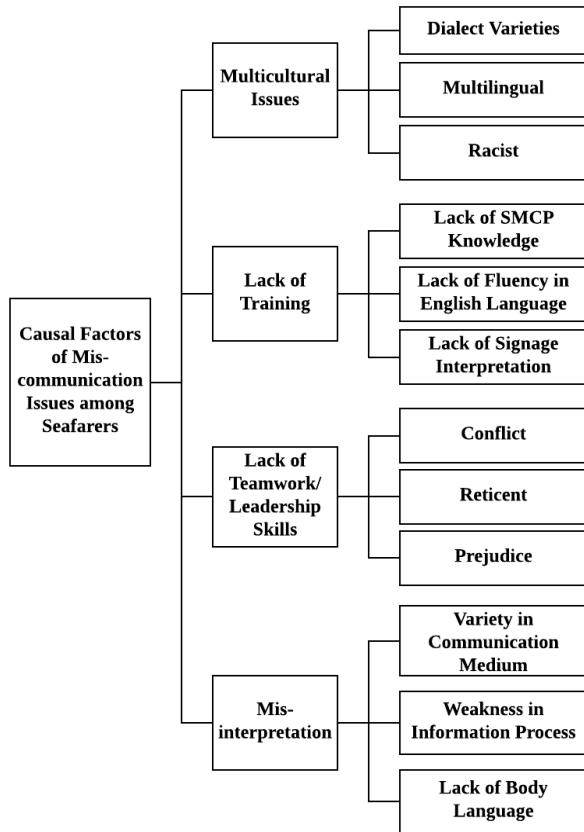
#### 3.1. Identification Process of Causal Factors of Miscommunication

In step 1, the identification process for the causal factors of miscommunication problems is conducted. In this paper, literature review (i.e. Sub-section 2.1) is used to identify the main factors and its sub-factors.

#### 3.2. Generic Model Development (Hierarchical Structure)

Based on the identification process, the generic model is developed as shown in Figure 2. The goal of this model is to visually illustrate the causal factors of miscommunication problems. The aforementioned there are four main criteria are identified, which are

multicultural problems, lack of training, lack of teamwork or leadership skills and misinterpretation. Multicultural problems are classified into three sub-criteria, which are dialect varieties, multilanguage and racist. While lack of training can be categorized into three types which are, lack of SMCP knowledge, lack of maritime english knowledge, and lack of signage interpretation. Conflict, reticent and prejudice are the three sub-criteria that discussed under lack of teamwork/leadership skills. Finally, misinterpretation are divided into three categories which are variety of medium in delivering the idea, weakness in information process and lack of body language.



**Figure 2: Generic Model Development**

Source: Adapted from various literatures

3.3. Prioritization Process Using Analytical Hierarchy Process (AHP)

The AHP method is used to perform weight assignment for each main and causal factor of miscommunication problems. This method consists of five key formulas which need to be calculated. Table 1 shows a preferable scale of from 1 to 9 where a preferable scale 1 show the equivalent between factors while a preferable scale of 9 show the one criterion is very important than the other factors when they are compared (Saaty, 2008).

**Table 1: Comparison Scale**

Scale	Linguistic Meaning
1	Equally Important (EQ)
3	Weekly Important (WE)
5	Strongly Important (ST)
7	Very Strongly Important (VS)
9	Extremely Important (EX)
2, 4, 6, 8	Intermediate values between the two adjacent judgments.

Source: Saaty (1980; 2008)

To quantify judgments of pairs of criteria  $A_i$  and  $A_j$  a re presented by  $n \times n$  matrix  $D$ . The  $a_{ij}$  entries are defined by entry rules as follows:

- Rule 1: if  $a_{ij} = \alpha, 1/\alpha, \alpha \neq 0$
- Rule 2: if  $A_i$  is judging to be of equal number of equal relative number as  $A_j$ , then  $a_{ij} = a_{ji} = 1$ .

According to above rules of matrix  $D$  is shown as follows:

$$D = \begin{bmatrix} 1 & a_{12} & \dots & a_{1n} \\ 1/a_{12} & 1 & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ 1/a_{1n} & 1/a_{2n} & \dots & 1 \end{bmatrix} \tag{1}$$

where  $i, j = 1, 2, \dots, n$  and each  $a_{ij}$  is the relative importance of criterion  $A_i$  to criterion  $A_j$ .

The quantified judgment of comparison of pair  $(A_i, A_j)$  is noted as  $a_{ij}$  in the matrix  $D$ ; a further step is to allocate the weight vector for each criterion or alternative, as it show the prioritization of the criterion or alternatives (Riahi et al., 2012) a weight value  $w_k$  can be calculated as follow:

$$w_k = \frac{1}{n} \sum_{j=1}^n \left( \frac{a_{kj}}{\sum_{i=1}^n a_{ij}} \right) (k=1,2,3,\dots,n) \tag{2}$$

where  $a_{ij}$  stands for the entry row  $i$  and column  $j$  in a comparison matrix of order  $n$ .

By using the Consistency Ratio (CR), inconsistency of the pair wise comparison can be measured. If CR value is 0.10 or less, the consistency of the pair wise comparison can be accepted considered reasonable, and the AHP can continue with computations of weight vectors (Salleh et al., 2015; Salleh and Halim, 2018). In contrast, a CR with greater value than 0.10 indicates an inconsistency in the pair wise judgments. Thus, decision maker should review the pair wise judgments before proceeding. To check the consistency of the judgments, a CR is computed by using Equations 3-5 (Saaty, 1980; 2008).

$$CR = \frac{CI}{RI} \tag{3}$$

$$CI = \frac{\lambda_{max} - n}{n - 1} \tag{4}$$

$$\lambda_{max} = \frac{\sum_{j=1}^n \left[ \frac{\left( \sum_{k=1}^n w_k a_{jk} \right)}{w_j} \right]}{n} \tag{5}$$

where CI is the inconsistency index, RI is the average random index (Table 2),  $n$  is the number of items being compared, and  $\lambda_{\max}$  is the minimum weight value of the  $n \times n$  comparison matrix  $D$  (Salleh et al., 2015; Salleh and Halim, 2018).

**Table 2: Value of Average Index**

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Source: Saaty (1980; 2008)

### 3.3. Factors Assessment (Qualitative)

For assessing the causal factors of miscommunication problems quantitatively, qualitative criteria can be presented by linguistic variables (i.e. linguistic terms and their corresponding belief degrees) (Riahi et al., 2012; Mohd Salleh et al., 2015). Miller (1956) expressed the number of remarkable coincidences between the channel capacity of several human cognitive and perceptual tasks. Based on Miller’s study, the effective channel capacity is between five and nine equally weighted errorless choices (Riahi et al., 2012; Mohd Salleh et al., 2015). As a result, the impact of all causal factors on miscommunication problems among seafarers can be assessed by using five belief degrees which are very low, low, medium, high and very high.

After the assessment grades are obtained from the experts, they need to be aggregated. The aggregation is conducted by using an ER algorithm (Yang and Xu 2002; Xu and Yang, 2005). In this paper, the IDS (Intelligent Decisions System) software will be used to calculate the belief degrees and utility value based on the data that are obtained.

## 4. Results and Discussions

In this paper, for prioritizing and assessing the causal factors of miscommunication problems, interview sessions are conducted between researchers and the domain experts. The questionnaires are designed and provided during the interview session to guide the experts on issues. Mostly, experts are selected from seafarers who are currently working onboard merchant vessels and trainers who have 10 years’ experience and above. The data are collected

from several maritime institutions which are Pelita Academy institution, Ranaco institution, Consist College, University Malaysia Terengganu and also seafarers from Orkim Management Sdn. Bhd, CST Belchem Pte. Ltd, ICOM Offshore, Multi Marine Venture Sdn. Bhd, Bumi Armada Sdn. Bhd, KSP Towage, TH Alam Management and Alam Maritme Sdn. Bhd. All of them have working experience as a captain, chief officer, chief engineer, engineer, second and third engineer, oiler and crew. In order to test this model, the experts are selected to be interviewed and answer the questionnaires based on their education, qualification and working experience. The questionnaires are divided into three parts, which are part A, B and C. Part A is designed to obtain the demographic data of the selected expert. Part B is aimed to conducted pair-wise comparison (i.e. AHP method) where experts need to compare each factor in a given attribute. For example, between multicultural and lack of training, which one is more contribute to the miscommunication problems according to the scales that are given. Lastly, Part C assessing the impact of causal factors on miscommunication problems by using the ER.

**Table 3: Weights for Main and Sub-Causal Factors**

Main Causal Factors	Global Weight	Rank
Lack of Teamwork /Leadership Skills	0.4122	1
Lack of Training	0.2622	2
Misinterpretation	0.1740	3
Multicultural Issues	0.1516	4
Sub-Causal factors	Global Weight	Rank
Prejudice	0.2197	1
Reticent	0.1184	2
Lack of SMCP knowledge	0.1075	3
Weakness in information process	0.0851	4
Lack of signage Interpretation	0.0847	5
Conflict	0.0742	6
Lack of fluency in English language	0.0700	7
Dialect varieties	0.0691	8
Variety in communication medium	0.0465	9
Lack of body language	0.0424	10
Racist	0.0420	11
Multilingual	0.0406	12

Based on Table 3, the result has shown that lack of

teamwork/leadership skills are the most profound factors that cause miscommunication problems, with the weight of 0.4122, followed by lack of training (0.2622), misinterpretation (0.1740) and multicultural problems (0.1516). Based on global weight calculation, the most significance sub-factors that instigate miscommunication problems (i.e. across the model) are prejudice (0.2197), reticent (0.1184) and Lack of SMCP knowledge (0.1075).

After the causal factors of miscommunication problems are assessed quantitatively by using belief degrees, it needs to be aggregated. As a result, Table 4 shows the values of belief degree and the utility values of each sub-factor (i.e. impact value on miscommunication problems). The top three highest ranking values are dialect varieties (0.6915), followed by lack of SMCP knowledge (0.6848) and prejudice which (0.6675). While for the lowest value is lack of signage interpretation (0.3649).

**Table 4: Values of Belief Degrees (Aggregated) and Utility Values for the Sub-Factors**

Impact of Causal Factors of Communication Issues	Very Low	Low	Medium	High	Very High	Utility Value
Dialect Varieties	0	0.0668	0.4568	0.3616	0.1147	0.6311
Multilanguage	0.0305	0.3320	0.2921	0.3454	0	0.4881
Racist	0.0467	0.2160	0.4234	0.2731	0.0408	0.5113
Lack of SMCP Knowledge	0.0101	0.1276	0.1573	0.5244	0.1806	0.6845
Lack of Fluency in English	0.0049	0.0924	0.5205	0.3227	0.0595	0.5849
Lack of Signage Interpretation	0.0512	0.3577	0.4100	0.1811	0	0.4303
Conflict	0.0048	0.0913	0.5448	0.3247	0.0343	0.5730
Reticent	0.0721	0.1122	0.4707	0.3041	0.0409	0.5324
Prejudice	0	0.1192	0.2691	0.3829	0.2288	0.6803
Variety in Communication Medium	0.0153	0.2861	0.4299	0.1898	0.0789	0.5077
Weakness in Information Process	0.0257	0.2042	0.3822	0.3027	0.0852	0.5544
Lack of Body Language	0.0471	0.2982	0.3606	0.2247	0.0694	0.4928

According to Table 3, the highest weight establishment for the main causal factors is lack of teamwork/leadership skills (0.4122), followed by lack of training (0.2622), misinterpretation (0.1740) and multicultural issues (0.1516). Lack of teamwork/leadership skills are crucial in ensuring chain of command is smoothly conducted and harmonization is maintained. While the lowest factor of communication issues onboard merchant vessels is multicultural. Based on the experts' interview, multicultural issues usually can be adapted by seafarers within two to three months, depending on quantity and nationality of those seafarers. As a result, these issues contribute least impact to the miscommunication problems among seafarers.

In order to obtain the global weight for each sub-factor, its local weight is multiplied with the weight of its main factor. As shown in Table 3, the most significant causal factor of miscommunication

problems across the identified factors is prejudice (0.2197), followed by reticent (0.1184) and lack of SMCP knowledge (0.1075). Usually prejudice occurs between one nationality with another and there is no toleration and cooperation between them (Halid and Genova, 2011). During the interview session with the experts, they also claimed that some nationality is being discriminated and this will difficult for them to communicate or to change the information. Reticent is the second rank as causal factor that lead to miscommunication problems. Halid and Genova (2011) claimed that seafarers refuse to ask other person when they are in doubt in making decision, thus they make their own assumption.

Based on the ER calculation, the utility values for the sub-causal factors of miscommunication problems are calculated. As a result, the highest utility value of the causal-factors is lack of SMCP knowledge (0.6845), followed by prejudice (0.6803)



and dialect varieties (0.6311). While the highest result for the utility value of the main causal factors is multicultural issues (0.5460) followed by lack of training (0.5683), lack of teamwork /leadership skills (0.5948) and misinterpretation (0.5157). Despite, the utility value for the assessment value for the overall miscommunication problems caused by the identified causal factors is calculates as 0.5460. This result indicates that all 12 causal factors have contribute 54.6% to the miscommunication problems onboard merchant vessel. While other 45.4% is caused by other factors.

In order to overcome this issue, there are a few of possible solutions that are recommended from the domain experts. Firstly, the efficiency training for seafarers needs to be enhanced. Besides, a crewing management and human resource management departments should be careful on monitoring the seafarer's quality. Secondly, HELM course is important to all seafarers who are working onboard as they able to learn how to recognize and apply the best practice in teamwork, be aware of barriers of communication and how these may adversely affect situational awareness, how to responds with the multicultural issues, conflict etc. Besides, Rosedi (2015) suggested that training of SMCP towards the cadet is crucial as this training exposes them with many types of communication such as distress, urgency, safety, direction-finding bearings, navigation, messages relative to the meteorological (weather) and radiocommunications. Other than that, Ziarati *et al.* (2011) also suggested 2D/3D simulation and e-learning platform can be developed by the MET as the method or tools for training the seafarer. This project provides real-life communication situation including the real accident, incident and near-miss.

## 5. Conclusions

Miscommunication problems are the issues that instigated human error which can lead to marine accident such as vessel collision, grounding, false information, etc. In this paper, the model of causal factors of miscommunication problems onboard merchant vessels is developed. Firstly, the causal factors of miscommunication problems are identified

through literature review. Based on the factors' identification process, secondly, the generic model is developed. There are four main criteria of the causal factors of miscommunication problems among seafarers, which are multicultural issues, lack of training, lack of teamwork/leadership skills and misinterpretation. Thirdly, all the factors are prioritized by using the AHP method. From this calculation the result has shown that lack of teamwork/leadership skills is the most significant problem that caused miscommunication problems. This main causal factor is divided into three sub-factors which are conflict, reticent and prejudice. Among this sub-factor, prejudice was ranked as the top causal factor due to lack of teamwork/leadership skills. To overcome these issues, few suggestions and opinions from the experts are proposed. This research can assist marine training providers and shipowners to identify and evaluate the causal factors of communication failures thus corrective action can be taken. Also, training efficiency and effectiveness can be enhanced by targeting the root cause of miscommunication problems according to the SMCP.

## 6. Acknowledgements

Appreciation is given to the Universiti Malaysia Terengganu for research facility and financial support.

## References

- Ahmed, H. J. (2013), The impact of maritime english communication training for non-native english language speakers concerning the competency of seafarers: Iraqi maritime sector case study, *World Maritime University Dissertations*, paper 235.
- Aull-Hyde, R., Erdorgan, S. and Duke, J. M. (2006), An experiment on the consistency of aggregated comparison matrices in AHP, *European Journal of Operational Research*. Vol. 171, No. 1, pp. 290–295.
- Badawi, E. E. S. A., and Halawa, A. M. (2003), Maritime communication: The problem of cross cultural and multilingual crews, In *Proceedings of 4th International Association of Maritime Universities (IAMU) General Assembly and Conference*,

September 27–30. Alexandria.

Berg, N., Storgard, J., and Lappalainen, J. (2013), *The Impact of Ship Crews on Maritime Safety*, Publications of the Centre for Maritime Studies.

Cooke, N. J., Kiekel, P. A. and Helm, E. E. (2001), Comparing and validating measures of team knowledge, In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 361-365, Santa Monica.

Halid, E. and Genova, B. (2011), Cultural factors involved in maritime communication, *Nautical and Environmental Studies*, Vol. 1, No. 2.

Hetherington, C., Flin, R. and Mearns, K. (2006), Safety in shipping: The human element, *Journal of Safety Research*, Vol. 37, No. 4, pp. 401-411.

Horck, J. (2008), Cultural and gender diversities affecting the ship/port interface: Maritime education and training efforts to bridge diversity gaps, In *Proceedings of the 1st International Ship-Port Interface Conference (ISPIC 2008)*, May 19-21, Bremen, Germany.

International Maritime Organization (IMO) (2018a), *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW)* [Online], website: <http://www.imo.org>, last accessed in December 2017.

International Maritime Organization (IMO) (2018b), *IMO Standard Marine Communication Phrases* [Online], website: <http://www.imo.org>, last accessed in December 2017.

Kahvevi, E., Lane, T. and Sampson, H. (2001), *Transnational Seafarer Communities*, Seafarers International Research Centre, Cardiff University, London.

May, M. (2004), Wayfinding, ahips and augmented reality, In *Virtual Application: Applications with Virtual Inhabited 3D Worlds*, edited by Anderson P.B. and Qvortrup L. (pp. 212-233). London: Springer-Verlag.

Miller, G. A. (1956), The magical number seven plus or minus two: Some limits on our capacity for processing information, *Psychol. Rev.* Vol. 63, No. 1, pp. 81–97.

Pyne, R. and Koester, T. (2005), Methods and means for analysis of crew communication in the maritime domain, *The Archives of Transport*, Vol. 17, No. 3-4, pp. 193-208.

Riahi, R., Bonsall, S., Jenkingson, I. and Wang, J. (2012), A seafarer's reliability assessment incorporating subjective judgement, *Proceedings of the Institution of Mechanical Engineers, Part M: Journal of Engineering for the Maritime Environment*. Vol. 226, No 4, pp. 1-22.

Rosedi, S. R. M. (2015), *The Position of English in Marine Communication*, Pre Sea Studies Book, Department of Malaysia Marine Academy, Malaysia.

Rothblum, A. M. (2000), Human error and marine safety, In *Maritime Human Factors Conference 2000*, Linthicum, MD, March 13-14.

Saaty, T. L. (1980), *The Analytic Hierarchy Process*, McGraw-Hill, New York.

Saaty, T. L. (2008), Decision making with the analytic hierarchy process, *International Journal of Services Sciences*. Vol. 1, No. 1, pp. 83-98.

Salleh N. H. M. and Halim M. A. A. (2018), Enhancing environmental sustainability over fisheries industry through proactive risk evaluation: A case of Tok Bali fishing port, *Journal of Sustainability and Management*, Special Issue No. 4, pp. 5165.

Salleh, N. H. M., Riahi, R., Yang, Z. and Wang, J. (2015), Business environment-based risk model for the container liner shipping industry, *European Journal of Business and Management*, Vol. 7, No. 27, pp. 15-27.

Salleh, N. H. M., Riahi, R., Yang, Z. and Wang, J. (2017), Predicting a Containership's Arrival Punctuality in Liner Operations by Using a Fuzzy Rule-Based Bayesian Network, *The Asian Journal of Shipping and Logistics*, Vol. 33, No. 2, pp. 095-104.

Soo, R. S. and Goh, H. S. (2013), Reticent students in the ESL classrooms, *Advances in Language and Literary studies*, Vol. 4, No. 2, pp. 65-73.

The Swedish Club (2011), *Collisions and Groundings*, website: <https://www.swedishclub.com>, last accessed in September 2016.

Winbow, A. (2002), *The Importance of Effective*

Communication, In *International Seminar on Maritime English*, Istanbul, Turkey, March 20-22 2002.

Xu, D. and Yang, J. (2005), Intelligent decision system based on the Evidential Reasoning approach and its applications, *Journal of Telecommunications and Information Technology*, Vol. 3, pp. 73–80.

Yanchunas, D. (2007), Miscommunication may have contributed to tanker collision on the Mississippi, *Professional Mariner*, website: <http://www.professionalmariner.com>, last accessed in December 2017.

Yang, J. B. (2001), Rule and utility based Evidential Reasoning approach for multiple attribute decision making analysis under uncertainties, *European Journal of Operational Research*. Vol. 131, pp. 31-61.

Yang, J. B. and Singh, M. G. (1994), An Evidential Reasoning approach for multiple attribute decision making with uncertainty, *IEEE Transaction on System, Man and Cybernetics Part A: System and Humans*, Vol. 32, No. 3, pp. 289-304.

Yang J. B. and Xu, D. L. (2002), On the Evidential Reasoning Algorithm for multiple attribute decision analysis under uncertainty, *IEEE Transaction on System, Man and Cybernetics Part A: System and Humans*, Vol. 32, No. 3, pp. 289-304.

Ziarati, M., Ziarati, R., Bigland, O. and Acar, U. (2011), Communication and practical training applied in nautical studies, In *Proceedings of International Maritime English Conference 23*, Constanta Maritime University, Romania.