Determining the contribution of distraction factors on Malaysian seafarers using a systematic average mean value

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Abstract

Purpose – The purpose of this study is to determine the distraction factors based on their contributions in affecting seafarers' physical and psychological well-being.

Design/methodology/approach – A systematic average mean value technique incorporated with quantitative data collection is applied to determine the contributions of the involved factors in establishing the distraction problems among seafarers.

Findings – Element of "Food and nutrition" is recorded as the highest contributing factor to Malaysian seafarers, for deck and engine department, respectively, in establishing the distraction-related problem among five other factors involved.

Research limitations/implications – This paper is only providing a scope of knowledge regarding the contribution of potential distraction factors existing on board the offshore ships. However, the potential distraction factors and their contributions, respectively, are very dynamic and may vary, depending on the situation of a particular area and who are being involved.

Practical implications – The result assists the shipping industry in recognizing the actual causes of the occurrences of marine casualties and incidents related to human factors.

Social implications – The benefits are addressed to seafarers' community where their well-being and work performances could be enhanced, thus reducing the occurrences of marine casualties and incidents. Local community at the shores also will be less threatened by marine pollution caused by the accidents of ships at sea.

Originality/value – The result provides a scope of knowledge regarding distraction-related factors in shipboard operation and also the introduction to a systematic assessment approach to determine and rank the parameters by using the systematic average mean value technique which is also a straightforward method and can be applied in any other circumstances.

Keywords Average mean value, Distraction factors, Marine casualties, Maritime safety, Seafarers, Ship operation

Paper type Research paper

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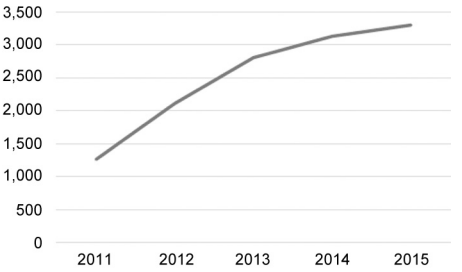
1. Introduction

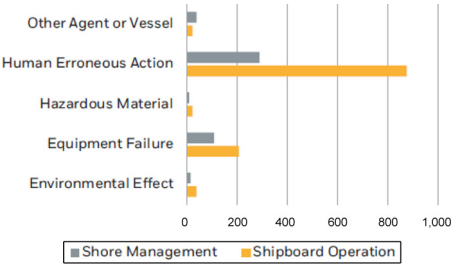
In the maritime sector, when safety is a priority, the element of human factor is crucial to be assessed in a particular system (IMO, 2004; Othman *et al.*, 2015) because the discipline of human factors is devoted to understand human capabilities and limitations to design equipment, work environments, procedures and policies that are compatible with the human ability. In this way, the designed technology, environments and organizations will work with people and enhance their performance, instead of working against people and degrading their performance. However, the technologies, environments and organizations that have been designed to enhance human performance may also act vice versa and be the key factors that lead to human errors, as they may incompatible with the optimal human performance (Rothblum, 2000). These incompatible factors could increase the risk of human errors and result in the occurrences of injuries, casualties, poor health and even fatalities. A serious increment of reported cases from year 2011 to 2015 which should be concerned of as the marine safety was seriously threatened as in Figure 1 (European Maritime Safety Agency, 2016).

Based on the investigations conducted to the increasing number of reported marine casualties and incidents since 2011 to 2015 as shown in Figure 1, the most contributing factor that caused the increase of marine casualties and incident per year was the human factor which were due to their erroneous actions in shipboard operation and it was represented by 71 per cent of total events recorded as illustrated in Figure 2.



Source: European Maritime Safety Agency (2016)

Figure 1.
Number of reported marine casualties and incidents per year (2011-2015)



Source: European Maritime Safety Agency (2016)

Figure 2.
The main contributing factors lead to accidental events from 2011 to 2015

Such contribution of human erroneous actions in marine casualties and incidents induced a worrying situation to the whole shipping industry, as safety is a priority in maritime operation and huge losses could be incurred if such incident cases kept increasing.

Several studies related that the causes of marine casualties and incidents in the shipping industry are due to the effects of distractions experienced by seafarers at their workplace (Geijerstam and Svensson, 2008; Othman *et al.*, 2015, 2016). Distractions, or another term used, interruptions, in almost all instances, are disruptive to performances and may increase human errors (Trafton and Monk, 2007). The effects of interruptions also used to be studied in various fields of high-risk workplace environments such as aviation (Latorella, 1998), medicine (Sanderson and Grundgeiger, 2015) and vehicle operation (Kim *et al.*, 2015) in which human error can have a serious, potentially disastrous consequence. Besides, interruptions are also explored in less-safety critical workplaces, such as offices, where interruptions can induce stress (Mark *et al.*, 2008), anxiety (Bailey and Konstan, 2006) and poorer performance (Cades *et al.*, 2010).

2. Literature review

Distraction can be defined as a diversion process of an individual or group's attention from the desired area of focus in which it may block or diminish the reception of desired information. Distraction can be caused by several states of situations which consist of the lack of ability to pay attention, lack of interest in the object of attention or the great intensity, novelty or attractiveness of something other than the object of attention (Post and Schumm, 1997; Distraction, 2016). Sources of distractions come from both external sources and internal sources (Alboher, 2008) which may significantly affect the seafarers and may cause many undesirable effects such as excessive fatigue, mental stress and poor work performances (Trafton and Monk, 2007; Othman *et al.*, 2015).

Generally, poor performance of a worker is an effect of insufficient number of healthy staffs, or not providing care according to standards, and not being responsive to the needs of the community and environment (Dieleman and Harnmeijer, 2006). A poorly designed ship or a system where the crew is tired or unaware of cultural differences could contribute to the lower level of safety of the ship operation (IMO, 2010; Othman *et al.*, 2015). Therefore, in the end, the outcome of the effects could be more adverse which also may cause human injuries, serious marine casualties and also fatalities among crews (Othman *et al.*, 2015).

Various factors can be considered to contribute in generating distraction effects to seafarers on board ships, mostly through fatigue, stress, poor health and poor attentions. The possible distraction factors that exist on board can be generated from various sources such as working and living conditions, interactions between human, individual factors, physical on board environment and also from food and nutrition supplied to them. This research is basically an extension work from the previous studies conducted by Othman *et al.* (2015, 2016). However, such papers did not clearly describe or discuss the weightage value of each contributing distraction factor in affecting seafarers' conditions and rank them accordingly.

The previous studies had referred only to deck seafarers as a sample study. However, this extension study has taken into account both, deck and engine seafarers, to figure out the most important factor in causing distractions on board and that should be given attention for improvement. To determine the contribution of the distraction factors, the list of parameters to be evaluated is based on the parameters pointed out by Othman *et al.* (2015, 2016), and the parameters which were classified into the main criteria and sub-criteria are shown in Table I.

Therefore, the objective of this paper is to determine and rank the main distraction factors based on their contributions in affecting seafarers' conditions at the working place (on board ship). This study is focusing on seafarers because they are valuable assets of the nation

Main criteria (Level 1)	Sub-criteria (Level 2)
Working condition (WC)	Staffing or crewing strength/number (SS)
	Burden of system in use/Technological inventions (BS)
	Arrangement of working hours (AWH)
	Work pace/demands/pressure (WP)
	Distribution of works (DW)
	Personal abilities/experiences (PAE)
Living condition (LC)	Comfortability of accommodations (CA)
	Recreational activities/facilities (RAF)
	Periods of rest (PR)
	Shore alienation/leaves (SL)
	Intensified activities (IA)
	Hygiene and tidiness (HT)
Human interactions (HI)	Language barrier among crews (LB)
	Quality of relationship (QR)
	Social isolation/family separation/away from home (SI)
	Level of autonomy (e.g. freedom from external control and influences) (LA)
	Multi-national crews/cultures/beliefs (MC)
	Supportive cultures (e.g. motivation and tutoring) (SC)
Behaviours/Individual factors (IF)	Discipline (DI)
	Mind set (e.g. way of thinking, awareness) (MS)
	Approachability (AP)
	Firmness (FI)
	Responsibility (RE)
	Vigilance/alertness/sensitivity (VAS)
On-board environment (OE)	Ship motions (SM)
	Climatic conditions (CC)
	Weather and mother nature (WM)
	Visual condition (VC)
	Exposure to hazardous substances/cargoes (EC)
	Noise and vibrating circumstances (NV)
Food/nutrition (FN)	Organization of food nutrition/composition (OF)
	Adequate supply of food (ASF)
	Quality of food preparation (QFP)
	Hygiene (HY)
	Equality in distribution of food/needs (EDF)
	Satisfaction on food preparation (SFP)

Table I.
The list of parameters

which play a crucial role in sustaining or increasing the profitability of the shipping business and marketability of local seafarers in global shipping industry. Thus, their well-beings shall be taken into account for future improvement.

3. Methodology

A test case is developed using systematic mathematical steps incorporated with an average mean value technique to determine the contribution of the distraction factors before they are ranked in preference order. The average mean value technique is a systematic mathematical algorithm is using a basic mathematical formula, the averaging, to produce more effective calculation steps and reliable outcomes (Jacobs, 1994; Foerster, 2006). In this research, the average mean value technique is used to assist in finding the weight for each of the

parameters involved. It is a straightforward concept by calculating the central tendency of the parameters based on the evaluation given by the respondents compared to the other method which is more complex to understand that may lead to misconduct of the real concept of the method. In addition, the outcomes would also be easily understood and interpreted. The formulae used for this technique, generally, are shown in Equations (1) and (2).

$$A = \frac{1}{n}\sum_{i=1}^{n} a_i.$$

or

$$A = \frac{X1 + X2 + X3 + X4 + \ldots + Xn}{n} \quad (1)$$

A = represents the arithmetic mean;
$\sum$ = summation symbol; is the addition of a sequence of numbers; the result is their sum or total;
X = value given per subject;
n = total number of subjects involved; and
a_i = value given per subject (Source: Medhi, 1992; Jacobs, 1994; Foerster, 2006).

Equation (1) is simplified to Equation (2) for further understanding and application.

$$\text{Average mean value} = \frac{\textit{Total value given for each category}}{\textit{Total number of all categories involved}} \quad (2)$$

Source: Authors

The weighted values of the main criteria and sub-criteria used to determine the amount of distractions faced by the seafarers. The weighted values were based on the evaluations given by selected respondents using five-point Likert scale values to each listed parameter involved in this study, after analysed using the systematic average mean value technique. The evaluation responses were gained based on survey process by distribution of sets of questionnaires to a total of 120 selected respondents, included: senior deck cadets (SDCs), junior deck officers, senior deck officers, senior engine cadets, junior engine officers and senior engine officers, who definitely have more than 12 months shipboard experience background and theoretical knowledge in shipboard operation. Responses from each of the groups were represented by a number of 20 respondents, respectively, in which to ensure the consistency in data collection as shown in Table II.

The sample respondents of this study was taken among Malaysian seafarers because there is lack of comprehensive research conducted regarding the distraction problem among Malaysian seafarers on board and based on that, this research may fill the gap of the literature regarding distraction issues especially for shipping operations, as distraction may have its own contribution in affecting seafarers at their workplace and induce errors in shipboard operation (Othman *et al.*, 2015, 2016).

In this research, the spider web or radar chart is used to illustrate multivariate observations with an arbitrary number of variables or factors represented on axes starting from the same point and the score given (Chambers *et al.*, 1983; Radar Chart, 2016; Abdul Rahman *et al.*, 2016). The purpose of using this chart is to illustrate and prove the tendency (score) or aptitude of contribution of each main criterion in affecting each group of ship's manning involved in this research.

Respondents	Working field	Total samples	Background
Senior cadets	Deck	20	More than 12 months sea times and engaged with current scenario of shipboard operations
	engine	20	
Junior officers	Deck	20	More than 12 months sea times and engaged with current scenario of shipboard operations
	engine	20	
			Act as fourth officers/engineers, third officers/engineers and second officers on-board
Senior officers	Deck	20	More than 12 months sea times and engaged with current scenario of shipboard operations
	engine	20	
			Consist of second engineers, chief officers, chief engineers and captains of the ship
Total		120	

Table II.
Total respondents involved in this study

4. Findings

A test case was created based on the current situation faced by Malaysian seafarers on board ships. The process of selection was started by identifying the issue faced by seafarers during on board ships and determining the parameters to be used as shown in Table I. Second, the main body of the test case contains:

- calculation of the mean value of the evaluation sub-criteria;
- calculation of the average mean value of each sub-criteria in separated respondents' groups;
- determination of average mean value of main criteria; and
- calculation of weight value of each main criteria for each category or group involved.

Finally, it concluded by ranking the preference order of all main criteria. The illustrations of the steps conducted were shown further as below.

4.1 Step 1: Calculate mean value of the evaluation criteria

The value of each category recorded in Table AI represented the total rate given by the respondents according to the five-point "Likert" scales used in the survey questions, which will be used to measure the contribution of each criterion and sub-criterion involved in affecting their conditions based on their experiences working and living on board ship environment. For example, sub-criteria "SS" recorded the rate in total of 72, after the rate given for the sub-criteria "SS" by each respondent is totalled up according to separated category of respondent groups, "SDC". The similar technique is used for all the other respondent groups involved in this study as shown in Table AI. Table AI summarized the total rate given by respondents as per categories involved respectively.

4.2 Step 2: Calculate the average mean value of the sub-criteria

All the feedback received from the respondents as according to the questionnaires distributed were further calculated by using Equation (1) of Average Mean Value technique for evaluating the criteria and sub-criteria mentioned. The output values determined throughout this technique were represented as the average mean value of the sub-criteria involved. The example of the calculation using Equation (1) is shown below:

$$\text{Average mean value for sub-criterion SS} = 72/20 = 3.60$$

The value of 3.60 represents the average mean value recorded for the sub-criterion "SS" based on the total evaluation made by the total of 20 respondents from "SDC" group. Similar calculations were performed for all sub-criteria in different key study areas for each group of respondents selected. The data of the average mean value of all sub-criteria evaluated are shown in Table AII.

4.3 Step 3: Determine the average weight value of main criteria

To determine the average mean value for the main criteria, initially, the levels of criteria need to be identified and separated. For this study, there are two levels of criteria which were identified as shown in Table I. The main criteria were known as Level 1, while the sub-criteria were known as Level 2. The average mean values of sub-criteria recorded in this study were determined to influence on the average mean value of the main criteria. All the results will subject to the ranking process which will rank the main factors in each group and show the degree of distractions recorded for each ship's manning (Deck/Engine) which is indicated using the average weight value.

Based on Table I which is used to illustrate that the Level 2 criterion is deemed to influence the Level 1 criterion, the average mean values of the main criteria were determined based on the sum of the average mean values of all sub-criteria under each main criterion (refer to Tables AII and III) of separated groups. The total average mean value of "WC" was determined as follow:

$$\text{Total average mean value of all sub-criteria under the criterion "WC" for SDC group} = 3.60 + 3.45 + 3.90 + 3.75 + 3.85 + 3.45 = 22.00$$

Similar calculations were performed to determine the average mean value of all main criteria. The average mean value of each main criterion is summarized as in Table III.

Meanwhile, the average weight values of the main criteria were determined based on the averaging calculations computed on the average mean value of each criterion as shown in Table III with the total number of the sub-criteria of the criterion they contribute, respectively. The calculations of average weight values of all criteria were using Equation (2). Given the main criterion "WC" for the SDC category as an example, the weight value was computed as follows:

$$\text{Weight of the criteria} = \frac{22}{6} = 3.66667$$

The weight of each criterion was determined by dividing the average mean value of the main criterion "WC" (refer Table AII) which is 22, with the total number of the sub-criteria placed

Main criteria Categories	WC	LC	HI	IF	OE	FN
Deck						
SDC	22.00	20.75	21.30	22.30	20.57	21.55
JDO	19.50	19.35	18.90	20.80	17.95	20.95
SDO	22.25	21.00	20.75	21.45	20.80	22.15
Engine						
SEC	22.55	23.05	22.15	22.60	22.40	24.20
JEO	23.30	22.60	22.20	22.50	20.90	23.25
SEO	17.45	20.25	17.25	22.75	22.25	22.30

Table III. Average mean value of main criteria

under the main criterion "WC" which is 6. The output for the main criterion "WC" is computed as 3.66667. Similar calculations were conducted to all criteria to determine the average weight value of all the main criteria. Table IV summarized all the output values of the main criteria weight in average.

4.4 Step 4: Calculate the weight value of each main criteria for each category or group involved

The average weight contribution is determined to discover the tendency of the criteria in influencing each group/category of respondents involved in this study. The average weight contribution of a criterion is likely to represent the portion of contribution of the particular criterion when it is compared to the other contributions of the other criteria in similar group/category.

Taking the criterion "WC" as an example for determining a portion of contribution, the average weight value of 3.66667 is divided from the total value of all contributions recorded from six contributors for the "Senior Deck Cadets" group, respectively, which are 21.41167 as shown below.

$$\text{Average weight contribution of the criterion "WC"} = 3.66667/21.41167 = 0.171246 \,@\, 0.1713$$

The output of the calculation, which is also the average weight contribution of the criterion "WC", is equal to 0.1713. In a similar way, the weight calculation algorithm was applied to all other main criteria with the given average weight values for each category. Table V summarizes all of the output values of the average weight contribution calculation for all the six categories involved.

Table IV.
The average weight value of all main criteria for each category

Category/criteria	WC	LC	HI	IF	OE	FN	Total
Deck							
Senior deck cadets	3.66667	3.45833	3.55000	3.71667	3.42833	3.59167	21.41167
Junior deck officers	3.25000	3.22500	3.15000	3.46667	2.99167	3.49167	19.57501
Senior deck officers	3.70833	3.50000	3.45833	3.57500	3.46667	3.69167	21.40000
Engine							
Senior engine cadets	3.75833	3.84167	3.69167	3.76667	3.73333	4.03333	22.82500
Junior engine officers	3.88333	3.76667	3.70000	3.75000	3.48333	3.87500	22.45833
Senior engine officers	2.90833	3.37500	2.87500	3.79167	3.70833	3.71667	20.37500

Table V.
The average weight contribution of all main criteria for each category

Category/criteria	WC	LC	HI	IF	OE	FN
Deck						
Senior deck cadets	0.1713	0.1615	0.1658	0.1736	0.1601	0.1677
Junior deck officers	0.1660	0.1648	0.1609	0.1771	0.1528	0.1784
Senior deck officers	0.1733	0.1635	0.1616	0.1671	0.1620	0.1725
Engine						
Senior engine cadets	0.1647	0.1683	0.1617	0.1650	0.1636	0.1767
Junior engine officers	0.1729	0.1677	0.1647	0.1670	0.1551	0.1725
Senior engine officers	0.1427	0.1656	0.1411	0.1861	0.1820	0.1824

The average weight contributions of main criteria were interpolated into a spider web or radar chart presentation to describe the average contribution of all main criteria on every category. The illustration of the main criteria contribution on each category is shown as in Figure 3.

Based on Figure 3, there were six parameters tested to determine their contributions to affect six groups of ship's manning. Each coloured line with a dot represented a parameter. The contribution of each parameter was determined to the weighted amount of distractions which contributed to each group. The nearer the dotted coloured line to the group, the more significant/the higher the amount of distractions that the parameter influences the group. If all the dotted coloured lines are at almost the same point in a particular group, such illustration shows that the group was experiencing a significant distraction problem with the parameters tested.

Based on the values in Table V, the average weight contributions of the main criteria for deck and engine side manning were determined separately, according to category, in the issue of distractions on different departments because a person having different job scopes and responsibilities will experience different types and amounts of distractions. The calculation for determining the overall ranking order for each side/department was using the average weighting formula which generated from Equation (2). The example of calculation is shown as below and the outputs are summarized in Table VI:

$$\text{Average weight for "Deck Side" ranking} = (\text{weight in SDC} + \text{weight in JDO} + \text{weight in SDO})/(\text{Number of categories})$$

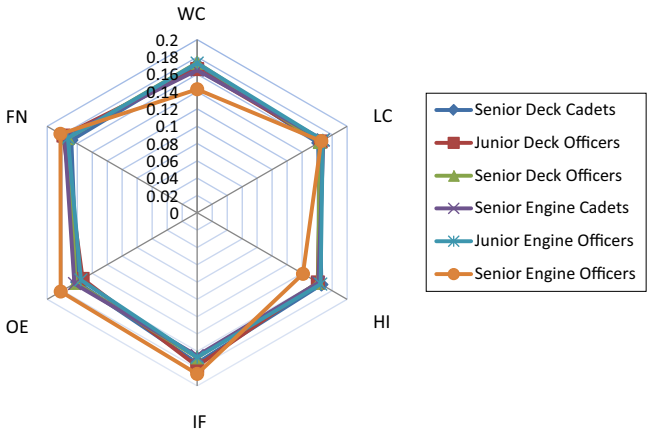


Figure 3.
The average weight contribution of all main criteria recorded on each category

Rank	Deck side	Average weight	Engine side	Average weight
1	Food/nutrition	0.1729	Food/nutrition	0.1772
2	Individual factors	0.1726	Individual factors	0.1727
3	Working condition	0.1702	Living condition	0.1672
4	Living condition	0.1633	On-board environment	0.1669
5	Human interactions	0.1628	Working condition	0.1601
6	On-board environment	0.1583	Human interactions	0.1558

Table VI.
Ranking of main criteria according to category (deck side/ engine side)

Example:

$$\text{Average weight for deck side ranking (Working Condition)} = (0.1713 + 0.1660 + 0.1733)/3 = 0.1702$$

Similar calculations were also performed for the Engine side ranking to determine the average weight of each main criterion recorded in each category.

Table VI shows the average weight contribution of each main criteria which caused distractions on the deck and engine side/department. It represents the extent or tendency to which the criteria are affecting both departments. As a result, the "Food & Nutrition" is recorded to be the highest contributing factors for both side/department, followed by "Individual Factors". The average weight contribution of the other criteria can refer to Table VI, as each department experienced different amounts of distractions.

5. Discussions

The factors of "food and nutrition" and "Individual factors" are leading the ranking order of overall analysis which means that they have a huge influence in affecting seafarers' conditions on board ships compared to other factors involved in this research. The percentage value of contribution between each of the factors involved, regardless of the departments that they're being into, are not so much different as each factor is interrelated with one another, for instance, food and nutrition may be the highest contribution in affecting overall Malaysian seafarers' conditions due to the effect of individual factors who manage it such as in terms of the quality of preparation and maintenance of the food or the equality of the food served on board. The quality of preparation and maintenance of the food can be seen in terms of food preparation, taste and hygiene during preparation and storage, meanwhile, the equality can be seen in terms of quantity of the halal and non-halal food served on board the ship. Factor of individual may link in the food and nutrition consumed, as the individual factors of the steward crew may influence the hygiene and the quality of the food prepared. Thus, if the food and nutrition is not so good in terms of hygiene, quality, taste and segregation of the "halal" or non-halal' food, all the crew, regardless of which department, could be affected, as they may engage with the feeling of un-satisfaction or doubtful situation to consume the food, thus will increase the poor consumption of healthy and nutritious foods for recovery from harsh working jobs. Besides, the crew may also experience a poor state of health condition due to consumption of poor quality of food, as they may engage with food poisoning, diarrhoea, nausea or dizziness, and these situations may probably interrupt the whole activities on board, as the affected person may be distracted by the uncomfortable feeling and lead him to be less aware or leave his duties to the other crew. Such actions may cause increase of negligence or unsafe acts to occur, or may cause other crew to engage with the fatigue problem during the working hours. In the end, the safety on board will be jeopardized if such actions are not under control.

The issue of food and nutrition is being the main cause that contributes to increase in the tendency of distraction problem among Malaysian seafarers, regardless from which department, because it is not just about getting the right fuel into bodies but also significantly important on a psychological level of an individual. The boredom of life on board ship can be treated by having good food, especially in good companies. Having good nutrition, which seafarers look forward to, is able to lift the mood of an individual, and it is important to consider the role that food plays or can play on board, as it can influence seafarers' feeding rates and the rationale behind the consumptions.

As on board a ship is occupied with multi-national crew which do have different lifestyles, eating and working habits, especially the steward crew, these may develop a variety of

questionable scenario on seafarers which may distract them most of the times, for example, regarding the quality of food prepared, hygiene, tastes or variety of the foods served each day and also, the status of "Halal" food for Muslim seafarers. This is because the cook or steward of the ship may not be a Muslim, and so, this may create a doubtful situation on seafarers, especially to the Muslim seafarers, because the quality of the foods is very important to them in terms of how it is being handled, stored and prepared. Sometimes this issue is not being given good attention by the companies and leads to the neglect of the standard and equality of food preparation for Muslim seafarers, for instance. Most Malaysian seafarers may consider the elements inside the food and nutrition factor are very important, as they may come from a Muslim background or "Halal"-practicing person for non-Muslim seafarers. Therefore, the factor of food and nutrition became the most contributing factor to cause distraction problems among Malaysian seafarers in this research.

Based on the findings, regardless of personal experiences, seafarers really need good and concerned managers and owners who acknowledge the importance of good management of food on board their ships, so that seafarers won't be affected by this factor. With seafaring becoming increasingly challenging with highly loaded and strict requirements, it is also vitally important that crews do not become over fed with junk food and soft drinks. Realizing the possible effects that may develop, the requirements set by the authorities (i.e. in Occupational Safety and Health Administration, International Labour Organization, Maritime Labour Convention) should be well implemented and monitored not only on papers, but also in the real situation, to provide a good nutrition practice for seafarers. If not, seafarers tend to practice a poor diet and unable to fully recover to do the next job for each day, thus increasing the possibility of fatigue and negligence.

6. Conclusion

The contributions of all listed distraction factors are determined as shown in Table V which is meeting the objective of this study, to determine the amount of distractions faced by Malaysian seafarers while serving the shipboard operation due to the recognized distraction factors among seafarers at their workplace. The weightage values of the factors indicate that each factor does have variability of influence on the seafarers based on their work backgrounds. The findings of this study contribute a scope of knowledge regarding the potential distraction factors which may exist and increase the number of adverse risks on board ships. Nevertheless, the potential factors of the distraction problem on seafarers basically are very dynamic and subjective in which they are depending on the current situation of a particular area of study and who are being involved in this study. The findings of this study are only based on the surveys made to several offshore ships in Malaysia. Further research may be conducted to all maritime transports which are usually engaged with longer times at sea and shipboard operation.

This research contributes to the application of systematic evaluation approach to determine and rank the potential factors involved in creating distraction problem compared to the statistical data which can be retrieved from various sources. The value of this paper is to have a systematic approach to determine and rank the parameters by using the systematic average mean value technique where this systematic technique is a straightforward method and can be applied in any circumstances.

Besides, this research also may provide useful information to the companies to recognize the potential causes of a poor shipping operation or marine incident which may assist the companies to provide proactive actions in conducting a detailed inspection and in finding solution to improve the system to which less distraction.

The outcomes of this research and the systematic assessment approach are expected to benefit seafarers, shipping companies, shipping industry, society and also the nation if the distraction rates among seafarers could be lowered, which can then increase their work performances. Excellent work performances will form a chain of improvements, including but not limited to, improve the shipping operations, increase company revenue along with reduction of operational and maintenance costs, lower turnover jobs, increase employability rates of local seafarers, establish good impression and perception of society towards seafaring career and lower maritime pollution due to shipping accidents at sea. Positive improvement also may contribute to the increase of annual incomes from shipping sectors of the nation.

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Appendix 1

Main criteria	Sub-criteria	Categories					
			Deck side			Engine side	
		SDC	JDO	SDO	SEC	JEO	SEO
WC	SS	72	73	77	76	78	73
	BS	69	60	70	78	74	54
	AWH	78	70	72	70	82	59
	WP	75	68	82	78	75	55
	DW	77	60	76	76	77	57
	PAE	69	59	68	73	80	51
LC	CA	62	64	72	76	73	68
	RAF	70	61	65	81	75	53
	PR	78	70	81	76	80	82
	SL	68	69	70	79	79	69
	IA	67	61	67	71	72	58
	HT	70	62	65	78	73	75
HI	LB	67	66	67	73	71	66
	QR	72	63	72	78	73	50
	SI	71	72	79	77	81	70
	LA	72	64	70	70	76	57
	MC	69	56	64	70	68	55
	SC	75	57	63	75	75	47
IF	DI	73	74	75	75	76	88
	MS	72	65	73	80	76	77
	AP	77	59	70	72	71	65
	FI	72	59	68	75	70	68
	RE	74	78	71	76	77	79
	VAS	78	81	72	74	80	78
OE	SM	68	57	72	71	70	65
	CC	67	61	64	76	65	77
	WM	67	62	70	72	76	80
	VC	72	53	70	74	68	73
	EC	68	63	70	78	70	73
	NV	69	63	70	77	69	77
FN	OF	74	72	75	80	73	76
	ASF	69	68	76	82	75	76
	QFP	72	70	73	79	79	74
	HY	69	64	80	81	80	76
	EDF	74	58	68	80	79	64
	SFP	73	77	71	82	79	80

Table AI.
Total rate given by the respondents for the same sub-criteria

Appendix 2

Criteria	Sub-criteria	Categories Deck side SDC	JDO	SDO	Total	Categories Engine side SEC	JEO	SEO	Total
WC	SS	3.6	3.65	3.85	11.1	3.8	3.9	3.65	11.35
	BS	3.45	3	3.5	9.95	3.9	3.7	2.7	10.3
	AWH	3.9	3.5	3.6	11	3.5	4.1	2.95	10.55
	WP	3.75	3.4	4.1	11.25	3.9	3.75	2.75	10.4
	DW	3.85	3	3.8	10.65	3.8	3.85	2.85	10.5
	PAE	3.45	2.95	3.4	9.8	3.65	4	2.55	10.2
LC	CA	3.1	3.2	3.6	9.9	3.8	3.65	3.4	10.85
	RAF	3.5	3.05	3.25	9.8	4.05	3.75	2.65	10.45
	PR	3.9	3.5	4.05	11.45	3.8	4	4.1	11.9
	SL	3.4	3.45	3.5	10.35	3.95	3.95	3.45	11.35
	IA	3.35	3.05	3.35	9.75	3.55	3.6	2.9	10.05
	HT	3.5	3.1	3.25	9.85	3.9	3.65	3.75	11.3
HI	LB	3.35	3.3	3.35	10	3.65	3.55	3.3	10.5
	QR	3.6	3.15	3.6	10.35	3.9	3.65	2.5	10.05
	SI	3.55	3.6	3.95	11.1	3.85	4.05	3.5	11.4
	LA	3.66	3.2	3.5	10.36	3.5	3.8	2.85	10.15
	MC	3.45	2.8	3.2	9.45	3.5	3.4	2.75	9.65
	SC	3.75	2.85	3.15	9.75	3.75	3.75	2.35	9.85
IF	DI	3.65	3.7	3.75	11.1	3.75	3.8	4.4	11.95
	MS	3.6	3.25	3.65	10.5	4	3.8	3.85	11.65
	AP	3.85	2.95	3.5	10.3	3.6	3.55	3.25	10.4
	FI	3.6	2.95	3.4	9.95	3.75	3.5	3.4	10.65
	RE	3.7	3.9	3.55	11.15	3.8	3.85	3.95	11.6
	VAS	3.9	4.05	3.6	11.55	3.7	4	3.9	11.6
OE	SM	3.4	2.85	3.6	9.85	3.55	3.5	3.25	10.3
	CC	3.35	3.05	3.2	9.6	3.8	3.25	3.85	10.9
	WM	3.35	3.1	3.5	9.95	3.6	3.8	4	11.4
	VC	3.6	2.65	3.5	9.75	3.7	3.4	3.65	10.75
	EC	3.4	3.15	3.5	10.05	3.9	3.5	3.65	11.05
	NV	3.45	3.15	3.5	10.1	3.85	3.45	3.85	11.15
FN	OF	3.7	3.6	3.75	11.05	4	3.65	3.8	11.45
	ASF	3.45	3.4	3.8	10.65	4.1	3.75	3.8	11.65
	QFP	3.6	3.5	3.65	10.75	3.95	4.16	3.7	11.81
	HY	3.45	3.2	4	10.65	4.05	4	3.8	11.85
	EDF	3.7	3.4	3.4	10.5	4	3.95	3.2	11.15
	SFP	3.65	3.85	3.55	11.05	4.01	3.95	4	11.96

Table AII.
Average mean value of all sub-criteria evaluated using ARV technique

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