Frustration and Task Deviation Causes Accidents at Sea

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ABSTRACT

The surge in the number of maritime accidents in the last decades is the greatest challenge for the maritime industry to address. The majority of investigations on these accidents blame seafarers' poor performance as the main contributing factor. The international maritime authorities attempts to address the issue by adopting and updating maritime safety regulations and conventions has had limited success. Although accident investigation reports show that seafarers' task deviation is one of the major causal elements however, there are not many research projects that address this phenomenon. The finding of our qualitative research in task deviation in the maritime domain, discovered that seafarers' frustration is a key contributing factor which causes task deviations in maritime accidents.

INTRODUCTION

Maritime accidents involving commercial ships are continually on the rise [1,2] so as their average costs [3,4]. Accident investigations' reports show that the task deviations by seafarers is the major contributing factor in most accidents at sea [5]. Although, the world maritime regulatory body, International Maritime Organisation (IMO), has frequently adopted and amended maritime safety regulations to minimise accidents at sea due to task deviations by seafarers, the effort has achieved only partial success [6,7]. Research has shown that in devising contemporary shipping standards it is perceived that shipping is a linear operations which may be one of the reasons for this partial success [8].

Shipping is a complex activity that consisted of independent and interconnected elements which forms non-linear operations [9]. The humans conducting these tasks may add to this complexity due to attributes such as frustration [10,11]. Therefore, 'work as done' (WAD) on ships by seafarers (employees) could be unaligned with 'work as imagined' (WAI) by shipping operators (managers) who provide seafarers with procedures and checklists to comply with shipping

standards [12]. A nonconformity towards the prescribed series of actions in a procedure is considered as 'task deviation' [5,13]. To study what are the underlaying factors that cause task deviation on board ships and how can it be prevented we designed a research project. The earlier results indicated there are several elements involved in the everyday activates of seafarers that facilitate their deviation from their main task. One the findings showed that frustration plays an important role among others in task deviation on board ships.

Using a socio-cultural approach, the aim of this paper is to investigate how frustration among seafarers may lead to discrepancies between WAI and WAD which have the potential to lead to consequential outcomes. Most marine accident investigations do not capture human element contributions to the accidents sufficiently to implement countermeasures [5, 14,15,16,17,18,19,20,21]. Further, this research utilises a novel approach to studying the task deviation using a socio-cultural theoretical framework to better understand how the inadequate alignment between WAI and WAD leads to frustration among seafarers.

Research shows the importance of socio-cultural attributes of workplaces and the way they influence safe practices of workers who deviate from work procedures provided by managers [22,23]. This study utilised Cultural Historical Activity Theory (CHAT) which is also called Activity Theory to examine this complex issue of seafarers' frustration. Using CHAT enabled us to understand the multi-mediational processes [24] in play in everyday activities on commercial ships, thereby provided insights to factors causing seafarers' frustration leading to accidents.

BACKGROUND

Studies show that frustration cause headaches, forgetfulness, lack of concentration, lack of attention to detail, confusion which may results in errors in decision-making, lack of confidence, risk taking and carelessness among others because of which people may deviate from their tasks leading to consequential outcomes [25,26,27,28,29,30,31,32,33,34]. Additionally, frustration is a source of distraction [35]. Thus, conducting tasks under the influence of frustration constitutes an impairment [36].

While extensive research on frustration is carried out in industries such as transportation, research on this topic in the maritime domain remains partial with limited discussion on effect of frustration on WAI and WAD. Lack of such research could be the reason for maritime industry's view of mitigating task deviations with more procedures, tighter training programs and technology [37,38,39]. Since this approach has not achieved the expected success [6], comprehension of seafarers' complex social and cultural context at sea in terms of frustration and how it causes task deviations through differences in WAI and WAD may have the potential to enhance maritime safety.

Any operational task is designed and executed at two levels in any organisation [40]. The design level is the blunt end (shipping operator) and the execution level is the sharp end (seafarers). WAI is what the shipping operators believe should happen to achieve a work task safely at sea. WAD is how the sharp end (the seafarers) conduct the work in the actual context [41]. The concept of WAI and WAD can be used in investigating factors causing discrepancies when work as done on the front line at sea could differ from the procedures work as imagined by those who design guidelines and checklists [42].

Due to many issues at the time of work, persons conducting work could deviate from procedures provided by shipping operators to complete the task despite the need to submit the signed checklist at the termination of the operation [43]. Thus, a signed checklist does not necessarily mean that the procedure has been properly followed. Although, task deviation does not always lead to accidents however, an adverse outcome is inevitable if the situation is not recovered from, before it is too late [5,44].

Although task deviation due to frustration has been addressed in literature in different perspectives such as sociobiological [45,46] and means of retaliation [47], yet it remains an elusive topic of study. In the context of this research, we utilised the Cultural historical activity theory (CHAT) to comprehend why frustration takes place at sea. CHAT provides a proper framework for analysing socio-cultural relations between seafarers and their work environment [48,49].

CHAT is based on the premise that a collection of sociocultural components containing complex mediational structures which, collectively, influence the behaviour of humans who are motivated to achieve a common goal [5,50,51]. Thus, the principal unit of analysis in CHAT is an activity system [50]. An activity system is a system of human doing. These elements within a single activity system are *subject, object, outcome, community, rules, division of labour* and *tools* as illustrated in figure 1 [5,49,50]. As depicted in figure 1, in any activity a subject uses tools to work on an object for obtaining a desired outcome. In the process the subject which is part of the division of labour in the community of work needs to follow certain rules to achieve the goal of the activity.
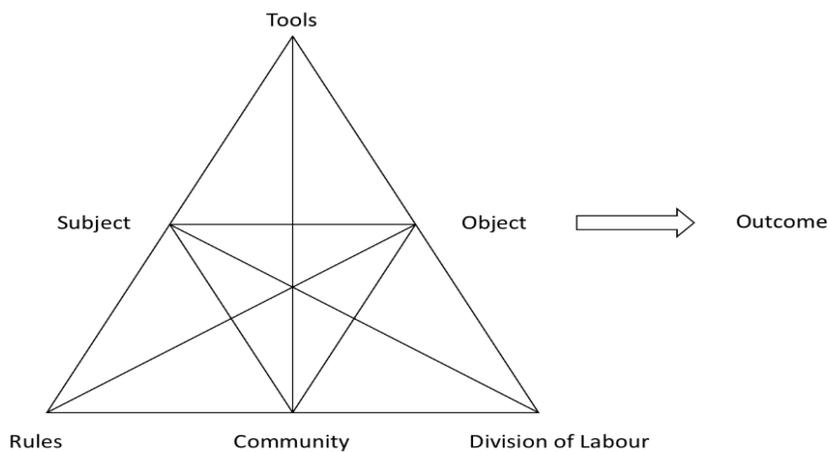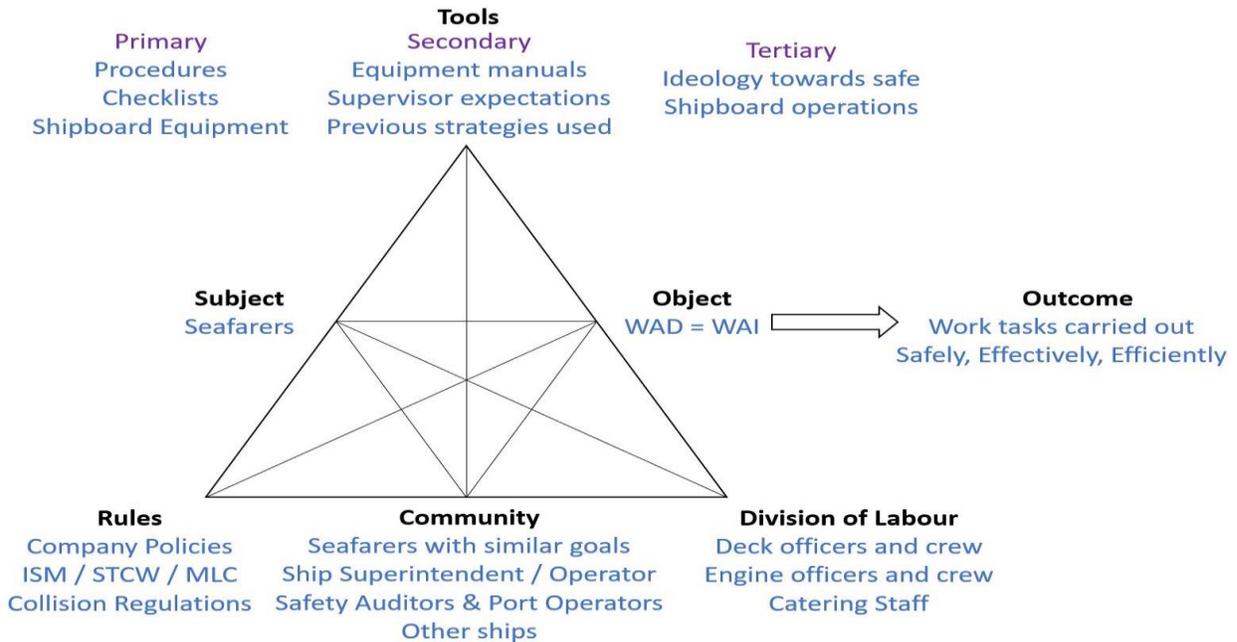

Figure 1. Activity System (Engeström, 1987, p. 78)

An activity system has internal and external tensions called *contradictions.* They cause changes within the activity system over time [52]. For example, seafarers need to follow rules and regulations (e.g. procedures and checklists) to conduct tasks. However, following inappropriate or badly designed rules and regulations may cause frustration which do not allow seafarers to perform their jobs safely. This creates a contradiction within the activity system. By examining

these contradictions in the seafarers' activity system, this study is an attempt to establish why seafarers are frustrated at sea [5].

RESEARCH METHOD

This qualitative project utilised CHAT to examine contradictions between WAI and WAD on board commercial ships with the aim of exploring why seafarer frustration takes place. This study

Tools

Primary — Procedures, Checklists, Shipboard Equipment

Secondary — Equipment manuals, Supervisor expectations, Previous strategies used

Tertiary — Ideology towards safe Shipboard operations

Subject — Seafarers

Object — WAD = WAI

Outcome — Work tasks carried out Safely, Effectively, Efficiently

Rules — Company Policies, ISM / STCW / MLC, Collision Regulations

Community — Seafarers with similar goals, Ship Superintendent / Operator, Safety Auditors & Port Operators, Other ships

Division of Labour — Deck officers and crew, Engine officers and crew, Catering Staff

perceives shipboard tasks as part of the seafarers' activity system (figure 2).

Figure 2. Seafarers' activity system [5]

This approach had three primary benefits for this study. Firstly, it facilitated comprehension of real-world data obtained from research participants. Secondly, it assisted in providing a structure for management of interpretations of research data gathered. Thirdly, this approach enabled identification of contradictions present in the seafarers' activity system leading to task deviations due to frustration.

Fourth generation evaluation was used to maintain trustworthiness of the study, where trustworthiness was measured in terms of credibility, transferability, dependability and confirmability [53].

Data Collection

Unstructured one-on-one interviews was the strategy used for data collection in this research. While using interviews led to the capture of reliable perspectives from respondents [48], they also provided supplementary useful data in terms of research participant's tone of voice, body

gestures, pauses and mannerisms which added to the richness of data [54,55]. Thereby, using the qualitative approach resulted in accumulation of thorough accounts of seafarer behaviour and views within the maritime domain [55,56,57,58,59,60].

Data from sixty-one interviews were used for the study. They represented senior and junior officers with ratings from deck, engine and catering departments. Out of the interviewees one was a female. The average age of the interviewees was 47 years, while average sea service was 14 years. Interviewees represented Australia and eight countries in Asia, Europe, and West Africa. Research participants possessed work experience on different types of commercial ships such as tankers, containers, bulk carriers, general cargo ships, reefer ships, and offshore support vessels.

The interviewer requested the research participants to describe circumstances, situations and sequence of events which caused seafarer frustration leading to accidents due to task deviation. If interviewees were not directly involved in these accidents, they were witnesses. Accidents interviewees narrated were related to capsizing, collisions, groundings, fire, flooding, oil spills, and personal injuries.

The interviews lasted between thirty minutes to three hours. In total sequence of events and circumstances leading to seventy-four accidents were ascertained.

Data Analysis

Initial step was to conduct theoretical thematic analysis using Braun & Clarke's [61] 6-step framework to identify patterns within the gathered qualitative data [61,62]. Initial and major codes emerged through theoretical saturation of data [63,64,65,66] by constantly conceptualising patterns until no new attributes of patterns emerged [67,68].

Next step was to identify sociocultural contexts that caused frustration in seafarers at sea. This was done by using results from the first step in conjunction with the seafarers' activity system as presented in Figure 2. Analysis of dialectical relationships between the major codes using CHAT as a lens assisted in a wider understanding of sociocultural contexts causing frustration at sea. In order to achieve this, relationship codes were assigned between each component in the seafarers' activity system such as subject to subject, subject to object, subject to rules etc using the major codes established prior.

The third and the final step was to analyse contradictions within the seafarers' activity system using these relationship codes. The output of this step was identification of mediators in the seafarers' activity system that clashed with the object of conducting work at sea safely (WAI) due to seafarers engaging in tasks under the influence of frustration (WAD), thereby generating themes and categories.

FINDINGS

In this study, four categories emerged that contradict the object of getting WAD (by seafarers) aligned with WAI (by ship operators) as shown in Table 1. This study shows that seafarers' frustration at work may influence their decision making and behaviour to deviate from the prescribed procedures [69] leading to consequential outcomes. Most interviewees stated that accident investigations do not capture these areas of human element.

Table 1. Categories and themes

Categories and their themes			
Physical hardship to conduct task	**Loss or isolation from loved ones**	**Working with undesirable people**	**Severed Expectations**
Lack of physical fitness	Going through divorce or break up with partner	Unfair treatment	Postponed or cancelled shore leave due to work
Too tired after shore leave	Missing important functions at home	Perceived unfair appraisal reports	Delays to promised promotions / raises
Illness while at work	Single parents worried about kids at home	One or more team members disagree on execution method of the job	Lack of human resources on board to match work load
Adverse weather conditions	Someone ill in the family	Language barriers	Perceived unnecessary paper work
Fear of reprimand or negative appraisal if found resting	Death in the family	Perceived damage to reputation	Delays to jobs because of paperwork / permit renewal
Favouritism – physically strenuous tasks not assigned equally	Slow or no Wi-Fi onboard making it difficult to communicate with family	Working with colleagues who are not familiar with job tasks	Perceived financial losses
Simultaneous tasks		Supervisor blaming / insulting his own team with other supervisors	Unexpected pilot errors
Low quality food			Unexpected manoeuvring actions from other ships
Inadequate equipment to conduct jobs			Pressure from ship operator to continue operating vessel in spite of breakdowns
Audits and Inspections			Delayed sign off

Physical hardship to conduct task

Mandatory international regulations enforced by maritime authorities *(rules)* require medical examinations of all seafarers to assess their fitness for work at sea. However, some tasks which is asked to be undertaken by seafarers needs what is beyond their estimated physical fitness capacity which cause task deviation due to frustration. This situation is aggravated when seafarers fall ill or are suffering from seasickness. Older seafarers *(subject)* may also be vulnerable to become frustrated on board due to lack of fitness. Adverse weather conditions are also an

issue for fitness. A seafarer *(subject)* (R8) explained how he narrowly escaped certain death due to frustration causing task deviation:

> *That time the temperature in the pump room (oil tanker ship) must have been over 60 degrees. It was so hot and I was drenched in sweat. I was feeling angry for no reason and couldn't think clearly. Rather than going up two stair cases to reach the (main) staircase (to access the bottom deck), I decided to jump across to a nearby hanging tank top (short cut) because I was exhausted. I did and held on to a tank top railing which came off. I was so lucky that my right foot landed in a clear area otherwise I would have fallen at least 25m to the bottom of the pump room.*

When seafarers undertake physically difficult work tasks, they can demonstrate anger and in some instances aggression due to frustration because of contradictions within the component of subject in the seafarers' activity system. For example, seafarers taking shore leave in ports sometimes results in insufficient rest before they take over duties again on board which frustrates them. Additionally, many research participants explained how the extra work hours required for safety audits at ports *(rules)* lead to violation of rest hours assigned to seafarers as per STCW convention. This frustrates them leading to task deviation causing discrepancies between WAI and WAD.

Another cause of frustration among seafarers leading to task deviation was the unavailability of correct tools and equipment resulting in more physical exertion to complete tasks. Further, fear of negative appraisal by supervisors may lead to seafarers continuing to work in fatigued conditions causing frustration and may lead to task deviation.

Engaging in simultaneous tasks *(rules)* [5] and favouritism among crew *(division of labour)* also may results in frustration. Also, low quality food on board *(tools)* can results in frustration.

This study shows that physical hardship to carry out tasks on board conflicts within the components of *subject*, *rules, tools* and *division of labour* in the seafarers' activity system by contradicting the object of conducting 'WAD aligned with WAI'.

Loss or isolation from loved ones

Seafarers most of their time at work are within the confines of a ship [70]. This research supports previous research findings showing seafarers consider their tenures on board as isolated for their family [71]. Interviewees spoke of how frustration due to this isolation leads to accidents [72]. Frustrations are heightened on important days such as birthdays and anniversaries. Also, being at sea, seafarers are likely to miss out on passing away of loved ones and most of the time unable to attend funerals. For example, a senior officer (R52) explained:

> *I received a message from my wife about the sudden passing away of my mother. We were sailing towards New-foundland and there was simply not even time to get to her funeral. The company asked me 3 times whether I need to go home from Canada but there was no point going home after 3 days of the funeral. I made the hard decision to remain on board because I was in a money critical time as well. It was torture to be onboard swearing at myself for not*

being with her. Without my own knowledge I had become a hazard in the engine room and the chief engineer asked me to stay in my cabin for some time until I could get my head right.

Seafarers (*subject*) are also distracted because of frustration when they hear that their loved ones are going through illnesses, which may lead to accidents by creating a contradiction in the seafarers' activity system. However, accident investigations do not capture these human element attributes, but seafarers are mostly blamed for not adhering to company's procedures or checklists.

Research participants also showed that the seafarers on board are distracted by frustration during periods of divorce or relationship troubles. Out of frustration, they at times display aggressive behaviour and engaged in risky decision making leading to accidents. Similarly, another source of frustration for seafarers are poor communication facilities on board [73,74] leading to task deviation which may result in accidents.

Our analysis show that loss or isolation from loved ones causes frustration among seafarers. Contradictions were observed in the *subject* component of the seafarers' activity system causing direct discrepancies to the system's object of WAD aligned with WAI where seafarers deviate from their work tasks with the potential to cause accidents.

Working with undesirable people

Working with undesirable people can cause frustration among seafarers which may lead to task deviation with undesirable consequential events. Unfair treatment is a reason why people are perceived to be undesirable. We found that although it is common in the workplace [75,76,77] it remains unreported most of the time. However, in some cases seafarers displayed aggression against their supervisors *(division of labour)* due to perceived unfair treatment [78]. A master (R32) explained:

> *Easiest way we can make a ship unsafe is by mistreating people. It is normal to be mistreated onboard by other shippies or department heads. Most of them try to deal with it alone motivated by their need to earn money. It has always happened and will happen in future. Makes men angry and helpless. Having said that, you find a swing of the wrist here and there. I feel that this is one of the most overlooked safety concerns on ships. An angry seaman is a dangerous seaman, sometimes a dead one.*

Interviewees spoke of how seafarers are subjected to unfair treatment by shipping operators which frustrated them. They also showed that when seafarers "speak-up" to point out safety concerns, they are sometimes blamed and considered "trouble makers" affecting their chances of re-employment. Further, perceived racism is prevalent on commercial ships and research participants of how sometimes other seafarers didn't even respond when they greeted them. Severe abuse either verbal or physical by senior officers is very common as well leading to frustration. Nevertheless, these circumstances almost are never reported.

When seafarers consider their reputation is tarnished among colleagues due to being blamed from supervisors, rumours, and even issues at home *(subject / community / division of labour)*, they experience frustration and may engage in task deviation. Additionally, seafarers are frustrated when their supervisors *(division of labour)* spoke negatively about their team or individually to others on board. Similarly, perceived unfair negative appraisal reports prepared by supervisors is a severe cause of frustration which leads to task deviation.

Moreover, seafarers *(subject)* experience frustration when they do not agree with procedures arranged to be followed by the team members and supervisors *(community)*. Research participants stated how they experience frustration when their safety concerns as a team member are dismissed by their team or their supervisor. They do not desire to work in such teams. Seafarers are also frustrated when other work team members are not familiar with the equipment and job tasks having to compensate for their inadequacies as well. Furthermore, interviews spoke of how difficult it was to work with seafarers from some countries due to language barriers. These circumstances causes frustration which may lead to task deviation among seafarers potentially causing accidents.

Thus, this study shows that working with undesirable people leads to seafarer frustration. Contradictions within the elements of *subject, community and division of labour* in the seafarers' activity system cause conflicts to the system's object of WAD aligned with WAI. In that way, seafarers deviate from their tasks which may lead to accidents at sea.

Severed Expectations

This research confirms that frustration occur due to severed expectations leading to task deviations as shown by previous research work [79,80,81]. Seafarers have expectations from their work environment and towards their future. If expectations are cut short by unanticipated circumstances, they experience frustration. Seafarers can experience disappointment on board which may lead to task deviation causing accidents frequently. For example, an electrical engineer (R10) explained:

> *The 2nd Engineer postponed the fitter's shore leave to help me with the alignment of the lub oil pump motor. He had a red hot argument with the 2nd engineer because 2nd had promised him shore leave this trip. He might have missed it last time. He had that disappointed red face the whole time he was helping me. This is was the reason he put his hand in the wrong place when I was aligning the motor.*

Delays to salary raise and promotion is another reason seafarers *(subject)* are frustrated. Shipping operators *(community)* quote various reasons as excuses. On some occasions, salaries were cut down.

Seafarers don't expect shipping companies to operate ships in coercion towards seafarers, when critical safety machinery was broken down. However, this study shows that this is sometimes the case even with highly reputed shipping companies which frustrates seafarers leading to accidents.

Furthermore, unforeseen administrative work commonly referred to as paperwork on board frustrates seafarers. It is frustrating when job tasks are unexpectedly postponed because of paperwork such as permit validations at shift changes *(rules)*. Seafarers also believe that many administrative tasks on board are unnecessary and it distracts seafarers causing frustration. Paperwork frustration is a cause for seafarers taking short cuts, and sometimes neglecting job tasks altogether leading to task deviation, and thereby to potential accidents.

Many research participants mentioned that accidents may also happen at sea due to disappointments causing task deviation in terms of lack of human resources to carry out the actual workload on board. However, these shipping operators are in compliance with international manning regulations *(rules)*.

Interviewees further explained that when watch-keepers on the wheelhouse observed unexpected manoeuvres of other ships violating international collision regulations *(community)*, they experienced frustration. This may lead to aggressive risk-taking manoeuvres on the watch-keepers' part which could result in close quarters situations and collisions. Also, we found another source of frustration in the wheelhouse is unexpected pilot errors *(community)* leading to task deviation which may lead to accidents.

Thus, severed expectations *(rules / community)* cause discrepancies between WAD and WAI at sea resulting in contradiction of safe operation of ships *(object)* by seafarers *(subject)* in the seafarers' activity system which may lead to maritime accidents.

DISCUSSION

This research shows the socio-cultural attributes of seafarers' work practices in terms of conducting WAD aligned with WAI at sea can criticality compromise safety at sea. By analysing the findings of this study, it can be perceived that in the current dominated practice in shipping domain the elements in the seafarers' activity system clearly contradicted with the objective of aligned WAD and WAI causing task deviation due to seafarer frustration. These findings may assist the maritime industry to enhance safety at sea.

The findings of this study are in line with findings from previous research in other industries pertaining to issues with frustration in the work place resulting in unsafe practices [25,26,27,28,29,30,31,32,33,34], and a source of distraction and impairment [35, 36]. This research is the first of its kind carried out in the maritime industry as per the authors' knowledge. Therefore, the findings may assist maritime governing bodies to conduct maritime accident investigations with more emphasis toward the role of human element in accidents [5]. However, since research participants involved in this research were from only nine countries, further research consisting of seafarers from other shipping nations may shed more light towards the findings of this research. Another limitation of this study is that feedback from the respondents mirrored their individual perceptions. Therefore, additional research in terms of frustration leading to task deviation causing discrepancies between WAD and WAI may assist the maritime industry to align WAD with WAI to mitigate accidents at sea.

This research acknowledges that aligning WAD with WAI at sea to perform safe operations is a complex accomplishment [12]. This complexity is intensified by physical hardships

experienced by seafarers to conduct tasks, loss or isolation from loved ones, working with undesirable people and severed seafarer expectations at sea.

These concerns could be some of the causes leading to accidents where the human element is adjudged the main cause, even after the implementation of countless rules and regulations to prevent them. As accident investigators don't capture frustration as a contributing reason for marine accidents, addressing these socio-cultural and contextual concerns could be a step forward in mitigation of task deviation of seafarers leading to accidents at sea.

REFERENCES

1. EMSA. (2018). Annual overview of marine casualties and incidents 2018. European Maritime Safety Agency. Lisbon, Portugal.
2. EMSA. (2017). Annual overview of marine casualties and incidents 2017. European Maritime Safety Agency. Lisbon, Portugal.
3. IUMI. (2017). IUMI reports continued increase in frequency of major vessel casualties. International Union of Marine Insurance. Hamburg.
4. EMSA. (2016). Annual overview of marine casualties and incidents 2016. European Maritime Safety Agency. Lisbon, Portugal.
5. Rajapakse, A., Emad, G. R., Lützhöft, M. and Grech, M. (2019). A study on time constraints and task deviations at sea leading to accidents – a cultural-historical perspective. Maritime Policy & Management, DOI: 10.1080/03088839.2019.1574407
6. Batalden, B. and Sydnes, A. K. (2014). Maritime safety and the ISM code: a study of investigated casualties and incidents. WMU Journal of Maritime Affairs, 13, 3-25.
7. Knudsen, O. F. and B. Hassler. (2011). IMO legislation and its implementation: Accident risk, vessel deficiencies and national administrative practices. Marine Policy 35: 201–207.
8. Oltedal, H. A. and M. Lützhöft. (2018). Managing Maritime Safety. Oxon: Routledge.
9. Caschili, S. and F. R. Medda. (2012). A review of the maritime container shipping industry as a complex system. Interdisciplinary Description of Complex Systems 10: 1-15.
10. Dingus, T. A., Guo, F., Lee, S., Antin, J. F., Perez, M., Buchanan-King, M., and Hankey, J. (2016). Driver crash risk factors and prevalence evaluation using naturalistic driving data. Proceedings of the National Academy of Sciences, 113(10), 2636–2641.
11. Strayer, D. L., Turrill, J., Coleman, J. R., Ortiz, E. V., and Cooper, J. M. (2014). Measuring cognitive distraction in the automobile II: Assessing in-vehicle voice-based interactive technologies. Washington, DC: AAA Foundation for Traffic Safety.
12. Hollnagel, E. (2013). A Resilience Engineering Approach to Assess Major Accident Risks. In: Albrechtsen, E. and D. Besnard. (eds.) Oil and Gas, Technology and humans assessing the Human Factors of Technological change. Trondheim: Ashgate.
13. Leveson, G. N. (2004). A New Accident Model for Engineering Safer Systems. Safety Science, 42: 237-270.
14. de Vries, L. (2017). Work as done? Understanding the practice of sociotechnical work in the maritime domain. Journal of Cognitive Engineering and Decision Making 11(3): 270-295, DOI: 10.1177/1555343417707664.

15. Praetorius, G., E. Hollnagel, and J. Dahlman. (2015). Modelling Vessel Traffic Service to understand resilience in everyday operations. Reliability Engineering and System Safety 141: 10-21.
16. Praetorius, G. and E. Hollnagel. (2014). Control and resilience within the maritime traffic management domain. Journal of Cognitive Engineering and Decision Making Dec 2014 8: 303-317, DOI:10.1177/1555343414560022.
17. Van Westrenen, F. (2014). Modelling arrival control in a vessel traffic management system. Cognition, Technology & Work 16(4): 501-508.
18. Praetorius, G. and M. Lundh. (2013). "Under Dangerous Conditions" : Safety Construction and Safety-Related Work Onboard of Merchant Vessels. Proceedings, 5th Symposium on Resilience Engineering: Managing Trade-offs : 24th-27th June 2013 at Soesterberg, The Netherlands. 61-66.
19. Bergström, J., Dahlström, N., Van-Winsen, R., Lützhöft, M., Nyce, J., and Dekker, S. (2009). Rule and role retreat: an empirical study of procedures and resilience. Journal of Maritime Research, 6(3), 41-58.

20. Lützhöft. M., B. Sherwood Jones, J. V. Earthy and C. Bergquist. (2006). Making safety by tying the knot: examining resilience in shipping. Proceedings of The 2nd Symposium on Resilience Engineering. Juan-les-Pins, France, November 8–10.
21. Morel, G. and C. Chauvin. (2006). A socio-technical approach of risk management applied to collisions involving fishing vessels. Safety Science, 44(7): 599-619.
22. Waring, J. and E. Rowley. (2011). A Socio-cultural Perspective on Patient Safety. Farnham Surrey, UK: Ashgate.
23. Woods, M. (2010). Cultural safety and the socioethical nurse. Nursing ethics 17: 715-25. 10.1177/0969733010379296.
24. Engeström, Y. (1999). Expansive visibilization at work: an activity theoretical perspective. Computer Supported Co-operative Work 8: 63-93.
25. Arkes H. R., Dawes, R. M., and Christensen, C. (1988) Factors influencing the use of a decision rule in aprobabilistic task. In: Dowie J, Elstein AS (eds) Professional judgment: a reader in clinical decisionmaking. Cambridge University Press, New York.
26. NTSB. (1994). Aircraft Accident Report, Controlled Collision With Terrain, Express II Airlines, Inc./Northwest Airlink Flight 5719, Jetstream BA-3100, N334PX, Hibbing, Minnesota, December 1, 1993 (PDF). National Transportation Safety Board.
27. Gasper, K. and Clore, G. L. (1998). The persistent use of negative affect by anxious individuals to estimate risk. J Pers Soc Psychol 74:1350–1363.
28. Lowenstein, G. and Lerner, J. (2003). The role of affect in decision-making. In: Davidson R, Scherer K,Goldsmith H (eds) Handbook of affective science. Oxford University Press, New York.
29. Fessler, D. M. T., Pillsworth, E. G., and Flamson, T. J. (2004). Angry men and disgusted Women: an evolutionaryapproach to the influence of emotions on risk-taking. Organ Behav Hum Decis Process 95:107–123.
30. Lerner, J. S. and Tiedens, L. Z. (2006) Portrait of the angry decision maker: how appraisal tendencies shapeanger's influence on cognition. J Behav Decis Making 19:115–137.

31. Mesken, J., Hagenzieker, M. P., Rothengatter, T., and de Waard, D. (2007). Frequency, determinants, and consequences of different drivers' emotions: An on the-road study using self-reports, (observed) behaviour, and physiology. Transportation Research Part F: Traffic Psychology and Behavior, 10(6), 458–475. https://doi.org/10.1016/j.trf.2007.05.001.

32. Beisswingert, B. M., Zhang, K., Goetz, T., Fang, P., and Fischbacher, U. (2015). The effects of subjective loss of control on risk-taking behavior: The mediating role of anger. Frontiers in Psychology, 6. https://doi.org/10.3389/fpsyg.2015.00774.

33. Brandenburg, S., Oehl, M., and Seigies, K. (2017). German taxi drivers' experiences and expressions of driving anger: Are the driving anger scale and the driving anger expression inventory valid measures? Traffic Injury Prevention, 18(8), 807–812. https://doi.org/10.1080/15389588.2017.1316493.

34. Ge, Y., Zhang, Q., Zhao, W., Zhang, K., and Qu, W. (2017). Effects of trait anger, driving anger, and driving experience on dangerous driving behavior: A moderated mediation analysis. Aggressive Behavior, 43(6), 544–552. https://doi.org/10.1002/ab.21712.

35. Nesbit, S. M., and Conger, C. C. (2011). Evaluation of cognitive responses to anger-provoking driving situations using the Articulated Thoughts during Simulated Situations procedure, Transportation Research Part F: Traffic Psychology and Behaviour, Volume 14, Issue 1, Pages 54-65, ISSN 1369-8478, https://doi.org/10.1016/j.trf.2010.09.006.

36. Dahlen, E. R. and White, R. P. (2006). The Big Five factors, sensation seeking, and driving anger in the prediction of unsafe driving. Personality and Individual Differences. 41:903–915.

37. Dekker, S. (2018). The Field Guide to understanding human error. London - Routledge.

38. Emad, G., and Roth, W.M. (2008). Contradictions in practices of training for and assessment of competency: A case study from the maritime domain. Education and Training, 50, 260–272.

39. Emad, G. and Roth, W. M. (2009). Policy as boundary object: A new way to look at educational policy design and implementation. Vocations and Learning, 2, 19–35.

40. Hollnagel, E. (2014). Safety 1 & Safety 2 The past and future of safety management. Farnham, Surrey, England: Ashgate.

41. Hollnagel, E. (2014). Why WAI is different from WAD. Presented at the third resilience health care net meeting, Middlefart, Denmark, 12–14 August 2014.

42. Hollnagel, E. (2012). FRAM: the functional resonance analysis method. Modelling complex socio-technical systems. Surrey, UK: Ashgate Publishing Limited.

43. Dekker, S. (2006). Chronicling the Emergence of Confused Consensus. In: HOLLNAGEL, E. & LEVESON, G. N. (eds.) Resilience Engineering : Concepts and Precepts, pp. 77–92. Aldershot: Taylor & Francis Ltd.

44. Kontogiannis, T. (1999). User Strategies in Recovering from Errors in Man-Machine Systems. Safety Science 32: 49-68.

45. Freud, S. (1930). Civilization and its discontents. London: Hogarth Press.

46. Lorenz, K. (1974). Civilized man's eight deadly sins. New York: Harcourt, Brace, and Jovanovich.

47. Berkowitz, L. (1993). Aggression: its causes, consequences, and control. New York: McGraw-Hill.

48. Devane, B. and K. Squire. (2012). Activity theory in the learning technologies. In D. Jonassen, & S. Land (Eds.) Theoretical foundations of learning environments, 242-268 New York, NY: Routledge.

49. Engeström, Y. (1987). Learning by expanding. An activity-theoretical approach to developmental research. Helsinki, Finland, Orienta-Konsultit Oy.

50. Sannino, A. and Engeström, Y. (2018). Cultural-historical activity theory: founding insights and new challenges. Cultural-Historical Psychology, 14(3), 43-56.

51. Cole, M., Engeström, Y., and Vasquez, O. (1997). Mind, Culture and Activity. Cambridge: Cambridge University Press.

52. Engeström, Y. and R. Miettinen. (1999). Introduction. In: Engeström, Y., R. Miettinen and R. Punamaki. (eds.) Perspectives on activity theory, pp 1-16. New York, NY: Cambridge University Press.

53. Guba, E. G. and Y. S. Lincoln. (1989). Fourth generation evaluation. Newbury Park, CA and London: Sage Publications.

54. Drew, P. (2009). Conversation analysis. In Jonathan A. Smith (Ed.), Qualitative psychology: A practical guide to research methods (pp. 133–159). Los Angeles: Sage.

55. Yin, R. K. (2011). Qualitative Research from start to finish. New York: Guilford Press.

56. Silverman, D. (2010). Qualitative research. London: Sage.

57. Cohen, L., Manion, L., & Morison, K. (2007). Research Methods in Education. (6th ed.). London: Routledge.

58. Berg, B. L. (2007). Qualitative research methods for the social sciences. London: Pearson.

59. Rubin, H. J. and Rubin, I. S. (2005). Qualitative interviewing: The art of hearing data (2nd ed.). Thousand Oaks, CA: Sage.

60. Brown, J. D. (2005). Research methods for applied linguistics. In: A. Davies and C. Elder,

61. Braun, V. and V. Clarke. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology 3: 77-101.

62. Javadi, M. and Zarea, M. (2016). Understanding Thematic Analysis and its Pitfalls. Journal Of Client Care, 1 (1) , 33-39.

63. Bertaux, D. (1981). From the life-history approach to the transformation of sociological practice. In Biography and society: The life history approach in the social sciences, ed. by D. Bertaux, 29–45. London: Sage.

64. Kuzel, A. (1992). Sampling in qualitative inquiry. In Doing qualitative research, ed. B. Crabtree and W. Miller, 31–44. Newbury Park, CA: Sage

65. Creswell, J. W. (1994). Research Design: Qualitative and Quantitative Approaches. Thousand Oaks. CA: Sage.

66. Ryan, G. W. and Bernard, H. R. (2000). Data management and analysis methods. In Norman K. Denzin & Yvonna S. Lincoln (Eds.), Handbook of qualitative research (pp.769-802). Thousand Oaks: Sage.

67. Glaser, B. G. (2001). The grounded theory perspective: Conceptualization contrasted with description. Mill Valley, CA: Sociology Press.

68. Charmaz, K. (2006). Constructing grounded theory: A practical guide through qualitative analysis. London: Sage.

69. Lerner, J. and Keltner D. (2000). Beyond valence: toward a model of emotion-specific influences on judgement and choice. Cogn Emot 14:473–493.

70. Oldenberg, M. and Jensen, H.J. (2012), "Merchant seafaring: A changing and hazardous occupation", Occupational *and Environmental Medicine*, Vol.69, No.6, pp.132-148.

71. Dimitrova, D. N. and Blanpain, R. (2010). Seafarers' rights in the globalized maritime industry. Alphen aan den Rijn: Kluwer Law International.

72. Thomas, M. and Bailey, N. (2009). Out of time: Work, temporal synchrony and families. *Sociology*, Vol.43, No.4, pp.613-630.

73. Thomas, M. and Bailey, N. (2006). Square Pegs in Round Holes? Leave Periods and Role Displacement in UK-Based Seafaring Families. Work, Employment and Society 20(1): 129-149. doi:10.1177/0950017006061277.

74. Thomas, M., Sampson, H. and Zhao, M. (2003). Finding A Balance: Companies, Seafarers and Family Life. Maritime Policy and Management 30(1): 59-76. doi:10.1080/0308883032000051630

75. Baron, R. A. (1994). The physical environment of work settings; Effects on task performance, interpersonal relations, and job satisfaction. In B. M. Staw & L. L. Cummings (Eds.), Research in organizational behavior (Vol. 16, pp. 1-46). Greenwich, CT; JAI Press.

76. Kinney, J. A. (1995). Violence at work: How to make your company safer for employees and customers. Englewood Cliffs, NJ: Prentice Hall.

77. Mantell, M. R. (1994). Ticking bombs: Defusing violence in the workplace. Burr Ridge, IL: Irwin.

78. Neuman, J. H. and Baron, R. A. (1997). Aggression in the workplace. In R. Giacalone & J. Greenberg (Eds.), Antisocial behavior in organizations (pp. 37-67). Thousand Oaks, CA: Sage.

79. Hennessy, D. A. and Wiesenthal, D. L. (1999). Traffic congestion, driver stress, and driver aggression. Aggressive Behavior, 25(6), 409–423.

80. Fraine, G., Smith, S. G., Zinkiewicz, L., Chapman, R., and Sheehan, M. (2007). At home on the road? Can drivers' relationships with their cars be associated with territoriality? Journal of Environmental Psychology, 27(3), 204–214.

81. Hennessy, D. A. (2008). The impact of commuter stress on workplace aggression. Journal of Applied Social Psychology, 38(9), 2315–2335.