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SAFETY CULTURE ONBOARD SHIPS

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A project focusing on identifying and describing maritime risks is being conducted in the heavily trafficked water area of the Sound, situated in northern Europe between Sweden and Denmark. This paper reports of a test of a first version of a questionnaire constructed for measuring safety culture onboard vessels. 48 crew members on a Swedish registered passenger/cargo ship completed and returned the questionnaire. The crew members were able to complete the questionnaire with few unanswered questions. Acceptable homogeneity was obtained for all but one of the nine dimensions of safety culture. Significant differences on several of the safety culture dimensions were found between deck/engine vs catering personnel, men vs women and different age groups, while little differences where found for supervisors vs non-supervisors or people with varying number of years onboard. Such safety culture dimensions need to be studied in relation to reports of accidents and near-misses, to further study the true relevance of safety culture.

INTRODUCTION

A multidisciplinary project focusing on identifying and describing maritime risks is being conducted in the heavily trafficked water area of the Sound, situated in northern Europe between Sweden and Denmark. The ergonomic part of the project includes the study of two basic phenomena: human machine interaction and safety culture onboard ships. We have conducted a pilot study for the development of a questionnaire for measuring safety culture onboard ships. This paper reports the results of this pilot study.

The attitudes and behavior of both individuals and organizations with respect to safety may have important implications for the actual risk for accidents associated with maritime activities.

The concept of 'safety culture' is not defined in a consistent manner in the professional literature. One of the most widely used definitions is the following: "The safety culture of an organisation is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health and safety management" (Health and Safety Commission, 1993).

There is also an ongoing discussion about the possible differences between the concepts of safety culture and safety climate and the extent to which they overlap each other. For example Reichers and Schneider (1990) conclude that "culture exists at a higher level of abstraction than climate, and climate is a manifestation of culture". Cox and Cox (1996) conceive of culture as the organization's personality, while climate represents a more transient mood state, sensitive to external pressures. However, as Flin (1998) says, questionnaires claiming to measure safety culture or safety climate are almost indistinguishable in terms of their component factors or dimensions.

In our study of safety culture onboard ships, we use a working definition that includes the following nine dimensions, the first four of which have previously been proposed by Reason (1997): Reporting culture e.g. the existence of trust and commitment resulting in good reporting of incidents, near-misses and anomalies; Flexible culture e.g. the respect for individuals' skills and experience, with control and decision making transferred to the most knowledgeable person present in the emergency situation; Just culture e.g. clear lines are drawn between acceptable and non- acceptable behavior, the consequences following a reporting of a near-miss are 'reasonable'; and Learning culture e.g. the desire and ability to learn about safety from experience, and the readiness to implement improvements. The other five dimensions concern the employees' Working conditions such as time pressure, fatigue, training in work and safety, and clarity in rules; Safety related behavior e.g. individual and organizational behaviors concerning priorities, responsibilities, risk taking, encouragement of orderliness and pressure to take short cuts; Attitudes towards safety e.g. individual and organizational attitudes concerning the importance of safety, distribution of work and responsibilities, and encouragement toward safe practices; Communication e.g. the amount and clarity of the communication between work groups and different levels of the organization; and Risk perception i.e. the individual's perception of risk and safety on board.

Purpose of the Study

The primary purpose of this study was to test the first version of a questionnaire constructed for measuring safety culture onboard vessels, and specifically to test a) whether the crew could complete the questionnaire, b) whether the questions yielded a distribution of scores across different individuals, and c) whether the different questions used to measure a given safety culture dimension were homogeneous. The purpose of this study was not to investigate how well the measures relate to actual risk. To obtain experiences regarding how the questionnaire could be used, a secondary purpose was to determine in this vessel population whether the safety culture dimensions differed for A) deck/engine departments vs catering department, B) supervisors vs non-supervisors, C) women vs men, D) different age groups, and E) groups with varying numbers of years onboard the ship.

METHOD

Material. The study was conducted on a Swedish registered passenger/cargo ship in international traffic on the Baltic sea. The questionnaire was completed by 48 crew members (37% response rate), 34 of whom were men and 14 women. Their average age was 43 years (range 20 – 62 years) and they had been working onboard this ship for 8.6 years on the average (range ½ - 18 years). 90% came from European countries (67% from Sweden). Nineteen of the respondents (all of whom were men) belonged to the deck or engine departments onboard (i.e. the two departments responsible for the ship's conveyance) and 29 (15 men and 14 women) belonged to the catering department. Half (48%) of the respondents had at least some degree of supervisory duties and 77% of these were men.

Questionnaire. Safety culture was measured using a questionnaire with a total of 79 questions representing the above nine safety culture dimensions. Some of the questions were taken from a literature review (e.g. Moos, 1981), while other questions were constructed by the current authors. The answer to each question was scored on a five-degree scale (i.e. 'very much, much, a little, barely, not at all', or 'very often, often, sometimes, seldom, never'), where a 'better' safety culture score had a higher value on the scale.

An example of a question is the following:
'How often do you feel worn out while you are working?: very often, often, sometimes, seldom, never'.

The questionnaire was filled in anonymously.

Statistics. Where possible, each of the nine dimensions was to be represented by the mean score for the individual's answers to the questions belonging to that dimension. Cronbach's alpha coefficient was used to investigate the homogeneity of the questions in each of the nine dimensions. As the dimension 'Just' did not yield acceptably high homogeneity (alpha value), three individual items where instead chosen to represent this dimension. Differences in safety culture scores between the various subgroups among the crew (e.g. supervisors vs non-supervisors) were tested using t-test (significant differences obtained by t-test were also confirmed using the non-parametric Mann Whitney U test). Correlations were calculated between age/years onboard and the various safety culture dimensions.

RESULTS

The first purpose of the study was to test the usability of the questionnaire. We found that the respondents were able to complete the questionnaire, with few unanswered questions. Acceptable variation was found for the scores for all questions. Alpha coefficient values of >.70 were obtained for seven of the nine dimensions (Table 1).

Table 1. Cronbach's alpha coefficient and number of questions used to calculate mean score for the dimension.

Dimension	N of Qs*	Mean score	Cronbach's alpha**
Working condition	15	3.56	.90
Communication	7	3.62	.83
Safety behavior	15	3.77	.91
Safety attitude	7	4.24	.82
Flexibility	7	3.23	.76
Reporting	8	3.55	.83
Just	6	3.48	-
Learning	5	3.44	.84
Risk perception	4	3.53	.60

* Three additional questions from Flexibility and one from Communication were excluded from mean scores to improve alpha for the dimension but can be used as individual items. One additional Reporting item concerned further specification of feedback when reporting events onboard.
** Measure of homogeneity.

As a whole, the crew generally gave a positive report for all safety culture dimensions. Especially Attitudes towards safety received high ratings.

Deck/engine vs Catering Department

As compared to catering personnel, deck/engine personnel reported a more positive view of their Working conditions (p=.006), more Flexibility in work onboard (p=.009), better Communication (p<.0001), better Reporting (p=.023) and better Safety behavior onboard (p=.034). The deck/engine personnel also reported that the difference between acceptable and non-acceptable behavior had been made clear to a greater extent than the catering personnel reported (p=.012).

Supervisors vs Non-Supervisors

Little difference was found between supervisors and non-supervisors regarding reports of eight of the nine safety culture dimensions. Supervisors reported significantly better Reporting (p=.028).

Women vs Men

As compared with men, women reported experiencing a less positive view of their Working conditions ($p<.0001$), less Flexibility in their work onboard ($p=.002$), and poorer Communication ($p<.0001$). Women also reported that the difference between acceptable and non-acceptable behavior had been made clear to a lesser extent than men reported ($p=.004$).

Age Groups

Higher age correlated significantly positively with good Working conditions ($p=.005$), more Flexibility ($p=.003$), better Communication ($p=.001$), better Reporting ($p=.015$), and better Safety behavior onboard ($p=.008$).

Comparisons using t-tests showed further that individuals older than 30 (compared with younger) reported greater Flexibility ($p=.030$), better Communication ($p=.046$) and Reporting ($p=.012$) and better Safety Behavior ($p=.006$).

Years Onboard

In contrast, years onboard this vessel showed no significant correlation to any of the nine safety culture dimensions.

Comparisons using t-tests showed that individuals who had worked ½ to three years onboard were more worried about being blamed for mistakes than individuals who had worked four years or more onboard ($p=.022$).

DISCUSSION

This pilot study of safety culture onboard an international passenger/cargo ship showed that the newly developed questionnaire could be completed by crew members. The current answers were given by 37% of the crew. We are currently examining the characteristics of those not responding, as well as methods for increasing participation in future studies. The results showed that the questions chosen to represent safety culture dimensions provided homogeneous measures of eight of the nine dimensions. Significant differences in the dimensions were found between deck/engine vs catering departments, men vs women and older vs younger age groups. As there was a strong relationship between gender and deck/engine vs catering department, further analysis must be done to determine whether the differences observed in safety culture for these groups primarily resulted from gender or type of job onboard. In contrast, few differences on safety culture dimensions were found between supervisors vs non-supervisors, or among groups with different length of service onboard.

These results were obtained with a relatively small sample of crew members and definitely should be re-tested on extended samples. The differences observed among this crew provide nevertheless interesting grounds for further study of the nature and background of the crew members' working conditions, patterns of behavior and attitude and how these could be optimized to further improve safety culture onboard.

Work continues to define the difference between safety climate (of possibly more temporary nature) and safety culture (of possibly a more basic nature). According to Cox and Flin (1998), safety culture is best measured through a cross-referencing of methodologies involving case studies, comparative studies and psychometric surveys. This pilot study belongs to the latter category. This method may measure primarily safety climate and thus provide a momentary view of attitude and behavior onboard. This method does nevertheless yield an efficient way of obtaining at least a superficial view of safety culture both for the vessel as a whole and for the individual crew members. A more extensive investigation of safety culture would require the inclusion of in-depth interviews and perhaps also comparison of this vessel to other vessels.

Further, the results that are obtainable from such a questionnaire should clearly be related to reports of accidents and near-misses, to further study the true relevance of safety culture.

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