TØI Report 1501/2016

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Institute of Transport Economics
Norwegian Centre for Transport Research

Occupational safety and work related factors in Norwegian maritime transport

TØI Report
1501/2016

Organisational influences on occupational safety in Norwegian maritime transport

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ISSN 0808-1190
ISBN 978-82-480-1730-1 Electronic Version **Oslo, August 2016**

Tittel:	Organisatoriske faktorers betydning for arbeidsrelatert sikkerhet i norsk maritim transport	**Title:**	Organisational influences on occupational safety in Norwegian maritime transport
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Dato:	08.2016	**Date:**	08.2016
TØI rapport	1501/2016	**TØI Report:**	1501/2016
Sider:	78	**Pages:**	78
ISBN elektronisk:	978-82-480-1730-1	**ISBN Electronic:**	978-82-480-1730-1
ISSN:	0808-1190	**ISSN:**	0808-1190
Finansieringskilde:	Norges forskningsråd	**Financed by:**	The Research Council of Norway
Prosjekt:	4034 – Arbeidsrelaterte ulykker i veg, sjø og lufttransport: forekomst, årsaker og tiltak	**Project:**	4034 – Work-related accidents in road, sea and air transport: prevalence, causes and measures
Prosjektleder:	Beate Elvebakk	**Project Manager:**	Beate Elvebakk
Kvalitetsansvarlig:	Ross Owen Phillips	**Quality Manager:**	Ross Owen Phillips
Fagfelt:	Sikkerhet og organisering	**Research Area:**	Safety and Organisation
Emneord:	Arbeidsrelatert sikkerhet Norsk maritim transport Organisasjonssikkerhetskultur	**Keywords:**	Occupational safety Norwegian maritime transport Organisational safety culture

Sammendrag:

Denne studien bruker tre metoder for å vurdere betydningen av organisatoriske faktorer for arbeidsrelatert sikkerhet på norske skip. Analysene viser at organisasjonssikkerhetskultur er den viktigste organisatoriske faktoren i vårt utvalg, og at den påvirker alle målene våre på arbeidsrelatert sikkerhet: skader, risikopersepsjon, trøtthet, og prosedyrebrudd. Vi fant også at organisasjonssikkerhetskultur påvirket (andre) organisatoriske faktorer: arbeidspress, arbeidsforhold og prosedyrer som beskriver farer i arbeidet. Studien finner også interessante sammenhenger mellom organisasjonssikkerhetskultur, bemanningsnivå og arbeidsforhold som bør følges opp i videre forskning. Dataene viser at respondenter på skip med lav bemanning (3-4 personer) skårer dårligere på mange av variablene som måler arbeidsrelatert sikkerhet og organisatoriske faktorer.

Summary:

This study employs three methods to survey organisational influences on occupational safety in Norwegian maritime transport. Our analyses indicate that organisational safety culture is the most important organisational factor, predicting all our measures of occupational safety: injuries, risk perception, fatigue and procedure violations. We also found organizational safety culture to be a key predictor of (other) organisational factors, e.g. work pressure, working conditions and procedures describing hazards. The study has also found interesting relationships between organisational safety culture, manning level and working conditions which should be followed up in future research. Data from the small-scale survey indicates that respondents on vessels with low manning (3-4 people) score lower on many of the variables measuring occupational safety and organisational factors.

Language of report: English

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Preface

This report is part of a larger research project: "Work-related accidents in road, sea and air transport: prevalence, causes and measures" which lasts for three years, from March 2014 to March 2017. The project is financed by the TRANSIKK program of the Research Council of Norway. Our contact persons at the Research Council of Norway have been Lise Johansen and Mette Brest Jonassen. The main aims of the project are to survey the prevalence, causes and understanding of work-related accidents in road, sea and air transport (light helicopter inland), and to provide a scientific knowledge base that can be used to develop measures against work-related risk factors. The project is headed by Beate Elvebakk.

The data that we use in the present report were originally collected in another project focusing on the importance of flag state for maritime safety. This study is reported in Nævestad (2016). In the present study, we choose to focus on the 180 NOR (Norwegian Ordinary Ship Register) respondents in the original sample, in order to examine the importance of organisational factors for occupational safety in Norwegian sea transport.

The study is based on qualitative interviews with 10 sector experts, a reference group meeting and a small-scale survey with 180 seafarers. We are very grateful to the 10 sector experts who shared their knowledge and views with us in the qualitative interviews. We are also very grateful to the seafarers who answered the survey.

The respondents were recruited through "Kystrederiene", an employer organisation for Norwegian based shipping companies. We are very grateful for this cooperation, and we thank director Siri Hatland for her enthusiasm and patience.

Several people have answered our questions during the project period, and some have read and commented earlier versions of this report. We are very thankful for their kind and informative assistance. We are also grateful to the members of the reference group of the project, who gave us valuable feedback in a meeting in March 2014. We hope that we have been able to consider all comments.

Tor-Olav Nævestad has written the report and conducted the research. Ross Phillips is responsible for the quality assurance of the report, while Trude Kvalsvik has prepared the report for publication.

Oslo, August 2016
Institute of Transport Economics

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Content

Institute of Transport Economics
Norwegian Centre for Transport Research

Summary

Organisational influences on occupational safety in Norwegian maritime transport

TØI Report 1501/2016
Author: Tor-Olav Nævestad
Oslo 2016 80 pages English language

This study employs three methods to survey organisational influences on occupational safety in Norwegian maritime transport. Our analyses indicate that organisational safety culture is the most important organisational factor, predicting all our measures of occupational safety: injuries, risk perception, fatigue and procedure violations. We also found organizational safety culture to be a key predictor of (other) organisational factors, e.g. work pressure, working conditions and procedures describing hazards. Thus, future research should examine the preconditions of good maritime safety culture, in order to form a basis for developing safety culture interventions on board Norwegian vessels. The study has also found interesting relationships between organisational safety culture, manning level and working conditions which should be followed up in future research. Data from the small-scale survey indicates that respondents on vessels with low manning (3-4 people) score lower on many of the variables measuring occupational safety and organisational factors. These vessels have more personal injuries, and crew members rate the safety level and the safety culture as lower than crew members on other vessels. Future research should examine this further to facilitate measures to improve safety on board these vessels. It is important to note that we do not examine whether manning levels are too low on these vessels, we merely compare occupational safety and organisational factors. Finally, we also found that factors that are not organisational are important for the occupational safety of the seafarers in our sample. Both the age groups of the respondents and their positions/lines of work influence several different aspects of occupational safety.

Background and aims

Sea transport is central to world trade, as it carries about 90 % of internationally traded produce (Alderton & Winchester 2002). Sea transport dominates long distance goods transport in Norway, where it constitutes about 81 % of the import, measured in tonnes, including passenger ferries, and about 73 % of the export measured in tonnes, including ferries and excluding crude oil and natural gas (St. melding nr. 31 2003-2004).

According to Nævestad, Elvebakk, Phillips, Bye and Antonsen (2015), there were on average 15 killed and 424 injured annually on Norwegian ships in the period 2004-2013. In the present study we examine how occupational safety on board Norwegian vessels is influenced by organisational factors.

The study focuses on the following organisational factors, as these have been highlighted as important in previous research: 1) Organisational safety culture, 2) Manning, work load, and stress, 3) Working conditions and rest, and 4) Safety management system. The present study attempts to build on this research by focusing on organizational influences on occupational safety on vessels registered in the Norwegian Ordinary Ship Register (NOR).

The aims of the study are to:

1) Survey organizational factors and other factors influencing occupational safety on Norwegian vessels.
2) Survey variables influencing organizational factors in order to examine relationships between them and point to the most important factors influencing occupational safety on Norwegian vessels.

These aims are important, as obtaining knowledge on these factors is a prerequisite of implementing preventive measures to improve occupational safety. This report is part of a larger research project: "Work-related accidents in road, sea and air transport: prevalence, causes and measures" lasting for three years, from March 2014 to March 2017.

Key concepts and measures

In this study, *occupational safety* refers to the following variables:

1) Personal injuries occurring while at work (1 item).
2) Perception of risk related to work place hazards (2 items).
3) Safety compromising fatigue (1 item).
4) Procedure violations and lacking use of procedures (index summing up 3 items).

Organisational factors are defined as formal and informal aspects of seafarers' work organizations, which may influence occupational safety. In this study, organisational factors refer to the following variables:

1) Organisational safety culture (index summing up 18 items).
2) Manning level on vessels (1 item).
3) Work pressure (1 item).
4) Demanding working conditions (index summing up 3 items).
5) Working hours and rest on board (3 items).
6) Safety management system (2 items on work procedures and risk analyses)

We also examine the influence of *"non-organisational factors"* on occupational safety (aim 1) and on organizational factors (aim 2):

1) Seafarers' position/line of work (1 item).
2) Seafarers' age (1 item).
3) Vessel type (1 item).
4) Vessel age (1 item).
5) Number of port calls per week (1 item).

Methods

The data were originally collected for a study comparing safety and organisational factors on NOR vessels and foreign-flagged vessels (Nævestad 2016). In the present report, we choose however to take a closer look at the organisational factors influencing the occupational safety of the seafarers (N=180) on board NOR registered vessels in our sample. The study employed three different methods:

1) Qualitative interviews. We conducted qualitative interviews with 10 sector experts from employer organisations, employee organisations, authorities and other organisations involved in maritime safety.

2) Reference group meeting. We were provided with useful information and viewpoints in a reference group meeting held at the Institute of Transport Economics, March 27th, 2014. Results from this meeting are presented together with results from the interviews.

3) Small-scale survey. We present results from a small-scale survey (N=180) with seafarers who were recruited through "Kystrederiene", an employer organisation for shipping companies based in Norway.

Occupational safety

The study includes four measures of occupational safety, and personal injury is the most important measure. Our survey indicates that 17 % of our respondents (N=180) had been injured in their work on board in the course of the last two years.

We found that the following variables influenced seafarers' risk of injuries on board:

1) Age: The older the seafarers are, the less likely they are to have been injured in the last two years.

2) Position: Deck crew/apprentices were more inclined to be injured than others

3) Vessel type: crew members of well vessels were more inclined to be injured

4) Manning level: The higher manning level, the lower was the risk of personal injuries

5) Organisational safety culture: The better safety culture the respondents report, the less likely it is that they have had an injury in the last two years.

Interestingly, we see that only the two latter variables, manning level and organisational safety culture are what we refer to as organisational factors. The three former variables predicting seafarers' risk can be attributed to individuals or vessels.

We found, however, that respondents' risk perceptions largely were predicted by organisational factors. The following variables influenced respondents' perception of risk: 1) Respondents' experiences of safety-compromising fatigue, 2) Perception of work pressure, 3) Organisational safety culture, 4) Experiences of demanding working conditions (i.e. shift delays, 16-hours of continuous work and interrupted rests).

The research literature indicates that fatigue is an important safety risk in the maritime sector, and that is rooted in framework, organisational and working conditions, as well as individual characteristics and life outside of work. Seafarers share several important work characteristics influencing fatigue, for instance long working hours and sleep disturbances, due to for instance motion, noise and night work.

Respondents were asked to rate their agreement with the statement: "Sometimes I am so tired during working hours that safety is compromised". We conducted analyses to examine factors influencing respondents' experiences of safety-compromising fatigue. First, we found that the older seafarers are, the less likely they are to report of safety-compromising fatigue. Second, deck personnel are more likely to be fatigued in manners that may compromise safety. Third, we found that having a good safety culture decreases the risk of safety-compromising fatigue. Finally, we found that respondents' experiences with demanding working conditions is the most important predictor of safety-compromising fatigue. Thus, we see that respondents' experiences with safety compromising fatigue is influenced by both individual factors and organisational factors.

Safety culture is a key organisational factor

We made an organisational safety culture index, consisting of 18 questions from the Global Aviation Information Network (GAIN)-scale (GAIN 2001), and we used this in our survey. Our analyses indicate that organisational safety culture is the most important organisational factor, predicting all of the aspects of occupational safety: 1) Personal injuries, 2) Worry about risk, 3) Assessment of the safety of the work place situation, 4) Safety compromising fatigue and 5) Lacking procedure use and procedure violations.

We also found organizational safety culture to be a key predictor of (other) organisational factors: 6) Work pressure, 7) Demanding working conditions and 8) Procedures describing hazards, see figure S.1.

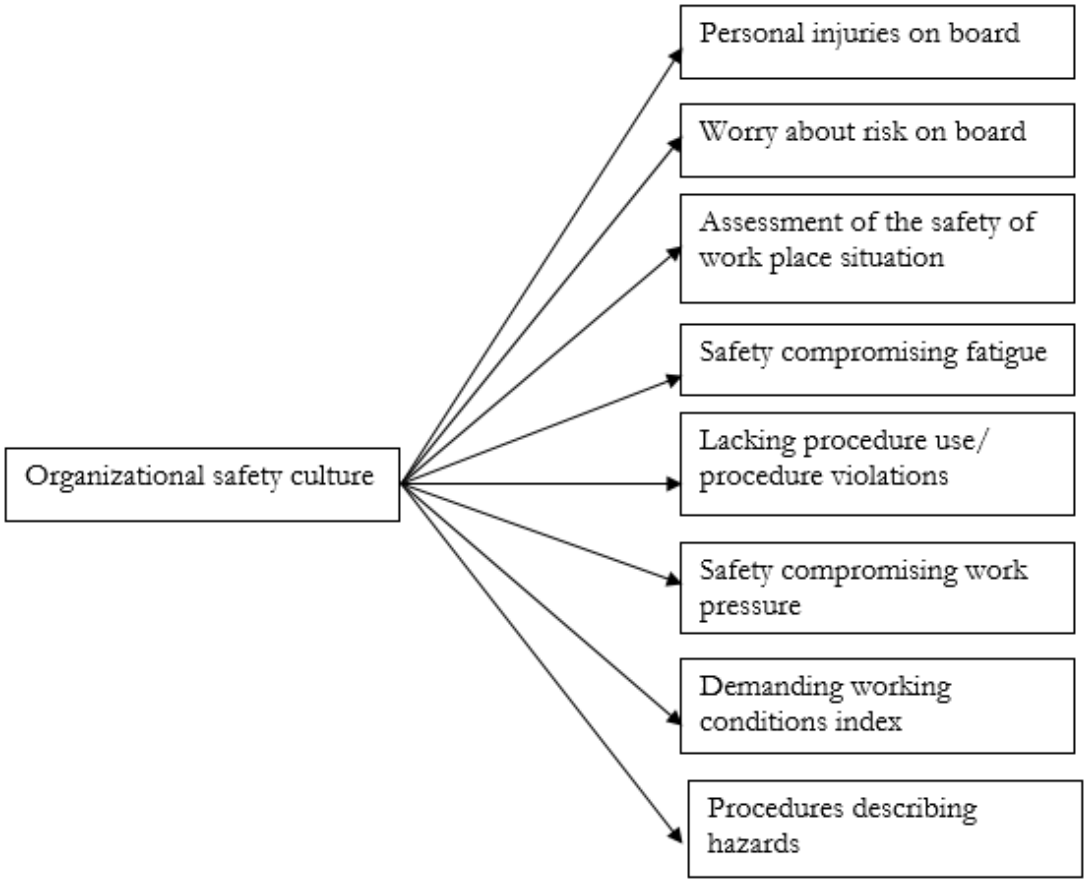


Figure S.1: Relationships between organisational safety culture and variables measuring occupational safety and organisational factors.

The importance of organisational safety culture for several safety outcomes, was also highlighted in the research literature and in the interviews. Culture, attitudes, knowledge, skills and risk understanding are factors that are important when it comes to explaining safety behaviour among crew members on board ships and the ship accident risk.

Manning level

Respondents were asked several question about the manning level on board their vessels. Our sample is too little for comparison and generalization, as we analysed manning numbers based on the unique vessels in our sample (calculations were made based on the captains in the sample). Keeping this in mind, we saw that the average manning level on vessels less than 500 dwt is 4.3, while it is 5.9 on vessels between 500 and 3,000 dwt.

Above, we saw that manning level predicts seafarers' risk of personal injuries: The higher manning level, the lower was the risk of personal injuries. Although differences between the shares are not statistically significant, vessels manned by 3-4 people had the highest share of crew members who had been injured in the last two years (26 %). The corresponding numbers for vessels manned by 5-6 people was 20 %, while it was 7 % for vessels manned by 7-8 people.

Data from the small-scale survey indicates that the vessels with low manning (3-4 people) score lower on many of our variables measuring occupational safety and organisational factors. Seafarers on vessels with a manning of 3-4 people rate the safety level of their work place as lower than other respondents (Mean: 7.3 versus 8.6 points) (P=0.00). Seafarers on vessels with a manning of 3-4 people also rate their organisational safety culture as lower than other respondents. Figure S.2 illustrates the relationship between these three variables.

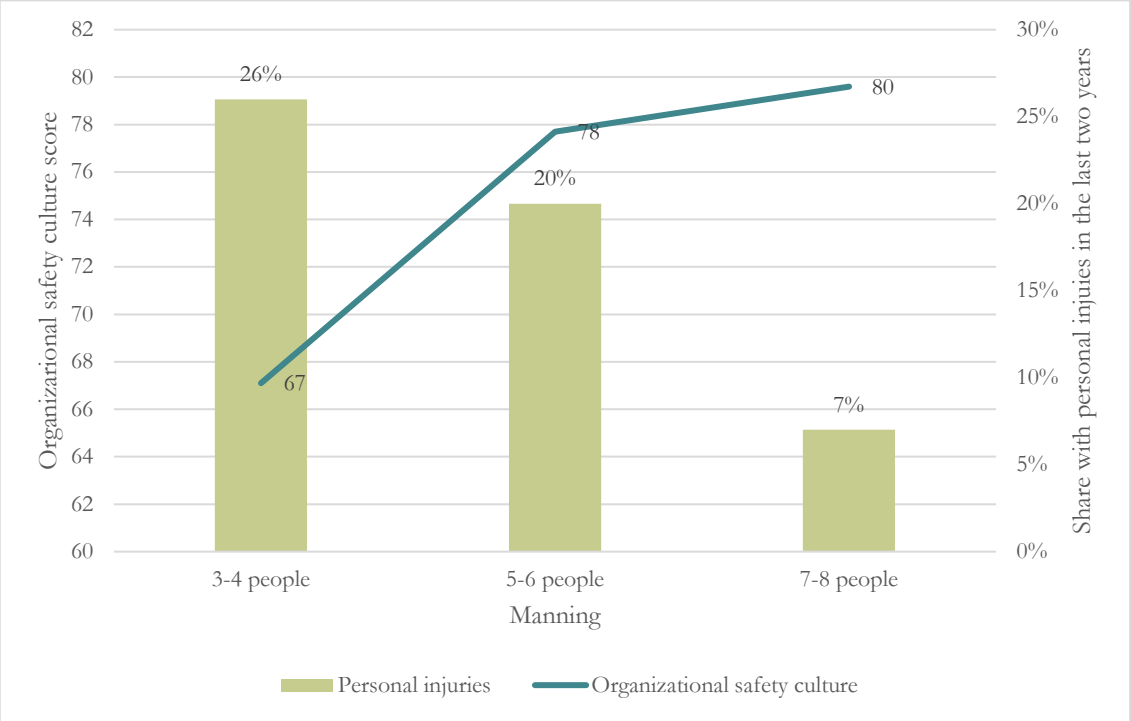


Figure S.2: Organisational safety culture scores (scale from 18 to 90 points) and shares of seafarers who have been injured on board in the last two years on vessels with different manning levels: 3-4 people (N=19), 5-6 people (N=113) and 7-8 people (N=45).

Although not all results were statistically significant, we saw that seafarers working on board vessels manned by 3-4 people reported more pressure to work even though it is not perfectly safe, they agreed less that they get sufficient sleep and rest on board, they experience more often demanding working conditions, and they report of higher levels of safety-compromising fatigue. Future research should examine occupational safety and organisational factors on vessels with low manning (3-4 people) in order to be able to implement measures to improve safety. We expand on this below.

When interpreting results, it is important to note that numbers are small in the sample of vessels manned by 3-4 people (N=19), although results indicate a tendency of higher scores on variables measuring occupational safety and organisational factors with increasing values on the manning level variable. Thus, results must be interpreted with caution and further research is required to examine the importance of manning level for occupational safety and organisational factors. We return to this below.

Demanding working conditions and work pressure

Above, we saw that demanding working conditions (i.e. experiences of shift delays, 16-hours of continuous work and interrupted rests) was the most important predictor of safety compromising fatigue.

We made an index measuring respondents' demanding working conditions and we analysed the factors influencing this index. First, we found that older respondents are less inclined to experience these things. Second, being a captain makes seafarers more prone to demanding working conditions. Third, we saw that higher manning levels reduced the occurrence of these experiences, until organisational safety culture was included in the analysis. Figure S.3 illustrates the relationship between these three variables. Finally, the most important predictor of respondents' demanding working conditions was organisational safety culture: a good safety culture reduced the occurrence of these experiences.

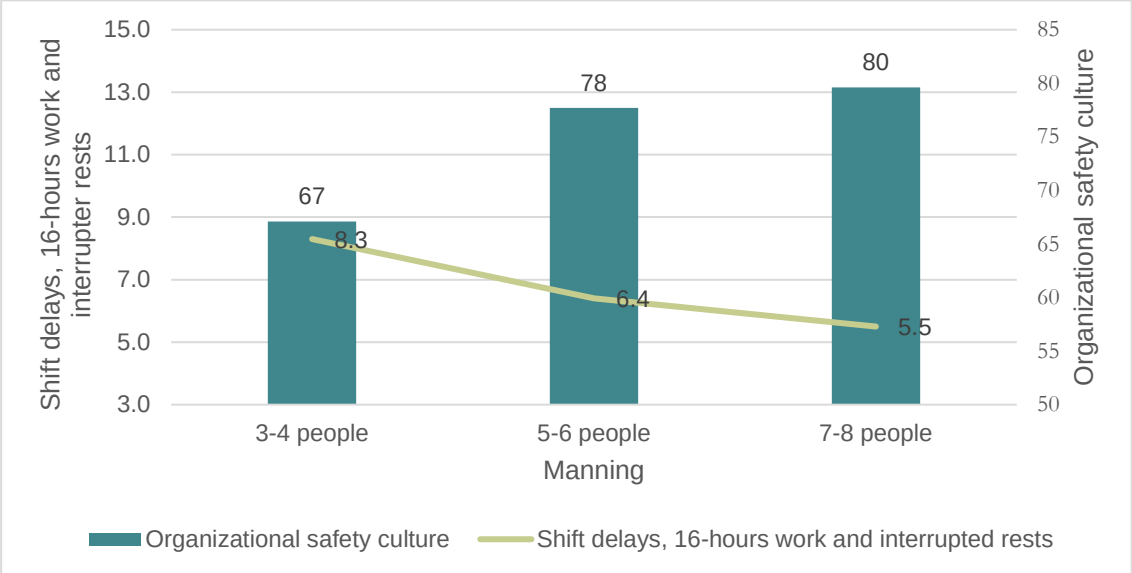


Figure S.3: Organisational safety culture scores (scale from 18 to 90 points) demanding working conditions index (scale from 3 to 21 points) on vessels with different manning levels: 3-4 people (N=19), 5-6 people (N=113) and 7-8 people (N=45).

Results indicate a close relationship between work pressure, demanding working conditions and organisational safety culture. Respondents were asked to rate their agreement with the statement: "Sometimes I feel pressured to continue working, even if it is not perfectly safe". We conducted analyses to examine factors influencing this variable, and found that organisational safety culture was the strongest predictor. A good organisational safety culture seems to reduce unsafe work pressure. We also found a relationship between unsafe work pressure and respondents' experiences of demanding working conditions. The more often respondents experience demanding working conditions, the more they agree with the statement "Sometimes I feel pressured to continue working, even if it is not perfectly safe".

Age and position influence several aspects of occupational safety

We also found that factors that are not organisational are important for the occupational safety of the seafarers in our sample. The age groups of the respondents, for instance, influence several different aspects of occupational safety. We found a relationship between age and personal injuries; the older respondents are, the less likely they are to have been personally injured in the last two years. We also found a relationship between age and fatigue; older seafarers (>60 years) are less likely to have experienced safety-compromising safety, perhaps as they reported of less demanding working conditions.

Our analyses also indicate that respondents' positions/lines of work influence several different aspects of occupational safety. Deck crew and apprentices were more likely to have experienced personal injuries in the last two years. Second, senior crew members (Captain, Deck Officer, Chief Engineer) were more worried about the risks on board than other crew members. Third, engine personnel agreed less than other groups that there were job descriptions/ procedures describing hazards of work assignments. Fourth, we found a relationship between line of work and fatigue; engine personnel were more inclined to sometimes be so tired during working hours that safety is compromised than other groups on board. Finally, captains were more inclined to have experienced demanding working conditions.

Questions for further research

Which factors influence organisational safety culture?

We conclude that organisational safety culture is the most important safety predictor in our sample, predicting, e.g. injuries, risk perception, fatigue, procedure violations, work pressure, working conditions. Thus, if we know how to facilitate good safety culture on Norwegian vessels, we may be able to influence several safety relevant outcomes.

We therefore conducted analyses to examine factors predicting respondents' organisational safety culture scores. We found that the variable "Sometimes I feel pressured to continue working, even if it is not perfectly safe" was the only variable which contributed significantly. As noted above, we also found that this variable is influenced by organisational safety culture. Thus, it is difficult to assess the causal relationship between these variables. Our study has been unsatisfactory when it comes to identifying the variables influencing organisational safety culture.

However, it may well be that the organisational safety culture on board the vessels that we have studied follow from the framework conditions of the sector (e.g. market, economy, manning level, work load). Thus, perhaps organizational safety culture interventions would be insufficient? Our results indicate, however, that a good organisational safety involves less demanding working conditions. Thus, perhaps safety culture interventions may help crew members reduce the impact of high workloads, low manning and fatigue? Future research should examine these questions. Below, we suggest that studies of working conditions on vessels with low manning levels could help us answer these questions. It is important to note, however, that these merely are hypotheses for further research.

Working conditions on vessels with low manning

Reference group members considered fatigue and manning level to be among the most important risk factors in maritime transport. They stated that the small NOR ships transporting goods along the coast of Norway have low manning, considerable work pressure and scarce time. This may lead to too high workloads and fatigue, they suggested. Increase in the administrative burden were also emphasized as factors that may lead to fatigue on board Norwegian vessels.

As noted above, data from the small-scale survey indicates that the vessels with low manning (3-4 people) score lower on many of our variables measuring occupational safety and organisational factors. Seafarers on vessels with a manning of 3-4 people rate the safety level of their work place as lower than other respondents. They also rate their organisational safety culture as lower, they report of more pressure to work even though it is not perfectly safe, they agreed less that they get sufficient sleep and rest on board, they experience more often demanding working conditions, and they report of higher levels of safety-compromising fatigue.

These results could perhaps be interpreted as data supporting the hypothesis coined by our interviewees and references group members; suggesting that the small NOR ships transporting goods along the coast of Norway have low manning, considerable work pressure and scarce time, resulting in negative safety outcomes. It is important to note that we do not examine whether manning levels are too low on these vessels, we merely compare occupational safety and organisational factors.

Why and how do manning levels matter for occupational safety? Why do vessels with low manning score lower on safety outcomes and variables measuring organisational factors. The qualitative data indicates, as mentioned, that economic framework conditions are an important explanation. But is this because more work pressure is caused by challenging economic framework conditions? Moreover, to what extent is it possible to reduce the impact of challenging framework conditions by means of safety culture interventions?

Additionally, we may ask whether the vessels with lower manning have fewer resources available for managing safety than larger vessels? Finally; perhaps implementing formal safety management systems is seen as less important on small crew vessels, as crew size allows for coordination and management to take place through direct informal contact? Our results indicate that the higher manning level the vessels have, the more respondents agree that they have job descriptions/ procedures that describe the hazards of various work assignments. These questions should be examined in future research.

How important are safety management systems for occupational safety?

According to the 2010 amendments to the ISM code, shipping companies and masters have a considerable responsibility when it comes to maintaining an updated and comprehensive Safety management system (SMS), focusing on proactive and regularly updated risk assessments, procedures and corrective actions. The Accident Investigation Board for maritime transport in Norway (AIBN) points to three key elements in safety management systems: 1) risk analyses, 2) procedures and 3) training. Respondents were therefore asked about these factors.

We conducted analyses to examine factors predicting respondents' answer to the question on procedures describing hazards, and found that the most important predictor of respondents' answers to the question was organisational safety culture.

Additionally, we made an index of three statements about procedure violations and lacking use of procedures. Again, we found that organisational safety culture was the most important predictor. A good safety culture reduces the occurrence of procedure violations and lacking use of procedures. These results indicates a relationship between safety culture and safety structure; between formal and informal aspects of maritime safety.

Nævestad et al (2015) study all reports from the AIBN between 2009 and 2014, and find that lack of complete, written risk assessments was the most frequently occurring risk factor in the AIBN reports. Although accident investigations often conclude that proper risk assessments would have identified the relevant risks, it is not given that vessels which have not been involved in accidents on average have better SMS than those which have had accidents. More research is needed to examine the importance of SMS for safety.

Transportøkonomisk institutt
Stiftelsen Norsk senter for samferdselsforskning

Sammendrag

Organisatoriske faktorers betydning for arbeidsrelatert sikkerhet i norsk maritim transport

TØI rapport 1501/2016
Forfatter: Tor-Olav Nævestad
Oslo 2016 80 sider

Denne studien bruker tre metoder for å undersøke betydningen av organisatoriske faktorer for arbeidsrelatert sikkerhet på norske skip. Analysene viser at organisasjonssikkerhetskultur er den viktigste organisatoriske faktoren i vårt utvalg, og at den påvirker alle målene våre på arbeidsrelatert sikkerhet: Skader, risikopersepsjon, trøtthet, og prosedyrebrudd. Vi fant også at organisasjonssikkerhetskultur påvirket (andre) organisatoriske faktorer: arbeidspress, arbeidsforhold og prosedyrer som beskriver farer i arbeidet. Fremtidig forskning bør derfor undersøke hvilke forhold som skaper god maritim sikkerhetskultur, for å legge grunnlaget for tiltak rettet mot sikkerhetskultur på norske skip. Studien finner også interessante sammenhenger mellom organisasjonssikkerhetskultur, bemanningsnivå og arbeidsforhold som bør følges opp i videre forskning. Dataene viser at respondenter på skip med lav bemanning (3-4 personer) skårer dårligere på mange av variablene som måler arbeidsrelatert sikkerhet og organisatoriske faktorer. Disse skipene har flere personskader, og mannskapet rangerer sikkerhetsnivået og sikkerhetskulturen som lavere enn mannskap på skip med høyere bemanning. Fremtidig forskning bør undersøke dette nærmere for å kunne sette inn tiltak for å forbedre sikkerheten på disse skipene. Vi tar ikke stilling til hvorvidt bemanningsnivået er for lavt på disse skipene, vi sammenlikner kun arbeidsrelatert sikkerhet og organisatoriske faktorer. Endelig fant vi også at faktorer som ikke er arbeidsrelaterte er viktige for den arbeidsrelaterte sikkerheten til sjøfolkene i vårt utvalg. Både respondentens alder og deres stilling/arbeidstype påvirker flere ulike aspekter ved arbeidsrelatert sikkerhet.

Bakgrunn og mål

Sjøtransport er sentral for verdens handel, siden skip frakter om lag 90 % av de produktene som handles internasjonalt (Alderton & Winchester 2002). Sjøtransport dominerer langdistansetransport av gods i Norge, hvor den står for omtrent 81 % av importen målt i tonn, inkludert passasjerferger, og omtrent 73 % av eksporten målt i tonn, inkludert passasjerferger og ekskludert råolje og naturgass (St. melding nr. 31 2003-2004).

I henhold til Nævestad, Elvebakk, Phillips, Bye og Antonsen (2015), ble i snitt 15 mennesker drept og 424 skadet årlig på norske skip i perioden 2004-2013. I den foreliggende studien undersøker vi hvordan arbeidsrelatert sikkerhet på norske skip er influert av organisatoriske faktorer.

I den foreliggende studien fokuserer vi på følgende organisatoriske faktorer, som har blitt fremhevet som viktige i tidligere forskning: 1) Organisasjonssikkerhetskultur, 2) Bemanning, arbeidsbelastning og stress, 3) Trøtthet og 4) Sikkerhetsstyringssystemer.

Den foreliggende studien bygger videre på denne forskningen ved å fokusere på arbeidsrelatert sikkerhet på skip registrert i Norsk Ordinært Skipsregister (NOR). Målene med studien er å:

1) Undersøke betydningen av organisatoriske faktorer og andre faktorer for arbeidsrelatert sikkerhet på norske skip.
2) Undersøke hvilke variabler som påvirker organisatoriske faktorer for å vurdere sammenhengen mellom dem og peke på hvilke organisatoriske faktorer som er viktigst for arbeidsrelatert sikkerhet på norske skip.

Disse målene er viktige, fordi kunnskap om faktorene som påvirker arbeidsrelatert sikkerhet er en forutsetning for å sette inn tiltak. Studien som presenteres i den foreliggende rapporten, er en del av et større forskningsprosjekt «Arbeidsrelaterte ulykker i veg sjø og lufttransport: forekomst, årsaker og tiltak», finansiert av Forskningsrådets transportsikkerhetsprogram «TRANSIKK». Prosjektet varer i tre år, fra mars 2014 til mars 2017.

Sentrale begreper og mål

I denne studien refererer *arbeidsrelatert sikkerhet* til følgende variabler:

1) Personskader om bord (1 spørsmål).
2) Persepsjon av risiko om bord og i arbeidet (2 spørsmål).
3) Sikkerhetstruende trøtthet (1 spørsmål).
4) Prosedyrebrudd og manglende prosedyrebruk (indeks som summerer 3 spørsmål).

Organisatorisk sikkerhet defineres som formelle og uformelle aspekter ved sjøfolks arbeidsorganisasjoner, som kan påvirke arbeidsrelatert sikkerhet. I denne studien refererer organisatorisk sikkerhet til følgende variabler:

1) Organisasjonssikkerhetskultur (indeks som summerer 18 spørsmål).
2) Bemanningsnivå på skip (1 spørsmål).
3) Sikkerhetstruende arbeidspress (1 spørsmål).
4) Krevende arbeidsforhold (indeks som summerer 3 spørsmål).
5) Arbeidstid og hvile om bord (3 spørsmål).
6) Sikkerhetsstyringssystemer (2 spørsmål om prosedyrer og risikoanalyser)

Vi undersøker også betydningen av *"ikke-organisatoriske faktorer"* for arbeidsrelatert sikkerhet (mål 1) og organisatoriske faktorer (mål 2):

1) Sjøfolks stilling/arbeidstype (1 item).
2) Sjøfolks alder (1 spørsmål).
3) Skipstype (1 spørsmål).
4) Skipets alder (1 spørsmål).
5) Antall havneanløp per uke (1 spørsmål).

Metoder

Dataene som vi bruker i prosjektet ble opprinnelig samlet inn til et prosjekt som sammenlikner sikkerhet og organisatoriske faktorer på nasjonalt flaggede (NOR) og utenlandskflaggede skip (Nævestad 2016). I den foreliggende rapporten ønsker vi imidlertid å gå i dybden på organisatoriske faktorers betydning for den arbeidsrelaterte sikkerheten til sjøfolkene (N=180) på de NOR registrerte skipene i vårt utvalg. Studien benytter tre ulike metoder:

1) *Kvalitative intervjuer.* Vi har gjennomført 10 kvalitative intervjuer med sektoreksperter fra arbeidsgivere, arbeidstakere og myndigheter.
2) *Referansegruppemøte.* Vi fikk mange nyttige synspunkter og informasjon i et referansegruppemøte som ble holdt på TØI, 27. mars 2014. Resultatene fra dette møtet presenteres sammen med fra intervjuene.
3) *Spørreundersøkelse.* Vi presenterer resultatene fra en liten spørreundersøkelse (N=180) med sjøfolk som ble rekruttert gjennom «Kystrederiene», som er en arbeidsgiverorganisasjon for norske rederier.

Arbeidsrelatert sikkerhet

Studien inneholder fire mål på arbeidsrelatert sikkerhet, og personskader er det viktigste målet på dette. Spørreundersøkelsen vår viser at 17 % av respondentene har blitt skadet i sitt arbeid om bord i løpet av de siste to årene. Våre analyser viser at følgende variabler påvirker risikoen for skader om bord:

1) Alder: Jo eldre sjøfolkene var, jo mindre sjanse er det for at de har blitt skadet de siste to årene.
2) Stilling: Dekksmannskap og lærlinger er mer utsatt for skader enn andre om bord.
3) Skipstype: Mannskap på brønnbåter er mer utsatt for skader enn andre.
4) Bemanning: Jo høyere bemanning på skipene, jo lavere risiko for skade om bord.
5) Organisasjonssikkerhetskultur: Jo bedre organisasjonssikkerhetskultur som sjøfolkene rapporterer om, jo lavere er sjansen for at de har vært skadet i løpet av de siste to årene.

Det er interessant å se at det kun er de to siste variablene, sikkerhetskultur og bemanning, som er organisatoriske. De tre andre variablene er relatert til individer eller skip.

Vi fant imidlertid at sjøfolkenes risikopersepsjon i stor grad var influert av organisatoriske faktorer. Vi analyserte også faktorene som påvirket respondentenes risikopersepsjon, og våre analyser viser at følgende variabler er sentrale: erfaringer med sikkerhetstruende trøtthet og sikkerhetstruende arbeidspress og erfaringer med krevende arbeidsforhold.

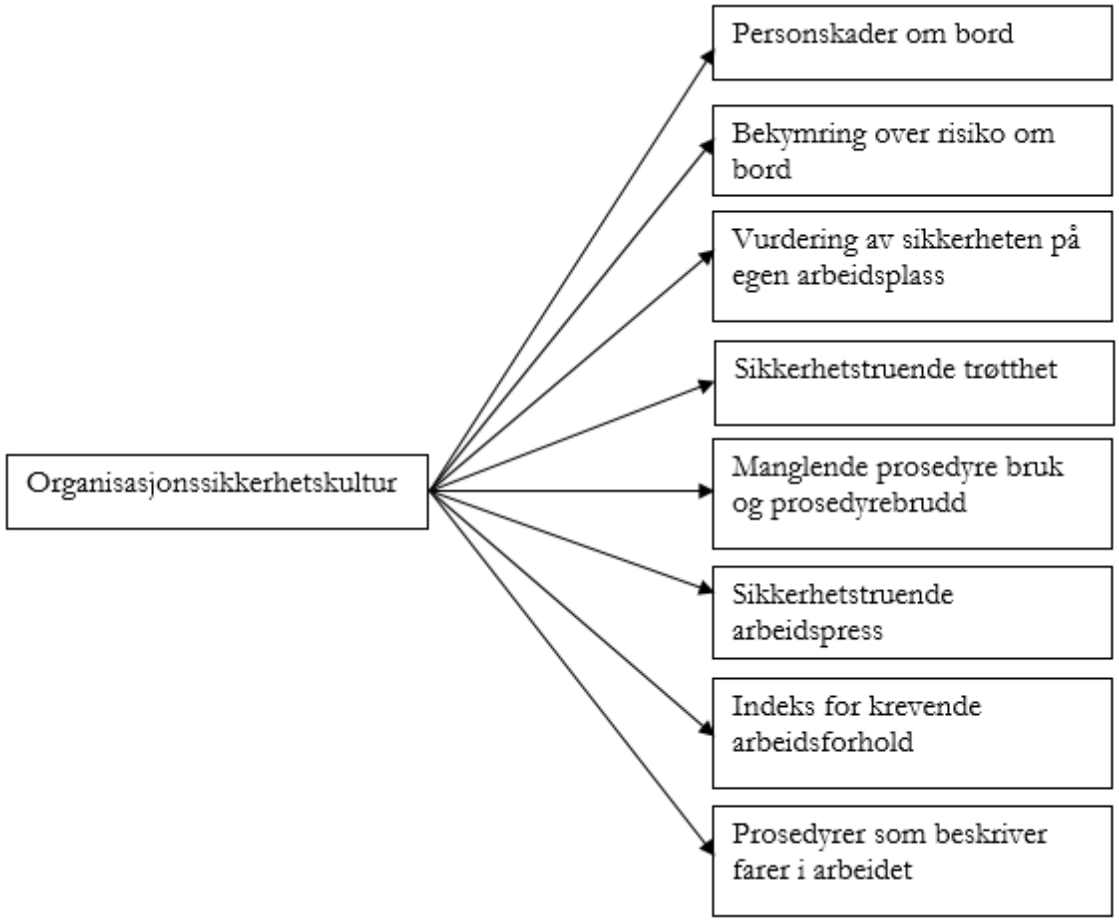
Forskningslitteraturen viser at trøtthet er en viktig risikofaktor på skip, og at trøtthet kan relateres til rammebetingelser, organisatoriske forhold og arbeidsvilkår, samt individuelle egenskaper og livet utenfor jobben. Det er flere trekk ved sjøfolks arbeidsvilkår som påvirker trøtthet, f.eks. lange arbeidsdager og søvnforstyrrelser, på grunn av f.eks. bevegelse og støy, og nattarbeid.

Respondentene ble bedt om å rangere sin enighet med påstanden: «Det hender at jeg er så trøtt i arbeidstiden at det går på sikkerheten løs». Vi gjennomførte analyser for å identifisere faktorene som påvirker sikkerhetstruende trøtthet. For det første fant vi at jo eldre sjøfolk er, jo mindre sannsynlig er det at de rapporterer om sikkerhetstruende trøtthet. For det

andre, fant vi at dekkspersonell er mer utsatt for sikkerhetstruende trøtthet. For det tredje, så vi at det å ha en god sikkerhetskultur reduserer risikoen for sikkerhetstruende trøtthet. Til slutt fant vi at respondentenes opplevelser av krevende arbeidsforhold er den viktigste faktoren som forklarer sikkerhetstruende trøtthet.

Sikkerhetskultur er en sentral organisatorisk faktor

Vi lagde en organisasjonssikkerhetskulturindeks, som består av 18 spørsmål fra «The Global Aviation Information Network» (GAIN) sin sikkerhetskulturindeks, og vi brukte den i spørreundersøkelsen. Våre analyser viser at sikkerhetskultur er den viktigste organisatoriske faktoren som påvirker alle målene våre på arbeidsrelatert sikkerhet: 1) Skader, 2) Bekymring over risiko om bord, 3) Vurdering av sikkerhet på egen arbeidsplass 4) Trøtthet, og 5) Prosedyrebrudd. Vi fant også at organisasjonssikkerhetskultur påvirket (andre) organisatoriske faktorer: 6) Sikkerhetstruende arbeidspress, 7) Krevende arbeidsforhold (skiftforsinkelser, 16-timers arbeidsperioder og avbrutte hviler), 8) Prosedyrer som beskriver farer i arbeidet, se figur S.1.



Figur S.1: Sammenhenger mellom organisasjonssikkerhetskultur og variabler som måler arbeidsrelatert sikkerhet og organisatoriske faktorer.

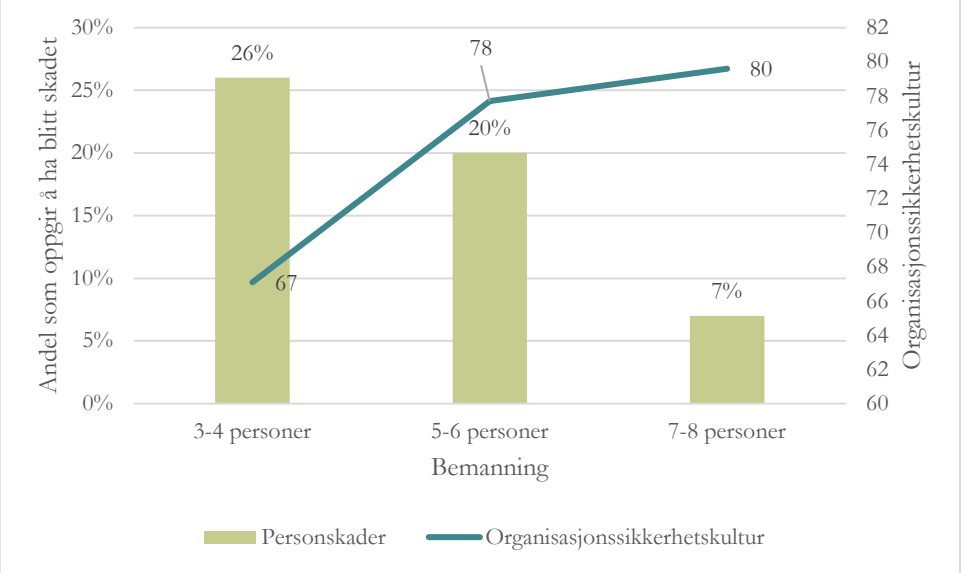
Forskningslitteraturen og de kvalitative intervjuene understreket også betydningen av organisasjonssikkerhetskultur for sikkerhet. Kultur, holdninger, kunnskap, ferdigheter og risikoforståelse er faktorer som er viktige når det gjelder å forklare sikkerhetsatferd blant mannskap om bord på skip og ulykkesrisiko.

Bemanningsnivå

Vi stilte respondentene flere spørsmål om bemanningen om bord. Vårt utvalg er imidlertid for lite til å sammenligne og generalisere resultater, siden vi baserer våre analyser av bemanning på unike fartøy i vårt utvalg. Det vil si at beregningene våre er gjort på grunnlag av kapteinene i utvalget. Med dette viktige forbeholdet, så vi at den gjennomsnittlige bemanningen på fartøy som er mindre enn 500 dwt er 4,3, mens den er 5,9 på skip mellom 500 og 3000 dwt.

Over så vi at bemanningsnivå influerer på sjøfolkenes risiko for personskader om bord: jo høyere bemanningsnivå skipene har, jo lavere er risikoen for personskader. Selv om forskjellene mellom andelene ikke er statistisk signifikante, ser det ut til at skip bemannet med 3-4 personer har den høyeste andelen av besetningsmedlemmene som har blitt skadet i løpet av de to siste årene (26 %). De tilsvarende tallene for skip bemannet med 5-6 personer var 20 %, mens det var 7 % for fartøy bemannet med 7-8 personer.

Data fra spørreundersøkelsen tyder på at fartøyene med lav bemanning (3-4 personer) scorer lavere på mange av variablene som måler arbeidsrelatert sikkerhet og organisatoriske faktorer. Fartøyene med lav bemanning (3-4 personer) scorer også lavere på andre variabler som måler organisatoriske faktorer. Sjøfolk på skip med en bemanning på 3-4 personer vurdere sikkerhetsnivået på sin arbeidsplass som lavere enn de andre respondentene (Gjennomsnitt: 7,3 mot 8,6 poeng) (P = 0,00). Sjøfolk på skip med lav bemanning vurderer også organisasjonssikkerhetskulturen som lavere enn andre respondenter Figur S.2 illustrerer sammenhengen mellom disse tre variablene.



Figur S.2: Organisasjonssikkerhetskulturskårer (skala fra 18 til 90 poeng) og andel sjøfolk som har opplevd å bli skadet om bord i løpet av de siste to årene på skip med ulik bemanning: 3-4 personer (N=19), 5-6 personer (N=113), 7-8 personer (N=45).

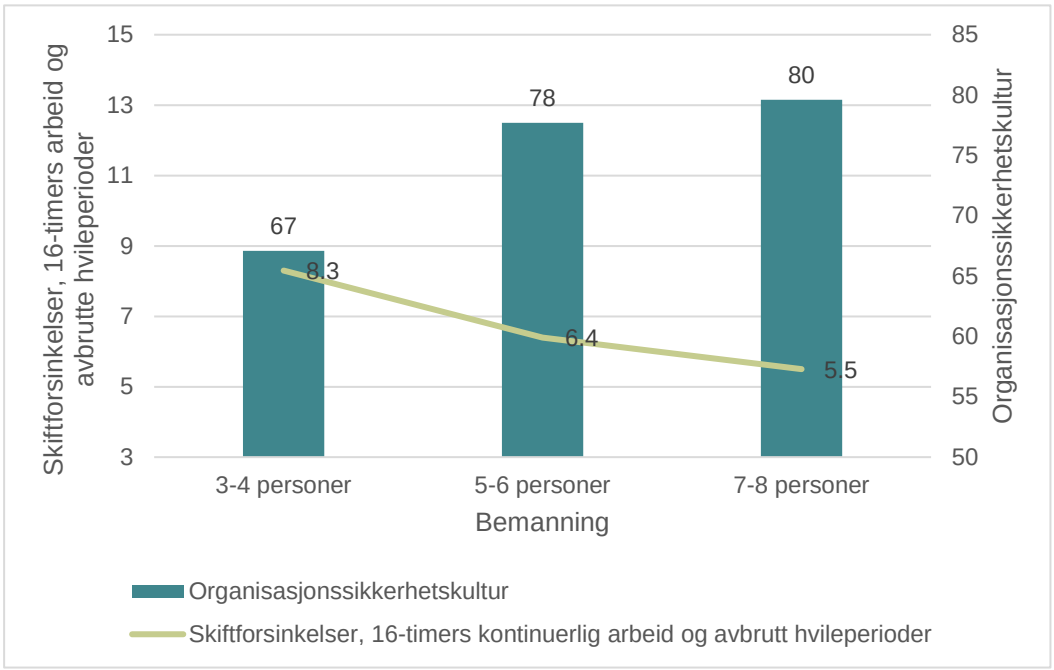
Selv om alle resultatene ikke var statistisk signifikante, så vi at sjøfolk som arbeider om bord på fartøy bemannet med 3-4 personer rapporterte om mer sikkerhetstruende arbeidspress, de fikk i mindre grad tilstrekkelig søvn og hvile om bord, de opplevde oftere krevende arbeidsforhold, og de rapporterte høyere nivåer av sikkerhetstruende trøtthet. Fremtidig forskning bør undersøke sikkerhet og organisatoriske faktorer på fartøy med lav bemanning (3-4 personer) for å kunne iverksette tiltak for å bedre arbeidsrelatert sikkerhet.

Når vi tolker resultatene er det viktig å legge merke til at antallet sjøfolk er små i utvalget av skip som er bemannet av 3-4 personer (N=19), selv om resultatene indikerer en tendens med høyere skårer på variabler som måler arbeidsrelatert sikkerhet og organisatoriske faktorer for når verdiene på bemanningsvariabelen øker. Resultatene bør derfor tolkes med varsomhet, og vi trenger mer forskning for å vurdere betydningen av bemanningsnivå for arbeidsrelatert sikkerhet og organisatoriske faktorer. Vi kommer tilbake til dette under.

Krevende arbeidsforhold og arbeidspress

I det foregående så vi at krevende arbeidsforhold (skiftforsinkelser, 16-timers kontinuerlig arbeid og avbrutte hvileperioder) var den variabelen som i størst grad påvirket respondentens erfaringer med sikkerhetstruende trøtthet.

Vi lagde en indeks som måler respondentenes opplevelser av erfaringer med krevende arbeidsforhold, og analyserte hvilke faktorer som påvirker denne indeksen. For det første fant vi at eldre respondenter er mindre tilbøyelige til å oppleve disse tingene. For det andre, så vi at kapteiner er mer utsatte for å oppleve krevende arbeidsforhold. For det tredje, så vi at skipenes bemanning reduserte forekomsten av slike opplevelser, inntil organisasjonssikkerhetskultur ble inkludert i analysen. Figur S.3 illustrerer sammenhengen mellom disse tre variablene. Den viktigste faktoren som forklarer respondentenes opplevelser av krevende arbeidsforhold er organisasjonssikkerhetskultur: En god sikkerhetskultur reduserer forekomsten av slike opplevelser.



Figur S.3: Organisasjonssikkerhetskulturskårer (skala fra 18 til 90 poeng) og respondentenes opplevelser av krevende arbeidsforhold på skip med ulik bemanning (skala fra 3 til 21 poeng): 3-4 personer (N=19), 5-6 personer (N=113), 7-8 personer (N=45).

Resultatene tyder på en nær sammenheng mellom bemanningsnivå, sikkerhetstruende arbeidspress, krevende arbeidsforhold og organisasjonssikkerhetskultur. Respondentene ble bedt om å rangere hvor enige de er i utsagnet: «Noen ganger føler jeg meg presset til å fortsette å jobbe selv om det ikke er helt sikkert». Vi gjennomførte analyser for å undersøke hvilke faktorer som påvirker denne variabelen, og fant at organisasjonssikkerhetskultur har størst betydning. En god organisasjonssikkerhetskultur synes å redusere sikkerhetstruende arbeidspress. Til slutt, har vi også funnet en sammenheng mellom sikkerhetstruende arbeidspress og respondentenes erfaringer med krevende arbeidsforhold. Jo oftere respondentene opplever disse tingene, jo mer de er enige i påstanden «Noen ganger føler jeg meg presset til å fortsette å jobbe selv om det ikke er helt sikkert».

Alder og stilling påvirker flere aspekter ved arbeidsrelatert sikkerhet

Vi fant også at faktorer som ikke er arbeidsrelaterte er viktige for den arbeidsrelaterte sikkerheten til sjøfolkene i vårt utvalg. Respondentens alder påvirket flere aspekter ved arbeidsrelatert sikkerhet. Vi fant en sammenheng mellom alder og personskader; jo eldre respondentene er, jo mindre sannsynlig er det at de har hatt en personskade i løpet av de siste to årene. Eldre sjøfolk har også mindre sannsynlighet for å ha opplevd farlige situasjoner på grunn av språklige misforståelser. Vi fant også en sammenheng mellom alder og trøtthet; eldre sjøfolk (> 60 år) har lavere sannsynlighet for å ha vært trøtt på måter som truer sikkerheten, kanskje fordi de også rapporterte om færre erfaringer med krevende arbeidsforhold.

I våre analyser av data fra spørreundersøkelses, fant vi også at respondentenes stilling/arbeidstype påvirker flere ulike aspekter ved arbeidsrelatert sikkerhet. Dekksmannskap og lærlinger hadde større sannsynlighet for å ha opplevd personskader i løpet av de siste to årene. For det andre var overordnet mannskap (kaptein, dekksoffiser, sjefsmaskinist) mer bekymret over risikoen om bord enn andre besetningsmedlemmer. For det tredje var maskinpersonell mindre enige enn andre grupper i at det finnes arbeidsbeskrivelser/prosedyrer som beskriver farene ved ulike arbeidsoppgaver. For det fjerde fant vi en sammenheng mellom arbeidstype og trøtthet; maskinpersonell var mer tilbøyelige enn andre grupper om bord til å oppgi at de noen ganger er så trøtte i arbeidstiden at det kan gå ut over sikkerheten. Endelig var kapteiner mer tilbøyelige til å ha opplevd krevende arbeidsforhold.

Spørsmål for fremtidig forskning

Hvilke faktorer påvirker organisasjonssikkerhetskultur?

Vi konkluderer med at organisasjonssikkerhetskultur er den viktigste arbeidsrelaterte faktoren i vårt utvalg, og at kultur påvirker flere mål på arbeidsrelatert sikkerhet, f.eks personskader, risikopersepsjon, trøtthet, prosedyrebrudd, arbeidsforhold og arbeidspress. Dette tilsier at vi kanskje kan legge til rette for god sikkerhet på norske skip, dersom vi vet hvilke forhold som er avgjørende for god sikkerhetskultur og hvordan vi kan påvirke disse.

Vi gjennomførte derfor analyser for å undersøke hvilke faktorer som påvirker organisasjonssikkerhetskultur i vårt utvalg. Vi fant at variabelen «Noen ganger føler jeg meg presset til å fortsette å jobbe, selv om det ikke er helt sikkert» var den eneste variabelen

som bidro signifikant. Som nevnt, fant vi også at denne variabelen påvirkes av organisasjonssikkerhetskultur. Det er derfor vanskelig å vurdere årsakssammenhengen mellom disse variablene. Vår undersøkelse har vært utilstrekkelig når det gjelder å identifisere variablene som påvirker organisasjonssikkerhetskultur.

Det kan imidlertid være at organisasjonssikkerhetskulturen om bord på fartøyene som vi har studert følger av rammebetingelsene for sektoren (f.eks. marked, økonomi, bemanning og arbeidsbelastning). I så fall er kanskje sikkerhetskulturtiltak alene utilstrekkelige til å forbedre sikkerhetsnivået? Våre resultater tyder imidlertid på at en god sikkerhetskultur innebærer lavere forekomst av krevende arbeidsforhold. Da kan kanskje tiltak for å bedre sikkerhetskultur bidra til å redusere virkningene av høy arbeidsbelastning, lav bemanning og trøtthet? Fremtidig forskning bør undersøke disse spørsmålene. Nedenfor foreslår vi at arbeidsforholdene på fartøy med lav bemanning kan hjelpe oss til å forstå disse spørsmålene bedre. Det er imidlertid viktig å merke seg at vi bare diskuterer hypoteser for videre forskning.

Arbeidsforhold på skip med lav bemanning

Referansegruppemedlemmene understreket at trøtthet og bemanning er de mest sentrale risikofaktorene i maritim transport. De mente at de små NOR registrerte skipene gjerne har lav bemanning, betydelig arbeidspress og knapt med tid. Det ble foreslått at dette kan føre til betydelig arbeidsbelastning og trøtthet. En økning i den administrative byrden ble også vektlagt som en faktor som kan føre til trøtthet på norske skip.

Som nevnt, indikerer data fra spørreundersøkelsen at fartøyene med lav bemanning (3-4 personer) scorer lavere på mange av variablene som måler arbeidsrelatert sikkerhet og organisatoriske faktorer. Sjøfolk på skip med en bemanning på 3-4 personer vurderer sikkerhetsnivået på sin arbeidsplass som lavere enn de andre respondentene. De vurderer også organisasjonssikkerhetskulturen som lavere, de rapporterte om mer sikkerhetstruende arbeidspress, de får i mindre grad tilstrekkelig søvn og hvile om bord, de opplever oftere krevende arbeidsforhold, og de rapporterte høyere nivåer av sikkerhetstruende trøtthet.

Disse resultatene kan kanskje tas til inntekt for våre intervjupersoners og referansegruppemedlemmers hypotese om at små NOR skip som frakter gods langs kysten av Norge har lav bemanning, betydelig arbeidspress og dårlig tid, og at dette gir negative utslag for sikkerheten. Vi tar som nevnt ikke stilling til hvorvidt bemanningsnivået er for lavt på disse skipene, vi sammenlikner kun arbeidsrelatert sikkerhet og organisatoriske faktorer.

Hvorfor og hvordan er bemanning viktig for arbeidsrelatert sikkerhet? Hvorfor skårer skipene med lav bemanning lavere på variablene som måler organisatoriske faktorer? De kvalitative dataene indikerer som nevnt at de økonomiske rammebetingelsene er sentrale for å forklarer dette. Men hvor viktig er arbeidspress forårsaket av utfordrende økonomiske rammebetingelser når det gjelder å forklare dette? Og er det mulig å redusere virkningen av utfordrende rammebetingelser ved hjelp av tiltak for å bedre sikkerhetskultur?

I tillegg kan man også undersøkes om det er slik at skipene med lav bemanning har færre ressurser å bruke på sikkerhetsledelse enn det større fartøy har? Endelig bør det også vurderes om kanskje formelle sikkerhetsstyringssystemer blir sett på som mindre viktig på skip med små mannskap, fordi slike små mannskap i større grad gir mulighet for koordinering og ledelse gjennom direkte uformell kontakt. Våre resultater tyder på at jo høyere bemanning skipene har, jo mer enige er respondentene i at de har jobbeskrivelser og prosedyrer som beskriver farene ved ulike arbeidsoppdrag.

Hvor viktig er sikkerhetsstyringssystemer for arbeidsrelatert sikkerhet?

I henhold til 2010 tilleggene til ISM-koden («International Safety Management Code»), har rederier og kapteiner på skip et betydelig ansvar for å ha et oppdatert sikkerhetsstyringssystem med jevnlige og proaktive risikovurderinger, oppdaterte prosedyrer og korrigerende tiltak. Statens havarikommisjon for transport (SHT) peker på tre viktige elementer i sikkerhetsstyringssystemer: 1) Risikoanalyser, 2) Prosedyrer og 3) Opplæring. Respondentene ble derfor spurt om disse faktorene.

Vi gjennomførte analyser for å undersøke hvilke faktorer som avgjør hvorvidt respondentene har prosedyrer som beskriver farer i arbeidet sitt. Vi fant at den viktigste faktoren var organisasjonssikkerhetskultur. I tillegg laget vi en indeks som måler prosedyrebrudd og manglende prosedyrebruk. Igjen, fant vi at organisasjonssikkerhets-kultur var den viktigste faktoren. En god sikkerhetskultur reduserer forekomsten av prosedyrebrudd og manglende prosedyrebruk. Disse resultatene tyder på en sammenheng mellom sikkerhetskultur og sikkerhetsstruktur; mellom formelle og uformelle aspekter ved maritim sikkerhet.

Nævestad mfl. (2015) ser på samtlige rapporter innen sjøtransport fra SHT publisert mellom 2009 og 2014, og finner at mangel på fullstendig, skriftlig risikovurdering var den hyppigst forekommende risikofaktoren i rapportene. Selv om ulykkesgranskninger ofte konkluderer med at riktig gjennomførte risikovurderinger ville ha identifisert de relevante risikoene, er det ikke gitt at fartøy som ikke har vært involvert i ulykker i gjennomsnitt har bedre sikkerhetsstyringssystemer enn de som har hatt ulykker. Det trengs mer forskning for å undersøke betydningen av sikkerhetsstyringssystemer.

1 Introduction

1.1 Background

Sea transport is central to world trade, as it carries about 90 % of internationally traded produce (Alderton & Winchester 2002). Sea transport dominates long distance goods transport in Norway, where it constitutes about 81 % of the import, measured in tonnes, including passenger ferries, and about 73 % of the export measured in tonnes, including ferries and excluding crude oil and natural gas (St. melding nr. 31 2003-2004).

According to Nævestad, Elvebakk, Phillips, Bye and Antonsen (2015), there were on average 15 killed and 424 injured annually on Norwegian ships (NOR and NIS) in the period 2004-2013. There were on average eight dead and 170 injured per year for cargo ships, which had the highest number of deaths and injuries per year, compared to fishing and passenger vessels.

Nævestad et al (2015) underline, however, that the Norwegian vessels have had considerable decreases in the number personal injuries in the period 2004-2013. When we look at the number of serious injuries per 1000 vessels, the number was reduced with 63 % for cargo vessels in the period 2005-2013.

In the present study we examine how occupational safety on board Norwegian vessels is influenced by organisational factors. The study focuses on the following organisational factors, as these have been highlighted in previous research as important in the maritime sector:

1) Organisational safety culture (Håvold 2005; 2010a, 2010b, 2010c; Håvold & Nesset 2009, Håvold, Nesset & Strand 2011; Lu & Tsai 2010; Mearns, Whitaker, Flin, Gordon & O'Connor, 2000; Williamson et al. 1997).
2) Manning level, work load and stress (Wadsworth et al. 2008; Størkersen et al. 2011).
3) Working conditions and fatigue (Phillips, Nævestad and Bjørnskau 2015; Lützhöft, Thorslund, Kircher, & Gillberg 2007; Allen et al. 2008; MAIB 2004).
4) Safety management system (Thomas 2012; Nævestad et al. 2015).

It should be noted that research also indicates that framework conditions of a sector or subsector (e.g. rules, regulation, inspections, market, competition, customers' willingness to pay for safety) are important for organisational factors and the safety level of a transport sector (Bjørnskau & Longva 2009; Nævestad et al. 2015).

1.2 The aims of the study

The present study attempts to build on this previous research by focusing on organizational influences on occupational safety on vessels registered in the Norwegian Ordinary Ship Register (NOR).

The aims of the study are to:

1) Survey organizational factors and other factors influencing occupational safety on Norwegian vessels.
2) Survey variables influencing organizational factors in order to examine relationships between them and point to the most important factors influencing occupational safety on Norwegian vessels.

These aims are important, as obtaining knowledge on these factors is a prerequisite of implementing preventive measures in order to improve occupational safety. Chapter 4. focuses on aim 1 and Chapter 5-8 focuses on aim 2.

In this study, occupational safety refers to the following variables:

1) Personal injuries occurring while at work (1 item).
2) Perception of risk related to work place hazards (2 items).
3) Safety compromising fatigue (1 item).
4) Procedure violations and lacking use of procedures (index summing up 3 items).

Organisational factors are defined as formal and informal aspects of seafarers' work organizations, which may influence occupational safety. We focus both on aspects explicitly relevant to safety, but also more general aspects which are usually not associated with Health, Safety and Environment (HSE), e.g. pay systems, work scheduling systems, contact with customers (Nævestad & Bjørnskau 2014). In this study, organisational factors refer to the following variables, which we use both as independent variables (aim 1) and as dependent variables (aim 2):

1) Organisational safety culture (index summing up 18 items).
2) Manning level on vessels (1 item).
3) Work pressure (1 item).
4) Demanding working conditions (index summing up 3 items).
5) Working hours and rest on board (3 items).
6) Safety management system (2 items on work procedures and risk analyses)

We also examine the influence of "non-organisational factors" on occupational safety (aim 1) and on organizational factors (aim 2):

1) Seafarers' position/line of work (1 item).
2) Seafarers' age (1 item).
3) Vessel type (1 item).
4) Vessel age (1 item).
5) Number of port calls per week (1 item).

The study employs three methods to fulfil the study aims:

1) Interviews with sector experts.
2) Reference group meeting.
3) Survey directed at seafarers.

1.2.1 Work-related accidents in road, sea and air transport

This report is part of a larger research project: "Work-related accidents in road, sea and air transport: prevalence, causes and measures" which lasts for three years, from March 2014 to March 2017. The project is financed by the TRANSIKK program of the Research Council of Norway. The main aims of the project are to survey the prevalence, causes and understanding of work-related accidents in road, sea and air transport (light helicopter inland), and to provide a scientific knowledge base that can be used to develop measures against work-related risk factors.

2 Previous research on occupational safety and organisational factors

2.1 Occupational safety

2.1.1 Prevalence of injuries with Norwegian vessels

As noted, Nævestad et al. (2015) examine the number of dead and injured people at work for fishing vessels, cargo ships and passenger ships with Norwegian (NIS/NOR) and foreign flags in Norwegian waters, and ships with Norwegian flag (NIS) in foreign waters in the period 2004-2013. There were on average six dead and 129 injured per year for fishing vessels, eight dead and 170 injured per year for cargo ships and one dead and 125 per year injured for passenger ships in the period. This gives a total average of 15 killed and 424 injured annually on Norwegian ships. (In comparison, over 30 people are killed in leisure boat accidents each year).

According to Nævestad et al. (2015) fishing, cargo and passenger vessels have had considerable decreases in the number personal injuries in the period 2004-2013. There was an average 60 % reduction in the number of injuries from 2004 to 2013. When we look at the number of serious injuries per 1000 vessels, the number was reduced with 54 % in the period for fishing vessels, 63 % for cargo vessels and 57 % for passenger vessels in the period 2005-2013.

The most prevalent injury types on board the vessels in Nævestad et al's study were: fall, crushing and cut/stab injuries. However, fishing vessels have a higher share of crushing injuries than the two other ship types, and passenger vessels have a somewhat higher share of fall injuries. The former is probably due to work in the factory facilities aboard or with fishing nets.

The highest share of the people injured were fishermen, followed by sailors and engine room crew. Nævestad et al. (2015) suggest that future research should look into the work processes of fishermen, e.g. work in the factory facilities aboard or with fishing nets, in order to develop appropriate safety measures.

2.1.2 Risk factors for injuries on Norwegian vessels

Nævestad et al's (2015) analyses of the maritime accidents involving people working aboard Norwegian and foreign vessels in Norwegian waters and Norwegian vessels in foreign waters are based on two data sources: Accident data from the Norwegian Maritime Authority (NMA) and reports from the Accident Investigation Board Norway (AIBN).

Nævestad et al. (2015) conclude that the data show that risky behaviour was a common factor among transport operators in all three transport sectors studied. The NMA-data do not include information on risky behaviours of injured ship crew members, but information on operator behaviour is included in the AIBN-reports.

Another risk factor common to transport operators in all the three sectors was lack of and lacking use of safety equipment. This was the most common behavioural risk factor.

Nævestad et al's (2015) analyses of AIBN-reports shows that the most frequently mentioned risk factor was lack of complete written risk assessment. The three elements that make up safety management systems were the most frequently mentioned work-related risk factors: risk assessments, safety procedures and safety training. We expand more on this below.

AIBN-reports also show that organisational factors often can be understood in light of shipping companies' and vessels' framework conditions, like (inter-) national regulations, inspection/audit/certification, and subsectors.

Nævestad et al. conclude that injuries at dock seem to represent a potential high risk situation. Nearly a third of the injuries aboard the ships in the study occurred at dock with crew on board the ship. Given the (presumably) fairly limited time spent at dock compared with the time spent at sea, future research should examine e.g. safety while at dock. Time spent at dock is probably hectic, as it requires a lot of work to be done within a given time, for instance loading/unloading and various maintenance work.

2.1.3 Prevalence of injuries in EMSA member nations

Although it is difficult to compare directly, the following European statistics from the European Maritime Safety Agency (EMSA, 2014) make for an interesting comparison. In 2013 there were 74 fatalities and 754 people injured across EMSA member nations. Between 2011 and 2013 there were 4015 ship casualties and 1801 occupational accidents reported.

In accordance with the results for the Norwegian vessels, most incidents occurred on cargo ships, (944 ship casualties and 241 occupational accidents); followed by passenger ships (425 ship casualties and 228 occupational accidents), service ships (306 ship causalities and 220 occupational accidents) and fishing vessels (235 ship casualties and 132 occupational accidents). Estimated level of underreporting of occurrences (casualties and incidents) was 30 %, although underreporting is more likely for less serious accidents.

2.1.4 Fatigue

There are many reasons why human operators performing safety-sensitive tasks are exposed to high levels of fatigue in shipping. The demands for safe operation 24-hours a day are greater in shipping than in any other transport sector. All rest must be obtained in the workplace, which can cross time zones and is exposed to varying degrees of motion, temperature and noise (Phillips 2000).

Phillips, Nævestad and Bjørnskau (2015) review the research literature and interview experts to examine fatigue among watchkeepers at sea, and among transport operators in road and rail transport. They conclude that data on Norwegian accidents and incidents confirms that fatigue is an important safety risk in the maritime sector, but that we nevertheless lack quantitative data on the prevalence of fatigue among Norwegian operators. They also conclude that the causes of operator fatigue in Norway are rooted in framework conditions, organisational factors and working conditions, as well as individual characteristics and life outside of work (Phillips et al. 2015; cf. Phillips 2015, 2014a-b).

Seafarers share several important work characteristics influencing fatigue, for instance long working hours, sleep disturbances, due to for instance motion noise, and night work (Lützhöft, Thorslund, Kircher & Gillberg 2007; Allen et al., 2008). Moreover, evidence is accumulating from international studies that fatigue is a problem for many watch keepers at sea. The Bridge Watch keeping Study of the Marine Accident Investigation Branch (MAIB)

concludes a third of all the groundings involved a fatigued officer alone on the bridge at night (MAIB 2004).

Examining fatigue as a safety problem in shipping, Phillips (2014) sums up its main causes as: minimal manning level, port calls at different times of day, poor organisation, high demands on board, in addition to suboptimal watch systems contributing to unpredictable, fragmented and irregular sleep, and regular working through circadian lows.

2.2 Organisational factors

2.2.1 Organisational safety culture

The concepts of safety culture and -climate have only recently been applied to the maritime sector. In 2005, Håvold reported literature searches indicating that only a couple of studies about this recently had been done in shipping (Håvold 2005). Thus, Håvold's own early studies of safety culture in Norwegian shipping are very important works. He has published conceptual papers on maritime safety culture (Håvold 2000), and several empirical studies, for instance of safety culture in a large shipping company (Håvold 2005), among seafarers working for Norwegian ship owners (Håvold & Nesset 2009, 2010a) aboard tankers (Håvold 2010b), fishing vessels (2010c) and among Norwegian and Filipino officers (Håvold, Nesset & Strand 2011).

It is widely recognized that safety culture is important for safety in organisational settings in hazardous industries (Nævestad 2010), and the concept is applied to an ever increasing range of different sectors and industries. In spite of a notable diversity in specifications of safety culture, studies of safety culture often seem to treat safety culture as shared and safety relevant ways of thinking or acting that are (re)created through the joint negotiation of people in social settings (Nævestad 2010). Safety culture provides a frame of reference that guides individuals' interpretation of actions, hazards and their identities, and which motivate and legitimize behaviours that have an impact on safety (Antonsen 2009, Nævestad 2010). Such shared frames of reference are created through interaction in groups (Nævestad 2010).

The safety culture perspective has traditionally been applied to (high risk) organisations, defining it as safety relevant aspects of culture in organisations (Nævestad 2010). Safety culture is generally measured by means of safety climate questionnaires, measuring a handful of key themes, e.g. management commitment to safety, employee commitment to safety and reporting culture (Guldenmund 2000; Cox & Flin 1998; Flin et al. 2000; Pidgeon & O'Leary 2000). Safety climate questionnaires only grasp the superficial and transient expressions of safety culture, and it can be conceived of as "snapshots", or manifestations of safety culture (Cox & Flin 1998: 192).

Measures of organisational safety culture and climate are important tools that can be used to assess the safety level of organisations. While traditional measures of organisational safety levels use retrospective data on accidents and incidents ("lagging indicators"), it is hoped that safety culture data may provide predictive assessments that enable safety improvements without having to wait for accidents or incidents to happen ("leading indicators") (Antonsen 2009a).

It may be useful to think of organisational safety culture as the informal aspects of safety in organisations (e.g. informal, shared ways of (inter) acting and thinking), in order to distinguish it from the formal aspects of safety in organisations, specified as rules,

procedures and so forth (the formal ways of (inter) acting and thinking) (cf. Antonsen 2009b).

In a literature review studying the relationship between safety culture and safety outcomes in transport, Bjørnskau and Nævestad (2013) conclude that there is fairly good evidence of the association between safety culture and safety performance in correlation studies and retrospective designs, in particular when safety performance is measured by use of self-reported safety behaviour. There is less support for the hypothesized link between safety culture and accidents/injuries. In retrospective designs some studies reveal a negative relationship – accident/injury rates are lower when safety culture is good, whereas others find the opposite relationship arguing that accident and injuries will improve safety culture. Although there are few studies from the maritime transport sector focusing on the relationship between organisational safety culture and safety performance, Bjørnskau and Nævestad (2013) report of two studies which study this relationship (Håvold & Nesset 2009; Lu & Tsai 2010). Both studies find that safety culture influences safety performance.

Håvold & Nesset (2009) include safety behaviour as a safety outcome variable in a large study containing 141 vessels and 2558 responses. Their study develops the safety culture concept further and defines "safety orientation" as an implementation of the safety culture concept. This is a very comprehensive study adopting a number of different safety culture scales. Safety behaviour is measured by self-reports in the form of assertions that respondents should respond to. Different safety behaviour scales are used in the study (e.g. Håvold, 2005; Mearns, Whitaker, Flin, Gordon, & O'Connor, 2000; Williamson et al., 1997). The authors conclude that the study confirms the usefulness of safety culture/climate factors as predictors of unsafe behaviour.

The influence of safety culture on seafarers' safety behaviour is also investigated by Lu and Tsai (2010) by use of a safety culture survey combined with self-reported safety behaviour. This study also revealed a positive relationship between safety culture and safety behaviour.

2.2.2 Manning level, work load and stress

According to Wadsworth et al. (2008), pressure to improve productivity and the introduction of new technology have resulted in reduced manning level, reduced port turnaround times and decreased layovers. In many branches of shipping there are long work weeks, nonstandard work days, extensive night operations, and periods of intense effort alternating with periods of monotony.

Størkersen et al. (2011) list three examples of underlying factors contributing to fatigue, work load and alienation aboard short sea cargo vessels sailing along the coast of Norway.

The first is "the administrative burden", which to some extent is dealt with in both rest and sailing periods. This is primarily a problem experienced by the largely (Norwegian) leading officers aboard, who take care of administrative tasks.

The second is "de-skilling of the crew" meaning that traditional seamanship, although it still is essential, has lost ground to skills related to IT, technology and law.

The third factor is "sleeping rules", meaning that some rules are followed while other are ignored. Størkersen et al. (2011) conclude that fatigue, substantial work load and alienation could increase the probability of operational errors.

According to Størkersen et al. (2011) these three underlying factors can be related to the extent of work tasks additional to navigation and sailing, seafarers' perception of the rationale of their tasks, crew size (numbers of navigators, engine crew, sailors), shipping company size, the frequency of (un)loading operations, staff size and equipment on

terminals, the contracts of the seafarers, distribution of pilot exemption certificate among navigators and flag state (i.e. which rules and regulations that apply for ship and personnel).

Maritime accident investigations and studies show that leading bridge officers and other crew members must constantly balance considerations related to economy and safety, and that the premises for safety to a great extent are set by shipping companies and owners of the cargo (Mostad 2011). Such goal conflicts may be a source of stress, and the way they are handled at all levels are key to safety (Perrow 1999; Reason 1997).

Størkersen et al's (2011) study includes items measuring such considerations, for instance: "The shipping company's demand for efficiency means that we sometimes have to violate the procedures" and "Sometimes I feel pressure to continue working, even if it is not perfectly safe". We use these questions in the present study.

2.2.3 Safety management system

The ISM (International Safety Management) Code requires vessel operators to implement an ISM Code-compliant Safety Management System (SMS). The 2010 amendments to the ISM Code focus heavily on the identification and assessment of risk.

According to the Sydney-based law firm "HWL Ebsworth Lawyers", the 2010 revisions to the ISM code can be summed up as follows:[1]

- Provides for pro-active risk assessment, with the obligation now to assess all risks and establish safeguards and to show in the SMS how these risks were identified.
- Imposes a requirement for masters to "periodically" review their vessel's SMS and report deficiencies to shore based management, which AMSA has interpreted to mean "a complete review of the system both ashore and afloat at least annually" .
- Requires that procedures for corrective action include measures to prevent recurrence.
- Sets an annual requirement for mandatory internal safety audits.
- Introduces a need for the company to assess the effectiveness of its SMS in accordance with established procedures.

In conclusion, we see that the shipping companies and masters have a considerable responsibility when it comes to maintaining an updated and comprehensive SMS, focusing on proactive and regularly updated risk assessments, procedures and corrective actions.

Nævestad et al. (2015) maps the prevalence of work-related accidents in road, sea and air (light helicopter inland) transport, and examines risk factors related to these accidents, focusing especially on work-related risk factors. One of the data sources used by Nævestad et al. (2015) is reports from the Accident Investigation Board for maritime transport in Norway (AIBN). All AIBN reports concerning maritime accidents and incident taking place between 01.01. 2009 and 01.01.2014 published by January 2015 were included in the analysis. The number of accident reports from the period is 48 reports.

Lack of complete, written risk assessments was the most frequently occurring risk factor in the AIBN reports. Written risk assessments are not only required by the ISM code, it is

[1]The first bullet point was removed from the list by the author, as it refers to a technical definition of "major non conformity". Confer their website for the entire list of 2010 amendments to the ISM code: http://www.hwlebsworth.com.au/latest-news-a-publications/publications/transport/shipping-and-trade/item/391-new-amendments-to-the-ism-code-in-force-from-1-july-2010.html.

also required by the Norwegian HSE provision for people working aboard ships. The AIBN maritime defines risk assessments in a relatively broad sense (report 2013/03):

> "Risk assessment is often used as a generic term for planning, risk analysis and risk evaluation. The objective of risk assessment is to uncover hazards and identify undesirable incidents, analyse and evaluate risk, establish an overview of all risks, assess them in relation to what is deemed to be acceptable (acceptance criteria), propose risk reduction measures and consider alternative solutions."

Risk assessment is the cornerstone in what AIBN road refers to as *safety management systems (SMS)*, consisting of three elements. Taken together, these three processes summarize an ideal of how transport operators should relate to risk and how they should work with safety management. We formulate these normatively in the following:

1) Transport companies must perform (and document) risk assessments of critical operations.
2) These risk assessments must be used as the basis for job descriptions/procedures that transport operators can consult prior to operations.
3) The risk assessments and job descriptions/procedures must be used as the basis for a training programme for transport operators to prepare them for the risks related to their work.

In the accidents described in the AIBN-reports, it is often concluded that one or several of these processes have failed.

In a systematic review of the effectiveness of SMS in the transport sectors, Thomas (2012) concludes that little empirical research evidence has been presented to determine the impact on safety of a structured SMS.

Thomas' (2012) review found 2.009 articles, but only 37 of these were directly relevant to the objectives of his investigation. A significant amount of the literature was published in the past five years. Of these 37 directly relevant articles, Thomas (2009) found that nineteen studies used fairly objective measures of safety outcomes such as safety performance, employee behaviours, and accidents. He states that several of the nineteen studies found that organisations with a certified SMS had significantly lower accident rates. A main challenge with interpreting results from these studies was however, that there was a lack of agreement about which components of a safety management system individually contributed the most to safety performance.

The remaining 18 studies used self-reported measures of safety outcomes, e.g. perceptions of safety within the organisation, to examine the effectiveness of a SMS. Although there was also a general lack of consistency across which elements of a SMS affected safety the most, it was commonly found that both management commitment and safety communication were important, Thomas (2012) concludes. Thus, we may conclude that SMS seems important for safety, but that more research is needed to examine this, including how SMS is important for safety, i.e. the SMS elements which are most important when it comes to influencing safety outcomes.

2.3 Framework conditions

Previous research on safety in transport suggest that framework conditions of sectors and subsectors (e.g. rules, regulation, inspections, accident investigation, competition, economy, customers' willingness to pay for safety) influence organisational factors and safety

(Bjørnskau & Longva 2009; Nævestad & Phillips 2013; Nævestad et al. 2015). Framework conditions are not a work-related factor, but framework conditions may nevertheless be a very important influence on organisational factors.

Typical framework conditions in the maritime sector are national/international rules, regulation/inspection/controls and market/competition (Nævestad et al. 2015). Several maritime AIBN reports state for instance that it is problematic that national and international rules lack proper and detailed procedures for risk assessment aboard small fishing vessels, and that procedures and checklists for certification and inspection of vessels sometimes come short of detecting safety problems.

2.4 Summing up

An average of 15 people are killed and are 424 injured annually on Norwegian ships, and numbers have decreased in recent years. Nævestad et al (2015) underline, however, that the Norwegian vessels have had considerable decreases in the number personal injuries in the period 2004-2013. When we look at the number of serious injuries per 1000 vessels, the number was reduced with 63 % for cargo vessels in the period 2005-2013.

The following organisational factors have been highlighted in previous research as important in the maritime sector: 1) Organisational safety culture, 2) Manning level, work load and stress, 3) Working conditions and fatigue and 4) Safety management system. It should be noted that research also indicates that framework conditions of a sector or subsector (e.g. rules, regulation, inspections, market, competition, customers' willingness to pay for safety) are important for organisational factors and the safety level of a transport sector.

3 Methods

3.1 Introduction

In this chapter we describe how we will use the following methods to fulfil the aims of our study: 1) Interviews with sector experts from employer organisations, employee organisations, authorities and other organisations involved in maritime safety, 2) Reference group meeting, and 3) Survey of seafarers, examining the importance of various risk factors.

The data that we use in the present report was originally collected in another project, which is reported in Nævestad (2016).[2] In the present study, we focus on a sample of respondents from NOR-registered vessels only (N=180), so as to be able to consider the effects of organisational factors on occupational safety without the confounding effects of flag or nationality.

The main focus of a previous study was to compare nationally flagged (NOR) vessels with vessels flying flags of convenience (Nævestad 2016). In the present study we therefore wanted to do an in depth analysis of organisational factors without considering any variables related to vessel flag or crewmember nationality, focusing only on Norwegian and a few Nordic seafarers on NOR registered vessels. Below, we discuss whether the fact that one of the main purposes of the data collection was to compare nationalities influence the quality of our data use in the present study.

3.2 Interviews

We conducted qualitative interviews with 10 sector experts from employer organisations, employee organisations, authorities and other organisations involved in maritime safety. The purpose of these interviews was to gain knowledge on safety outcomes of increasing internationalisation, potential risk factors and relevant measures to increase maritime safety further. The interviews generally lasted for about 75 minutes.

We used a semi-structured interview guide (cf. Appendix 1), which contained questions on the following risk factors: organisational safety culture, national safety culture, communication, competence and training, economy, manning level and competition, long work periods and fatigue, technology and equipment and implementation and enforcement. Mostly, the interviewees were asked about the importance of these risk factors for maritime safety, and then whether nationally flagged and foreign flagged vessels differ on the risk factors.

[2]The aims of this project were to: 1) Examine safety outcomes of increasing internationalisation in (Norwegian) maritime transport, by comparing the safety performance of nationally flagged vessels and vessels flying FOCs, 2) Discuss the importance of potential risk factors, comparing nationally flagged vessels and vessels flying FOCs, and 3) Discuss potential measures to increase maritime safety further. The study employed four different methods to generate data needed to meet each of the three main study aims: 1) Literature review, 2) Qualitative interviews, 3) Small-scale survey and 4) Reference group meeting.

Thus, the interview data mostly focus on the importance of flag state and crew nationality for safety. Nevertheless, we also talked with the interviewees about the general importance of various organisational factors and factors influencing personal injuries on board. These results are presented in the present report. Consult Nævestad (2016) for the other interview results, and Appendix 1 for the interview guide.

The purpose of the interviews was to give us a deeper understanding of the context of relevant risk factors. Interviewees were encouraged to "think out loud" and assuring them that the purpose of the interview was to supplement the other data in our study.

3.3 Reference group meeting

We present the results from the interviews together with some of the results of reference group meeting which was held at The Institute of Transport Economics (TØI) March 27th, 2014. Seven external participants were present at the reference group meeting, in addition to three internal researchers. The external participants were from authorities, employer organizations and employee organizations, insurers and research. We got important feedback, learned more about nuances within our research field, and got suggestions to further research. As we got many important view points and comments in the reference group meeting, we choose to also include some relevant highlights from this meeting together with the presentation of the interview results. Although the explicit focus of the reference group meeting was on the importance of flag state and crew nationality for safety, the discussions also concerned the importance of organisational factors, as reference group members found these to be more important than nationality.

3.4 Small-scale survey

We conducted a small-scale survey (N=222). When collecting the survey data, we emphasized in the introductions that the purpose of the data collection was twofold: 1) to study the importance of flag state and crew nationality for safety and 2) to study safety and safety culture on board vessels (cf. Appendix 2).

In the original sample 81 % of the respondents work on NOR registered ships, 14 % work on ships flying flags of convenience, while the remaining 5 % work on NIS registered vessels. As noted above, we only focus on the 180 respondents working on board NOR vessels, as a previous report discussed the importance of flag state and crew nationality for maritime safety (Nævestad 2016).

3.4.1 Recruitment of respondents

The respondents were recruited through "Kystrederiene", an employer organisation for Norwegian based shipping companies. Thus, all of the respondents work on ships that are operated from Norway, i.e. the shipping companies are located in Norway.

Web links to the questionnaires were distributed by "Kystrederiene" to all its members along with an introductory text explaining the purpose of the survey. The survey and the introductory texts (cf. Appendix 3) were distributed both in Norwegian and in English. In the introductory texts, the shipping companies were asked to distribute the survey links to all employees working on ships. The introductory texts were in the beginning of each web survey, explaining the purposes of the surveys and stressing that the surveys were confidential.

3.4.2 Description of the samples

Table 3.1 sums up the characteristics of our respondents and their vessels on key background variables.

Table 3.1: Characteristics of the 222 respondents and their vessels on key background variables. %.

	Age group	Position	Experience	Vessel type	Year the vessel was built	Vessel size
1	Younger than 31 years	Captain	Less than one year	Bulk	Before 1980	<500 DWT
	31 %	28 %	4 %	34 %	16 %	19 %
2	31-40	Deck officer	1-3 years	General cargo	1980-1985	500-3000 DWT
	17 %	24 %	9 %	14 %	8 %	79 %
3	41-50	Deck crew	4-10 years	Tank vessel	1986-1991	>3000 DWT
	23 %	20 %	24 %	4 %	3 %	2 %
4	51-60	Chief engineer	11-15 years	Well vessel	1992-1997	-
	23 %	7 %	7 %	34 %	16 %	-
5	Older than 60 years	Engine officer	More than 15 years	Stand by vessel	1998-2003	-
	6 %	1 %	56 %	2 %	14 %	-
7	-	Engine crew	-	Anchor handling vessel	2004-2009	-
	-	4 %	-	1 %	23 %	-
8	-	Catering	-	Fish farming vessel	2010-2015	-
	-	5 %	-	6 %	21 %	-
9	-	Apprentice	-	Other	Before 1980	-
	-	9 %	-	5 %	14 %	-
10	-	Other	-		-	-
	-	2	-		-	-
Total	100 %	100 %	100 %	100 %	100 %	100 %

We do not show the distribution of seafarers' gender, as there are only two female respondents in the sample. Neither do we show the distribution of seafarers nationality, as we only focus on NOR vessels in this study. Seven % of the 180 respondents are from another Nordic country, 1 % are from another Western European country and 2 % are from a Central/Eastern European country.

3.4.3 Survey measures

The surveys included a total of eighty questions on the following themes:

1) Background variables related to respondents: 7 questions.
2) Organisational safety culture: 18 questions.
3) Nationality, language, communication and safety: 9 questions.
4) Manning level and fatigue: 19 questions.
5) Economy, efficiency, competition and safety: 5 questions.
6) Vessel characteristics and technology and safety: 6 questions.
7) Port calls and time pressure: 3 questions.
8) Competence, nationality and safety: 3 questions.
9) National safety culture: 7 questions.
10) Safety outcomes: 6 questions.
11) Risk analyses and procedures: 4 questions.

A structured version of the survey, where items is related to the themes that they are supposed to measure is presented in Appendix 2. The items are in Norwegian, but available from the author in English on request..

The present report only focuses on the questions that may shed light on the study aims; personal injuries and organisational factors. See Nævestad (2016) for a presentation of the other survey question, themes and result.

Many of the survey questions are from the study of Størkersen et al. (2011). This is highlighted in Appendix 2. Additionally, many of the questions are based on a questionnaire developed by Safetec for The Norwegian Maritime Authority. This is also highlighted in Appendix 2.

3.4.4 Analytical concepts and their relationships

As mentioned, the aims of the study are to:

1) Survey organizational factors and other factors influencing occupational safety on Norwegian vessels.
2) Survey variables influencing organizational factors in order to examine relationships between them and point to the most important factors influencing occupational safety on Norwegian vessels.

3.4.3.1. Variables measuring occupational safety

In this study, occupational safety refers to the following outcome variables:

1) Personal injuries occurring while at work:

- Have you been injured in your work on board in the course of the last two years?

2) Perception of risk related to work place hazards:

- To what extent do you worry about the risks associated with the work on board?
- All in all, how do you assess the safety of your work place situation?

3) Safety compromising fatigue:

- Sometimes I am so tired during working hours that safety is compromised

4) Procedure violations and lacking use of procedures:

- Violation of procedures seldom has consequences
- The competition between shipping companies means that we sometimes have to violate safety procedures
- I never use written procedures in the work I perform on board

3.4.3.2. Variables measuring organisational factors

Organisational factors are defined as formal and informal aspects of seafarers' work organizations, which may influence occupational safety. We focus both on aspects explicitly relevant to safety, but also more general aspects which are usually not associated with Health, Safety and Environment (HSE), e.g. pay systems, work scheduling systems, contact with customers (Nævestad & Bjørnskau 2014). In this study, organisational factors refer to the following variables, which we use both as independent variables (aim 1) and as dependent variables (aim 2):

1) Organisational safety culture

We made an organisational culture index, consisting of 18 questions from the GAIN-scale on organisational safety culture. We have used this scale in previous research from different transport sectors (Bjørnskau & Longva 2009; Nævestad & Bjørnskau 2014). The GAIN-scale is presented in the "Operator's Safety Handbook" (GAIN 2001).[3]

The GAIN-scale originally consists of 25 questions, but we only included 18 questions from the scale, as our survey includes a high number of questions (cf. appendix 2). The scale is based on five themes. Below we list each theme and the questions that each theme consist of:

Ia) Shipping company commitment to safety

- The shipping company regards safety to be a very important part of all work activities
- The shipping company is aware of the most important safety problems that we have on board

Ib) Ship management commitment to safety

Because seafarers relate to both the ship management on board and management and personnel in the shipping company a shore, we also ask the two abovementioned questions about the ship management, in addition to three other questions on ship management commitment to safety:

- Ship management regards safety to be a very important part of all work activities
- Ship management is aware of the most important safety problems that we have on board
- Ship management stops unsafe operations and activities
- Ship management detects crew members who work unsafely
- Ship management often praises crew members who work safely

3 Global Aviation Information Network (GAIN) is a voluntary association of airlines, manufacturers, trade unions, governments and other organisations in aviation. The purpose of GAIN is to produce and distribute relevant information to increase safety in aviation. GAIN was established in 1996 based on an idea that dissemination of experiences and knowledge of safety-related factors could improve aviation safety. The purpose of the GAIN manual is to help operators to start, improve and expand their internal safety programs.

II) Employee commitment to safety

- My colleagues on board usually report all safety problems and unsafe situations that they experience in their work
- My colleagues on board do all they can to prevent accidents and unwanted incidents

III) Reporting culture

- There are routines (procedures) on board for reporting safety problems
- All defects or hazards that are reported are corrected promptly
- After an accident has occurred, appropriate actions are usually taken to reduce the chance of reoccurrence
- Everyone has sufficient opportunity to make suggestions regarding safety

IV) Safety training

- All crew members on board receive adequate training to work in a safe way
- All newly employed are provided with sufficient training for their work activities
- Everyone on board is kept informed of any changes which may affect safety

V) General safety questions

- Safety on board is generally well controlled
- Safety on board this vessel is better than on other vessels

2) Manning level on vessels

- Please specify total manning on board the vessel

3) Work pressure

- Sometimes I feel pressured to continue working, even if it is not perfectly safe

4) Demanding working conditions. (index summing up 3 items).

How often do you think that the following events happen while you are at sea?

- Your shift change is delayed because of work operations, for instance port calls?
- You work more than 16 hours in the course of a 24 hour period?
- You are interrupted when you are off duty?

5) Working hours and rest on board

- I get sufficient sleep and rest on board
- How often do you think your working hours exceed those laid down in the rules on work and rest periods?
- On this vessel we work more than we report that we do

6) Safety management system

- Who participate in risk assessments of work operations on your vessels? (all on board the vessel)
- On this vessel we have job descriptions/procedures that describe the hazards of various risk assessments

3.4.3.3. Other factors

We also examine the influence of other, "non-organisational factors" on occupational safety (aim 1) and on organizational factors (aim 2):

1) Seafarers' position/line of work (1 item).

2) Seafarers' age (1 item).

3) Vessel type (1 item).

4) Vessel age (1 item).

5) Number of port calls per week (1 item).

3.4.5 Analysis of quantitative data

Cronbach's Alpha. Several multiple item measures were created for the purpose of this study. Internal consistency was assessed using Cronbach's Alpha.

We assume that respondents' answers to these questions correlate, meaning that it is likely that a person who agrees with one question in an index also agrees with the other questions, for instance related to safety attitudes or behaviours. We assume this when we make indexes, and Cronbach's Alpha provides a way of testing this assumption, as it measures the correlation among responses on the index. The value varies between 0 and 1. A Cronbach's Alpha over 0,9 is very high, a score between 0,7 and 0,9 is good, a score between 0,5 and 0,6 is acceptable and a score below 0,5 is unacceptable.

Significance tests of means. When comparing group scores on different variables and indexes, we examine the probability that the differences we observe are due to statistical chance. We do this by calculating the confidence intervals of the mean scores. The confidence intervals indicate the error margins of the mean scores, i.e. the interval in which a given probability indicates that the "true mean score" lies within. We conduct a sample study, and the "true mean score" is that of the population from which the sample is drawn (e.g. the population Norwegian seafarers working on board NOR vessels). When comparing mean scores, we may state that the difference between two mean scores is statistically significant if the means do not lie within each-others' confidence intervals.

The probability that the true mean score lies within a confidence interval is given in %, and we may also refer to this as a p-value. When choosing a confidence interval, you also choose the level of uncertainty that you will accept. A confidence interval of 90% means that you can be 90 % sure that the true value for the population which the sample represents lies within the range indicated. In other words, you will on average reach the wrong conclusion in one of ten cases. A probability level of 95 % means that it is 95 % likely that the true number lies within this interval. We use confidence intervals of 90 %, 95 % and 99 %, and we state that the differences are statistically significant at 10 %, 5 % and 1 % level.

Anova. When comparing the mean scores of different groups, we use one-way Anova tests, which compare whether the mean scores are equal (the null hypothesis) or (significantly) different.

Pearson's R. When examining bivariate relationships or the possible correlation between two variables, we use the Pearsons R or the " Pearson product-moment correlation coefficient". Pearsons R provides a measure of the linear correlation between two variables. It provides a value between +1 and −1 inclusive, where 1 involves a total positive correlation, 0 is no correlation, and −1 is a total negative correlation.

Chi Square. We also use Chi square tests to compare groups' scores on particular variables, if we for instance cannot compare means due to the variables' level of measurement. The chi square test tests whether the actual distribution of groups on a variable is statistically significant different from a coincidental distribution, or an independent normally distributed sample.

3.4.6 Multivariate analysis of quantitative data

We have conducted nine regression analyses (logistic and linear) to analyze the factors predicting respondents' answer on the following dependent variables measuring occupational safety:

1) Personal injuries in your work on board in the last two years (1 item).
2) To what extent do you worry about risk aboard? (1 item).
3) All in all, how do you assess the safety of your work place situation? (1 item).

We have also conducted regression analyses to examine the factors predicting respondents' answer on the following variables measuring organisational factors:

4) Organisational safety culture (average of respondents' score on 18 items).
5) Sometimes I feel pressured to continue working, even if it is not perfectly safe (1 item).
6) Demanding working conditions index (experiences of shift delays, 16-hours of work and interrupted rests) (average of respondents' score on 3 items).
7) Sometimes I am so tired during working hours that safety is compromised (1 item).
8) On this vessel we have job descriptions/ procedures that describe the hazards of various work assignments. (1 item)
9) Procedure violations and lacking use of procedures index (1 item).

We chose logistic regression analysis in the first regression analyses, as the dependent variable has two values (yes=0, no=1). In this analysis we include different independent variables in the analyses step-wise in order to be able to examine the isolated effect of the independent variables, i.e. when the other variables are held constant. B values are presented and they indicate whether the risk of personal injuries is reduced (negative B values) or increased (positive B values), when the independent variables increase with one value.

In the other analyses, we use hierarchical, linear regression analyses, where independent variables are included in successive steps. The most basic independent variables are included first, e.g. age, sex, vessel type, position. Then the other independent variables are included. It may be challenging to stick to the principle of presenting the most basic independent variables first when we include the more conceptual independent variables (e.g. safety culture, work pressure) in the regression analyses. In this case, the order of variable inclusion is based on hypotheses derived from previous research, or other hypotheses about the primacy of some independent variable over others. Generally, factual variables (e.g. manning levels, number of port calls) are included before conceptual variables (e.g. safety culture).

It is often difficult to assess the internal relationships and primacy between the conceptual independent variables *before* conducting the analyses, i.e. whether the effect of one of the independent variables on the dependent variable is (partly) caused by another. The analyses

give us, however, indications about this. Thus, *after* the analyses, we conclude that if the effect of one variable is removed when another independent variable is included in the analysis, the latter variable is more important. If the effect of one variable is reduced when another independent variable is included in the analysis, the variables seem to be strongly related. Of course, we cannot conclude about causality, as this is a cross-sectional and correlational study. We nevertheless use the term predict when we describe the regression analyses.

Tables of results present the standardized beta coefficients. The contributions of the different independent variables on the dependent variables can therefore be compared directly.

3.5 Quality assurance

The report has been submitted to quality assurance both internally and externally. To ensure that the results of our analyses and our interpretations of the results are as correct and plausible as possible, we have sent the report to relevant sector experts for quality assurance before publication. The experts conducting the quality assurance were invited to comment on the results, our analyses and our interpretations. We are very grateful to those who have commented on the report.

4 Occupational safety

In this chapter, we survey organizational factors and other factors influencing occupational safety on Norwegian vessels (aim 1). As noted, occupational safety refers to the following outcome variables:

1) Personal injuries occurring while at work (1 item).

2) Perception of risk related to work place hazards (2 items).

3) Safety compromising fatigue (1 item).

4) Procedure violations and lacking use of procedures (3 items).

We present results for each variable, analyzing how they are influenced by organizational factors and other factors by means of regression analyses.

4.1 Self-reported personal injuries

We asked respondents whether they had been injured in their work on board in the course of the last two years (Figure 4.1).

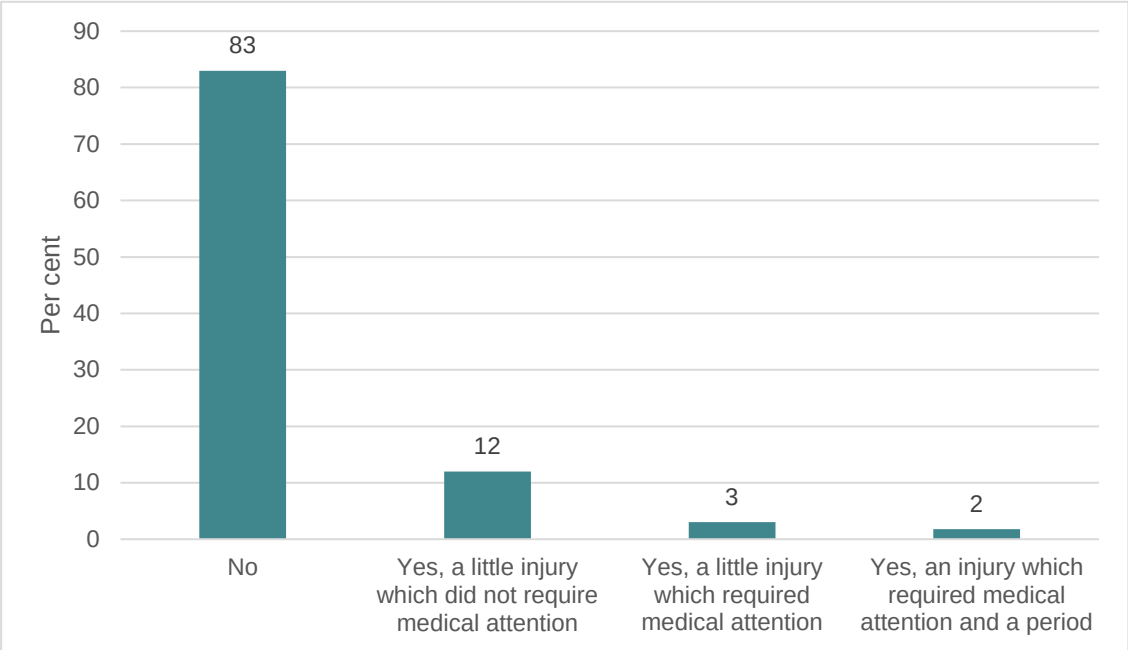


Figure 4.1: Respondents' response to the question: "Have you been injured in your work on board in the course of the last two years?" %. (N=180).

A total of 30 respondents (17 %) answered that they had been injured in their work on board in the course of the last two years. Seven of the 30 injured respondents answered that the personal injury was reported to the NMA, 12 answered no, while 11 did not know.

A logistic regression analysis was conducted with personal injuries as dependent variable, in order to find the variables predicting personal injury among our respondents. In this analysis, the injury variable, which originally had four answer alternatives (cf. Figure 4.1), was dichotomized, 0=no personal injury, 1=personal injury.

Table 4.1 presents the results of the logistic regression analyses with personal injury as the dependent variable. B values are presented and they indicate whether the risk of personal injuries is reduced (negative B values) or increased (positive B values), when the independent variables increase with one value. In this analysis we include different independent variables step-wise in the analyses in order to be able to examine the isolated effect of the independent variables, i.e. when the other variables are held constant.

Table 4.1: Logistic regression. Dependent variable: Personal injuries on board in the last two years (dichotomized: 0: no personal injury, 1=personal injury). B values.

Variables	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	Step 9
Age group	**-.526*** **	**-.423** **	**-.451** **	**-.488** **	**-.451** **	**-.439** **	**-.452** **	**-.458** **	**-.459** **
Position/line of work (Deck crew/apprentice=0, Other=1)		-.746	-.676	**-1.070** **	**-1.075** **	**-1.251*** **	**-1.255** **	**-1.230** **	**-1.299** **
Vessel type (Well vessel=0, Other=1)			**-.847***	**-.991** **	**-1.039** **	**-1.043** **	**-1.007** **	**-1.014** **	**-1.075** **
Manning level (coded with 7 values)				**-1.110*** **	**.993*** **	**-.970** **	**-.936** **	**-.931** **	**-.984** **
Sometimes I feel pressured to continue working, even if it is not perfectly safe					.274	.118	-.178	-.181	-.184
Sometimes I am so tired during working hours that safety is compromised						.313	.211	.193	.192
Organisational safety culture (coded with 5 values)							**-.439** **	**-.439** **	**-.464** **
Risk analyses ("all on board"=0, Other answer=1)								.155	.184
Procedures describing hazards									.153
Nagelkerke R^2	.090	.115	.149	.234	.254	.272	.311	.312	.315

* p < 0.1 ** p < 0.05 *** p < 0.01

First, we see that three background variables contribute negatively and significantly at the 0.05 level: age, position/line of work and vessel type. In step 9, we see that age group contributes negatively and significantly to the risk of having a personal injury, when we control for the other variables in the model. The age group variable consists of five values: 1) younger than 30 years, 2) 31-40, 3) 41-50, 4) 51-60 and 5) Older than 60 years. The older the seafarers are, the less likely they are to have been injured in the last two years.

We also see in step 8 that position or line of work contributes negatively and significantly to having a personal injury. This is the variable with the strongest effect on personal injuries. We dichotomized this variable, grouping deck crew/apprentice into one value (0) and all other groups into another value (1). This was based on the fact that deck crew/apprentice (30 %) had the highest shares of personal injuries compared to the other occupational groups on board (11 %). Thus, the former group had nearly three times higher share of injuries (P=0.002).

We also see in step 8 that vessel type contributes negatively and significantly to having a personal injury with a value of 0.40. We dichotomized this variable, grouping well vessel into one value (0) and all other groups into another value (1), as well vessel (25 %) had nearly twice the share of personal injuries compared to the other vessel types (13 %) (P=0.035).

In Step 4, we included the manning level variable, which contributes negatively and significantly to the risk of personal injuries at the 5 %-level. The higher manning level, the lower is the risk of personal injuries. This variable consists of seven values: 1) 1-2 people, 2) 3-4 people, 3) 5-6 people, 4) 7-8 people, 5) 9-10 people, 6) 11-12 people and 7) >12 people. This is the third strongest predictor of personal injuries in the model.

In Step 5 and 6, we included two statements: "Sometimes I feel pressured to continue working, even if it is not perfectly safe" and "Sometimes I am so tired during working hours that safety is compromised". Both statements vary between 1 (totally disagree) and 5 (totally agree). Neither of these variables contribute significantly.

In Step 7, the organisational safety culture index is included in the model, and it contributes negatively and significantly, which means that the better safety culture the respondents report, the less likely it is that they have had an injury in the last two years. The safety culture index consists of 18 questions; each with five answer alternatives which vary between 1 (totally disagree) and 5 (totally agree). Thus, the minimum score on the index is 18 points (average of totally disagree), while the maximum score is 90 points (average of totally agree). The safety culture variable which is used in Step 7 is coded with 5 values: 1) >70 points, 2) 70-75 points, 3) 76-80 points, 4) 81-85 points and 5) 86-90 points.

In Step 8 and 9 two variables measuring "Safety management system" are included, denoting risk analyses (which all on board take part in) and procedures describing hazards. Neither of the variables contribute significantly.

The Nagelkerke R^2 indicates the amount of variance in the dependent variable that is explained by the independent variables in the models. In step 8 in Table 4.1 the Nagelkerke R^2 is 0.315 which indicates that the independent variables explain 31.5 % of the variance in the dependent variable, personal injuries.

4.2 Risk perception

4.2.1 Respondents' worry about the risk associated with the work

We also asked respondents to what extent they worry about the risks associated with the work on board (Figure 4.2).

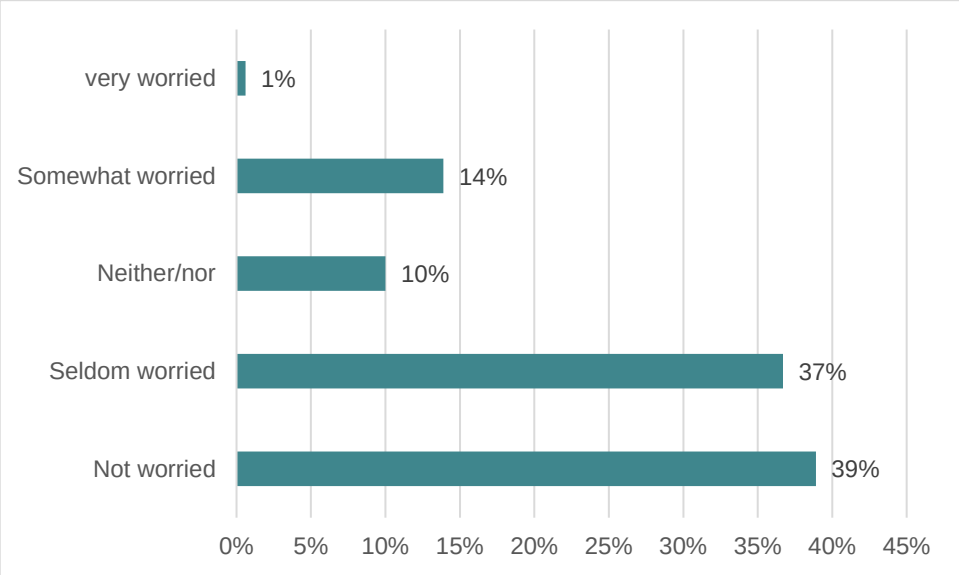


Figure 4.2: Respondents' response to the question: "To what extent do you worry about the risks associated with the work on board?" %. (N=180).

We see that 15 % of the respondents report that they are very worried or somewhat worried about the risks associated with the work on board.

In Table 4.2 we show results from a hierarchical, linear regression analysis, where independent variables are included in successive steps to examine the variables predicting respondents' worry about the risks associated with the work on board. The table presents the standardized beta coefficients. The contributions of the different independent variables on the dependent variables can therefore be compared directly.

The scores on the dependent variable vary between 1 and 5, where the lowest value (1) indicates that respondents not are worried, while the highest value (5) indicates that respondents are very worried.

Table 4.2: Linear regression. Dependent variable: "To what extent do you worry about risk aboard?". Standardized beta coefficients.

Variables	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Age group	-.066	-.111	-.114	-.029	-.002	-.004	.002
Position/line of work (Captain, Deck officer, Chief engineer=2)		**.194****	**.194****	**.143***	**.123***	**.122***	.116
Vessel type (Other=2)			.033	.063	.061	.059	.057
Sometimes I feel pressured to continue working, even if it is not perfectly safe				**.373*****	**.255*****	**.156***	.106
Sometimes I am so tired during working hours that safety is compromised					**.250*****	**.228*****	**.192****
Organisational safety culture						**-.202****	**-.173****
Demanding working conditions index							**.174****
Adjusted R2	-.001	.029	.024	.152	.194	.218	.236

* p < 0.1** p < 0.05 *** p < 0.01

The position/line of work variable contributes to respondents worry about the risks aboard in all steps, until Step 7, where we include the demanding working conditions index. We dichotomized the position/line of work variable into the following values: 1) "other crew members" and 2) senior crew members: "captain, deck officer, chief engineer" after conducting a comparison of means indicating that senior crew members were more worried about the risks on board than others. The fact that the position variable ceased to contribute significantly when we included the demanding working conditions index, indicates that senior crew members' working conditions could explain their worries.

Vessel type does not contribute significantly. We dichotomized the vessel type variable into 1) "other vessel types" after conducting a comparison of means indicating that crews on "other" vessels were more worried about the risks on board than others.

In Step 4 and 5, we included two statements: "Sometimes I feel pressured to continue working, even if it is not perfectly safe" and "Sometimes I am so tired during working hours that safety is compromised". Both statements vary between 1 (totally disagree) and 5 (totally agree). We see that both variables contribute positively, meaning that for each increasing value on these variables, respondents' worry about the risks on board increase. The work pressure variable ceases however to contribute significantly in Step 7, when the demanding working conditions index is included in the analysis.

In Step 6 we take in the Organisational safety culture index, which consist of 18 questions; each with five answer alternatives which vary between 1 (totally disagree) and 5 (totally agree). Thus, the minimum score on the index is 18 points (average of totally disagree), while the maximum score is 90 points (average of totally agree). We see that organisational culture contributes negatively and significantly to respondents' worry about the risks on board , which means that the better safety culture the respondents report, the less likely it is that they worry about the risks on board.

Finally, in Step 7 we include the demanding working conditions index. This index contributes positively and significantly at the 10 %-level, indicating that the more often respondents experience demanding working conditions, the more worried they are.

In conclusion, Table 4.2 indicates that respondents' experiences of safety-compromising fatigue, organisational safety culture, and experiences of demanding working conditions predict respondents' worry about risk.

The Adjusted R2 indicates the amount of variance in the dependent variable that is explained by the independent variables in the model. In step 8 the Adjusted R2 is 0.236 which indicates that the independent variables explain about 24 % of the variance in the dependent variable.

4.2.2 Respondents' assessment of the safety of their work place

We also asked respondents the following question: "All in all, how do you assess the safety of your work place situation?"

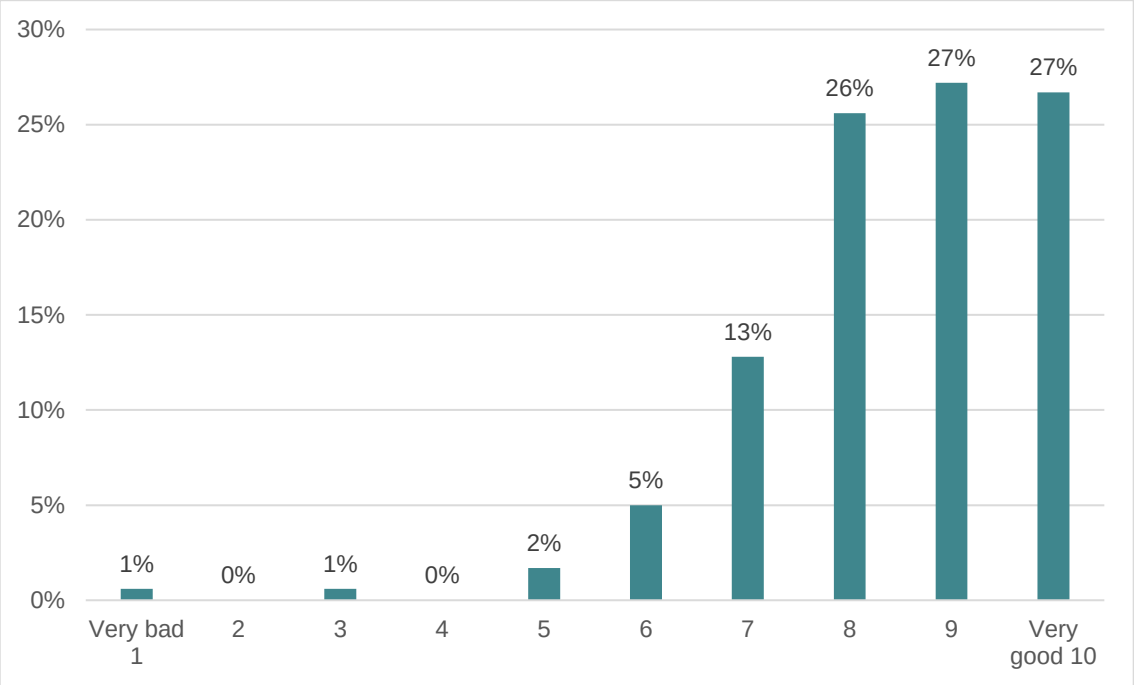


Figure 4.3: Respondents' response to the question: "All in all, how do you assess the safety of your work place situation?" %. (N=222).

In Table 4.3 we show results from a hierarchical, linear regression analysis, where independent variables are included to examine factors predicting respondents' assessments of the safety of their work place. The dependent variable varies between 1 (very bad safety) and 10 (very good safety).

Table 4.3: Linear regression. Dependent variable: "All in all, how do you assess the safety of your work place situation?" Standardized beta coefficients.

Variables	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Age group	**.153****	**.177****	**.173****	.037	.019	.022	.017
Position (Captain, Deck officer, Chief engineer=2)		-.103	-.105	-.024	-.011	-.009	-.003
Vessel type (Other=2)			.045	-.004	-.003	.000	.002
Sometimes I feel pressured to continue working, even if it is not perfectly safe				**-.598*****	**-.520*****	**-.365*****	**-.320*****
Sometimes I am so tired during working hours that safety is compromised					**-.164****	**-.129***	-.097
Organisational safety culture						**.317*****	**.291*****
Demanding working conditions index							**-.156****
Adjusted R2	.023	.033	.035	.370	.390	.459	.476

* p < 0.1** p < 0.05 *** p < 0.01

In Step 1, 2 and 3 we see that respondents' age contributes significantly to respondents' worry about the risk on board. The age group variable contributes positively, indicating that the older the seafarers in our sample are, the better they assess the safety of their work place. This variable ceases however to contribute significantly in Step 4, when we take in work pressure, perhaps indicating that younger seafarers are more inclined to experience work pressure.

The position/line of work variable does not contribute significantly. We dichotomized this variable when we saw that senior crew members rate the safety of their work place as lower than their subordinates on board.

Neither does vessel type does contribute significantly. We dichotomized the vessel type variable into 1) General cargo/bulk/well vessel and 2) "other vessel types" after conducting a comparison of means indicating that crews on "other" vessels were more worried about the risks on board than others.

In Step 4 and 5, we included two statements: "Sometimes I feel pressured to continue working, even if it is not perfectly safe" and "Sometimes I am so tired during working hours that safety is compromised". Both statements vary between 1 (totally disagree) and 5 (totally agree). Both variables contribute negatively, meaning that for each increasing value on these variables, respondents' assessment of the safety level on board decreases. We see, however, that perceived "work pressure" is a stronger predictor than fatigue, and that fatigue ceases to contribute significantly in Step 7.

In Step 6 we include the Organisational safety culture index, which consist of 18 questions. We see that organisational culture contributes positively and significantly to respondents' assessment of safety This means, not surprisingly, that the better safety culture the respondents report, the higher they rate the safety level of their work place.

Finally, in Step 7 we include the demanding working conditions index. This variable contributes negatively and significantly at the 5 %-level, indicating that the more often respondents experience demanding working conditions, the lower they rate the safety level of the work place situation. Finally, we see that safety-compromising fatigue ceases to contribute significantly when we include the demanding working conditions index. This indicates that these working conditions are more important than safety-compromising fatigue (and that it contributes to safety-compromising fatigue).

In conclusion, Table 4.3 indicates that respondents' perception of work pressure, organisational safety culture and experience demanding working conditions are the most important predictors of their perceptions of the safety level of their work places.

4.3 Safety-compromising fatigue

Respondents were asked to rate their agreement with the statement: "Sometimes I am so tired during working hours that safety is compromised". In Table 7.4 below, we compare mean scores for different groups on this variable. The minimum value is 1 (totally disagree) and the maximum value is 5 (totally agree).

Table 4.4: Means on the variable "Sometimes I am so tired during working hours that safety is compromised" The minimum value is 1 (totally disagree) and the maximum value is 5 (totally agree).

	Age group	Vessel type	Position/line of work	Port calls per week	Manning level	Organ. safety culture	Demanding working conditions index
1	Younger than 31 years	Bulk	Captain	1-3	1-2 people	>70	3-4 points
Score	2.2	1.9	1.8	2.1	-	2.7	1.4
2	31-40	General cargo	Deck personnel	4-6	3-4 people	70-75	5-6 points
Score	2.5	2.2	2.3	1.9	2.3	2.6	2
3	41-50	Tank vessel	Engine personnel	7-9	5-6 people	76-80	7-8 points
Score	1.8	2.8	2	2.1	2.1	2.3	2
4	51-60	Well vessel	Other	10-12	7-8 people	81-85	9-10 points
Score	1.9	2	1.7	1.9	1.9	1.9	3
5	Older than 60 years	Other	-	13-15	9-10 people	86-90	11-12 points
Score	1.3	1.9	-	1.9	-	1.4	3.1
6	-	-	-	>15	11-12 people	-	13-21 points
Score	-	-	-	2.3	-	-	3
P value	.039	.282	.088	.705	.315	.000	.000

Table 4.4 indicates significant differences between age groups and positions/line of work when it comes to safety-compromising fatigue. Older seafarers are less tired than young. Deck personnel are more tired than others. Finally we also see clear relationships between safety-compromising fatigue and organisational safety culture and between safety-compromising fatigue and respondents' experiences of demanding working conditions.

4.3.1 Which factors predict safety-compromising fatigue?

In Table 4.5 we show results from a hierarchical, linear regression analysis, where independent variables are included to examine factors predicting respondents' safety-compromising fatigue. The dependent variable varies between 1 (totally disagree) and 5 (totally agree).

Table 4.5: Linear regression. Dependent variable: "Sometimes I am so tired during working hours that safety is compromised". The dependent variable varies between 1 (totally disagree) and 5(totally agree). Standardized beta coefficients.

Variables	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Age group	**-.185****	**-.190****	**-.165****	**-.156****	**-.163****	**-.135***	-.085
Vessel type (Other=1, Tank vessel=2)		.102	.082	.071	.057	.059	.050
Position (Other=1, Deck personnel=2)			**.170****	**.174****	**.174****	**.141***	**.225*****
Port calls				.068	.065	.016	-.004
Manning level					-.086	-.035	.017
Organisational safety culture						**-.314*****	**-.175****
Demanding working conditions index							**.370*****
Adjusted R2	.034	.045	.072	.077	.084	.175	.279

* p < 0.1** p < 0.05 *** p < 0.01

First, we see that respondents' age contributes significantly and negatively to respondents' safety-compromising fatigue, indicating that the older seafarers are, the less safety-compromising fatigued they are. Age ceases however to contribute significantly in Step 7.

Second, we position/line of work contributes negatively and significantly at the 5 %-level to safety-compromising fatigue. This means that if you are deck personnel, you are more likely to be fatigued in manners that may compromise safety, when the other variables in the model are controlled for.

We see in Step 6 that organisational safety culture contributes significantly and positively at the 1 %-level. This indicates that having a good safety culture decreases the risk of safety-compromising fatigue. It would be interesting to examine the mechanisms behind this relationship further. Step 7 gives us a hint about this.

The effect of organisational safety culture is nearly cut to half in Step 7, when the demanding working conditions index is included in the analysis. This index is the most important predictor of safety-compromising fatigue. Given that this variable reduced the effect of organisational safety culture, we could assume that having a good safety culture involves preventing shift delays, 16-hours of continuous work and interrupted rests. More research is however needed to examine these relationships.

The Adjusted R^2 value in Step 7 is .279, indicating that the variables in the model explains about 28 % of the variation in the dependent variable.

4.3.2 Procedure violations and lacking use of procedures

Respondents were also asked to rate their agreement with three statements about procedure violations and lacking use of procedures:

- Violation of procedures seldom has consequences
- The competition between shipping companies means that we sometimes have to violate safety procedures
- I never use written procedures in the work I perform on board

We made an index of the questions. In Table 4.6 we compare mean score for different groups on this variable. The minimum value is 3 (totally disagree) and the maximum value is 15 (totally agree). The average score is 6.3 points.

Table 4.6: Means on the index with three questions on procedure violations and lacking use of procedures. The minimum value is 3 (totally disagree) and the maximum value is 15 (totally agree).

Value	Age group	Vessel type	Position/line of work	Port calls per week	Manning level	Risk assessment ("all on board")	Org. safety culture
1	Younger than 31 years	Bulk	Captain	1-3	1-2 people	"All on board the vessel participate"	18-69
Score	6.4	5.9	6.5	6.6	-	6.1	8.8
2	31-40	General cargo	Deck personnel	4-6	3-4 people	Other	70-75
Score	7.3	6.6	6.4	5.2	7.6	6.7	8.1
3	41-50	Tank vessel	Engine personnel	7-9	5-6 people	-	76-80
Score	6.3	6.3	6	7.1	6.3	-	6
4	51-60	Well vessel	Other	10-12	7-8 people	-	81-85
Score	5.6	6.6	6.1	7	5.9	-	5.9
5	Older than 60 years	Other	-	13-15	9-10 people	-	86-90
Score	6.1	6.6	-	5.8	-	-	4.9
6	-	-	-	>15	11-12 people	-	
Score	-	-	-	6.7	-	-	
P value	.202	.698	.846	.053	.208	.167	.000

Table 4.6 indicates a relationship between organisational safety culture and respondents' tendency to never use procedures, agree that competition between shipping companies sometimes leads to violation of procedures and that violations of procedures seldom has consequences. A high organisational safety culture score gives a low score on the index; i.e. fewer procedure violations and more procedure use.

4.3.3 Which factors predict score on the procedure violations and lacking use of procedures index?

In Table 4.7 we show results from a hierarchical, linear regression analysis, where independent variables are included to examine factors predicting respondents' score on the Procedure violations and lacking use of procedures index. The dependent variable varies between 1 (totally disagree) and 15 (totally agree).

Table 4.7: Linear. Dependent variable: "Procedure violations and lacking use of procedures index" The dependent variable varies between 1 (totally disagree) and 15(totally agree). Standardized beta coefficients.

Variables	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Age group	-.109	-.109	-.106	-.090	-.101	-.099	-.059
Vessel type (Other=1, Tank vessel=2)		.002	.001	-.016	-.049	-.059	-.049
Position (Other=1, Deck personnel=2)			.017	.019	.027	.025	-.036
Port calls				.123	.118	.126	.072
Manning level					**-.136***	**-.139***	-.037
Risk assessment ("all on board")						-.117	-.076
Org. safety culture							**-.450*** **
Adjusted R2	.006	.000	-.006	.004	.015	.024	.207

* p < 0.1** p < 0.05 *** p < 0.01

First, we see that manning level contributes significantly and negatively to respondents' evaluations of safety over economy priorities in Step 5-6 indicating that the higher manning level on the vessels that respondents work on, the less likely they are to agree with the questions concerning procedure violations and lacking use of procedures. This variable ceases to be significant when we take in organisational safety culture in Step 7.

Finally, we see in Step 7 that the only significant predictor of respondents' answers on the procedure violations and lacking use of procedures index is organisational safety culture. The effect of organisational safety culture is strong and negative, and it is significant at the 1 % level. This indicates an important and interesting relationship between safety culture, safety structure and safety behaviour (procedure use and violation).

Moreover, when organisational safety culture was taken into the analysis in Step 7, the Adjusted R^2 value rose to .207 indicating that the variables in the model explains about 21 % of the variation in the dependent variable. Most of this is explained by the organisational safety culture variable, as the Adjusted R^2 value in Step 6 was .024.

4.4 Summing up

A total of 30 respondents (17 %) answered that they had been injured in their work on board in the course of the last two years. We found that the following variables influenced respondents" risk of injuries on board: 1) Age: the older the seafarers are, the less likely they are to have been injured in the last two years, 2) Position: deck crew/apprentice were more inclined to be injured than others. 3) Vessel type: well vessels crew members were more inclined to be injured, 4) Manning level: the higher manning level, the lower is the risk of personal injuries, 5) Organisational safety culture: the better safety culture the respondents report, the less likely it is that they have had an injury in the last two years.

We also analysed the variables influencing respondents' perception of risk. Our analyses show that respondents' experiences of safety-compromising fatigue, organisational safety culture, and experiences of shift delays, 16-hours of continuous work and interrupted rests are predict respondents' worry about risk. We also found that respondents' perception of work pressure, organisational safety culture and experience demanding working conditions are the most important predictors of their perceptions of the safety level of their work places.

Respondents were asked to rate their agreement with the statement: "Sometimes I am so tired during working hours that safety is compromised". We conducted analyses to examine factors predicting respondents' safety-compromising fatigue. First, we found that the older seafarers are, the less likely they are to report of safety-compromising fatigue. Second, deck personnel are more likely to be fatigued in manners that may compromise safety. Third, we found that having a good safety culture decreases the risk of safety-compromising fatigue. Fourth, we found that respondents' experiences of demanding working conditions is the most important predictor of safety-compromising fatigue.

We made an index consisting of three questions on procedure violations and lacking use of procedures, and conducted a regression analysis to examine the factors predicting it. The only significant predictor of respondents' answers was organisational safety culture: higher safety culture scores involves fewer procedure violations and lacking use of procedures. Thus, the present chapter indicates an important and interesting relationship between safety culture and safety structure, between formal and informal aspects of maritime safety. We also see a relationship between these factors and safety behaviour (procedure use and violation).

5 Organisational safety culture

We saw in chapter 4, that organizational safety culture influences several measures of occupational safety. The second aim of the study is to survey variables influencing organizational factors in order to examine relationships between them and point to the most important factors influencing occupational safety on Norwegian vessels. In the following chapter, we examine variables influencing organizational safety culture. We focus both on organisational factors and "non-organisational factors".

5.1 Interview results

The importance of organisational safety culture was highlighted several times in the reference group meeting, and in the interviews. Culture, attitudes, knowledge, skills and risk understanding are factors that are important when it comes to explaining safety behaviour among crew members on board ships and the ship accident risk of vessels.

One interviewee stated that organisational safety culture clearly is the most important safety influencing factor in maritime transport. He underlined that shared safety attitudes and behaviours are crucial for safety, and it "starts on the top"; in the shipping company and with the captain. In order to influence a positive safety culture on board, the captain must provide a good example, as the safety standard set by the captain tends to be followed by the crew, either it is good or bad. Reference group members also emphasized that reporting of incidents is a crucial aspect of safety culture.

Reference group members also stated that the revision of the ISM code in 2010 involved a stronger organisational focus on safety. These revisions focused however more on bureaucracy and procedures than safety culture. It was suggested that the changes also should have directed attention to the importance of organisational safety culture.

5.2 Survey results

5.2.1 Scores on the organisational safety culture index

Table 5.1 shows the means on the organisational safety culture index for different groups. We have excluded the captains from the means presented in Table 5.1, as five of the 18 questions in the index concern the ship management. The average organisational safety culture score is 77.7 points (min=18, max=90).

Table 5.1: Means on the organisational safety culture index for seven variables, excluding captains (N=130). The average organisational safety culture score is 77.7 points (minimum score: 18, maximum score: 90).

Value	Age group	Vessel type	Position	Work pressure	Fatigue	Manning level
1	Younger than 31 years	Bulk	Deck personnel	Totally disagree	Totally disagree:	1-2 people
Score	78.5	76.8	77	83.1	82	-
2	31-40	General cargo	Engine personnel	Disagree somewhat	Disagree somewhat:	3-4 people
Score	71.1	78.1	79	77.7	78.4	67.1
3	41-50	Tank vessel	Other	Neither/nor	Neither/nor:	5-6 people
Score	79.3	73.5	78.5	69.7	69.6	77.7
4	51-60	Well vessel	Captain	Agree Somewhat	Agree Somewhat:	7-8 people
Score	76.8	78.1	79.9	69.4	75.1	79.6
5	Older than 60 years	Other		Totally agree	Totally agree:	9-10 people
Score	85.3	79.5		60.2	69.4	-
6						11-12 people
Score						83
P value	.027	.881	.694	.000	.000	.045

Table 5.1 indicates that respondents between 31-40 years rate the organisational safety culture level lower than other age groups. We also see that the more respondents agree with the statements on work pressure and fatigue the lower safety culture levels they report. The distribution of means on the work pressure values indicate that the work pressure variable relationship with organisational safety culture is stronger than the relationship between fatigue and safety culture. The figure also indicates that higher manning levels gives higher safety culture scores. Respondents on vessels manned with 3-4 people report the lowest organisational safety culture scores.

5.2.2 Which factors predict organisational safety culture?

In Table 5.2 we show results from a hierarchical, linear regression analysis, where independent variables are included to examine factors predicting respondents' organisational safety culture scores. The dependent variable varies between 18 points (totally disagree on 18 questions) and 90 points (totally agree on 18 questions).

We have excluded the captains from the regression analysis presented in Table 5.2, as five of the 18 questions in the index concern the ship management.

Table 5.2: Linear regression. Dependent variable: Organisational safety culture. Standardized beta coefficients.

Variables	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Age group (1=other, 2=31-40 years)	**-.234*** **	**-.234** **	-.107	-.089	-.086	-.088	-.086
Vessel type (Other=1, General cargo=2)		.009	.073	.085	.061	.060	.066
Sometimes I feel pressured to continue working, even if it is not perfectly safe			**-.533*** **	**-.463*** **	**-.454*** **	**-.453*** **	**-.396*** **
Sometimes I am so tired during working hours that safety is compromised				-.143	-.130	-.124	-.141
Manning level					.118	.118	.113
Risk analyses ("all on board"=0,					.020		.006
Other answer=1)							
Procedures describing hazards							.123
Adjusted R2	.047	.039	.303	.312	.320	.314	.321

* p < 0.1** p < 0.05 *** p < 0.01

First, we see that respondents' age contributes significantly and negatively to respondents assessment of organisational safety culture in the first two steps. We dichotomized this variable, when we saw that seafarers between 31 and 40 years old provided the most negative safety culture assessments. The age variable ceases to be significant when we include the work pressure variable in the analysis in Step 3, indicating that the age effect of respondents between 31-40 years old could be due to their work pressure. Vessel type does not contribute significantly.

In Step 3 and 4 we included two statements: "Sometimes I feel pressured to continue working, even if it is not perfectly safe" and "Sometimes I am so tired during working hours that safety is compromised". Both statements vary between 1 (totally disagree) and 5 (totally agree). We see that both variables contribute negatively, meaning that for each increasing value on these variables, respondents' assessment of organisational safety culture decreases.

It is however only the perceived "work pressure" variable which contributes significantly to organisational safety culture (at the 1 %-level). This is the only variable which contributes significantly to organisational safety culture in the analyses.

In Step 5 we take in the manning level variable. This variable consists of seven values: 1) 1-2 people, 2) 3-4, 3) 5-6, 4) 7-8, 5) 9-10, 6) 11-12 and 7) more than twelve people. We saw in Table 5.1 above, that the higher the manning levels, the higher the safety culture scores. This variable does however not contribute significantly in the analyses. Perhaps this is due to the "perceived work pressure" variable?

A bivariate correlation analysis shows that the two variables are significantly correlated at the 5 %-level (Pearson's R= -0.167). This could indicate that lower manning level gives higher work pressure, and perhaps this is why the manning level variable does not contribute significantly to organisational safety culture, although we see a bivariate relationship in Table 5.1.

In Step 8 and 9 variables measuring "Safety management system" are included, denoting risk analyses (which all on board take part in) and procedures describing hazards. Neither of the variables contribute significantly.

In conclusion, Table 5.2 indicates that respondents' perception of work pressure significantly predict their ratings of organisational culture. The adjusted R^2 value is .321, indicating that the model explains 32 % of the variation in the organisational safety culture variable.

5.3 Summing up

The importance of organisational safety culture for several safety outcomes was highlighted both in previous studies and in the qualitative data. Culture, attitudes, knowledge, skills and risk understanding are factors that are important when it comes to explaining safety behaviour among crew members on board ships and the ship accident risk of vessels.

We made an organisational safety culture index, consisting of 18 questions from the Global Aviation Information Network (GAIN)-scale. We used this in our small-scale survey, and found that safety culture influenced respondents' injury risk and risk perception.

We conducted analyses to examine factors predicting respondents' organisational safety culture scores, and found that the variable "Sometimes I feel pressured to continue working, even if it is not perfectly safe" was the only variable which contributed significantly.

6 Manning level and work-load

We saw in chapter 4, that manning level and work pressure influence several measures of occupational safety. The second aim of the study is to survey variables influencing organizational factors in order to examine relationships between them and point to the most important factors influencing occupational safety on Norwegian vessels. In the following chapter, we primarily focus on manning level and work pressure, examining the variables influencing the latter.

6.1 Results from the interviews

6.1.1 Safety manning and operational manning

In Norway the NMA defines the "safety manning" of vessels based on the international rules regulating manning of vessels (e.g. the IMO 1047 principles for safe manning). The "operational manning" is the manning level chosen by the shipping companies, based on their considerations of the needs of their vessels. It is the responsibility of the shipping company to staff vessels properly, i.e. in a way that facilitates the execution of all functions on board

The safe manning document gives the minimum crew size and minimum qualifications required for sailing from A to B. The definition of the safe manning applies, however, only to the number of people and functions required to sail. Usually, there are also operational tasks which must be done on board ships while sailing, for instance related to preparing for loading/unloading, maintenance, administrative tasks and so forth. If vessels choose to only have a safe manning, it is likely that they will be understaffed when it comes to safety critical functions.

It was for instance mentioned in the interviews that small short sea cargo vessels often have many port calls. Thus, in the night when two people are supposed to be at the bridge; a navigator and a subordinate crew member, the subordinate crew member will typically be another place in the vessel performing operational tasks like cleaning the cargo hold, performing maintenance tasks and so on.

The operational manning must of course not be lower than the "safety manning" defined by the NMA. It is important to note that ship owners can go above the safe manning requirements, but they cannot go below. The ship owner can require additional manning and higher qualifications. A general problem mentioned by interviewees, however, is that shipping companies may perceive the safety manning as the defined standard.

6.1.2 Manning level, work load and fatigue

Reference group members considered fatigue and manning level to be among the most important risk factors in maritime transport. They stated that the small Norwegian ships sailing along the coast of Norway have low manning level, considerable work pressure and scarce time.

Increase in the administrative burden was also emphasized in the discussion. This is due to an increase in formal authority requirements. Reference group members questioned the purpose of this, and rather suggested more measures to reduce the administrative pressure.

The increase in administrative tasks has not been followed by an increase in available time on board. Thus, crew members have more work tasks that they must perform, and less time to rest. This means that the level of manning is not adapted to the work task. According to reference group members, this is largely a question of economy, which is essential for most.

We asked interviewees whether there is a clear connection between manning level and safety. You cannot categorically say that safety on board increases with the number of people one interviewee said. For example, if there are too many people, they have too little to do and do not remain alert. However, with too few people on board there is a risk in and of itself. So you need to find optimal manning levels and even then they may vary with operational phase.

Fatigue is mentioned in several accident reports, for instance describing people falling asleep on the bridge and then run aground. Fatigue is however hard to document in accident analyses. One interviewee stated that authorities cannot claim that vessels cheat with rest period lists, but said that they know that crew members often may work more than the rest period lists claim.

6.1.3 Safety manning performing commercial tasks

The safety regulations say that between sundown and sunrise and at reduced visibility you need two people on the bridge. The two on the bridge shall be navigator and one subordinate crewmember to take care of the lookout function in the dark and at reduced visibility.

On smaller cargo vessels for instance, there is a considerable pressure, with little time and many tasks. They only have safety manning, several interviewees suggested. The sailor who should have been on the bridge with the navigator at night may be some other place on the ship, doing other job tasks. In such situations, it may happen that the navigator falls asleep and runs aground. The conclusion is that these vessels often have a manning level which is not in accordance with the work tasks that must be done. This is especially a problem in short sea shipping and freight trade. These vessels barely make a profit, some interviewees stated.

All vessels are supposed to have a bridge alarm, however, which is a very useful tool. If you do not move in a period of for example, 5-10 minutes, an alarm goes off, sufficiently loud to wake you up. I think it is a very good measure. If you are exempted from having one, you are supposed to always have two people on the bridge. Today, all ships have one installed. But it is important to note that this does not exempt you from having the necessary manning level on the bridge.

We asked whether it is possible to implement measures to prevent the safety manning from performing commercial tasks (e.g. maintenance, cleaning). Hardly, one interviewee answered, as vessel crew write in the deck logs that they have a man on the bridge. To have full control we would need an inspector on every ship, one interviewee stated.

Finally, interviewees stated that it lies in the nature of shipping that you get peaks with a lot of work before you can rest again. The problem with the fleet of smaller vessels is that they have such peak periods all the time, because of, for instance, many port calls.

6.2 Results from the small-scale survey

6.2.1 Manning level

Respondents were asked several question about the manning level on board their vessels. In order to avoid counting the same vessels several times, we filtered our data according to a unique vessel identity. We use the captains in the sample for this purpose. When we only compare the means for the captains in our sample we are left with 50 vessels. This sample is too little for comparison, as we need to compare manning levels for different vessel types controlled for their size.

Nevertheless, Figure 6.1 compares the manning level for different ships types within different vessel sizes, focusing on the reports of captains only. We must remember that numbers are very small, and that we cannot conclude or generalize based on the numbers in the figure.

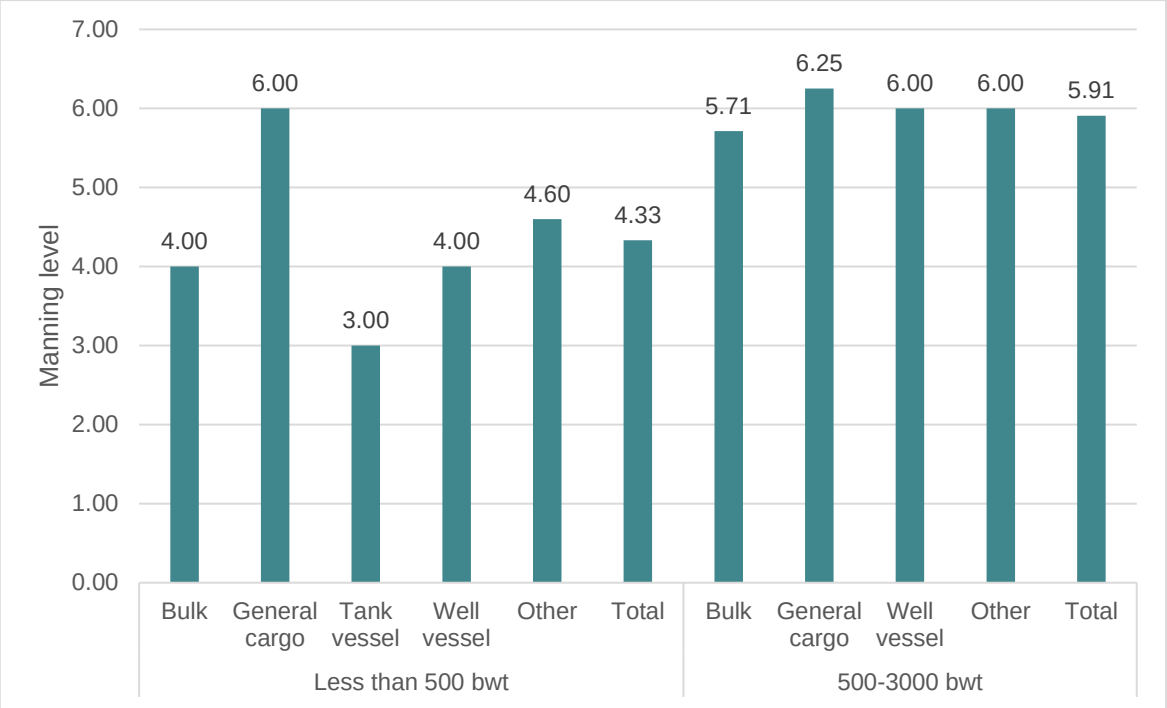


Figure 6.1: The manning level for different ships types among vessels weighing less than 500 dwt (N=15) and between 500-3000 dwt (N=33) focusing on the reports of captains only.

Keeping in mind that numbers are small, we see that the average manning level on vessels less than 500 dwt is 4.33, while it is 5.91 on vessels between 500 and 3000 dwt.

The most prevalent vessel types among our respondents are bulk and well vessels. In Figure 6.2, we therefore compare respondents mean scores for these vessels on two statements, taking vessel size into account:

- We usually have a larger crew than the vessel's safety manning specifies
- Manning on board is sufficient to ensure that safety is maintained

The answer alternatives range from 1 (=totally disagree) to 5 (totally agree). The sixth answer alternative do not know/not relevant was removed. We only present numbers for well vessels in the smallest vessel group, as there were too few bulk vessels to report in this group.

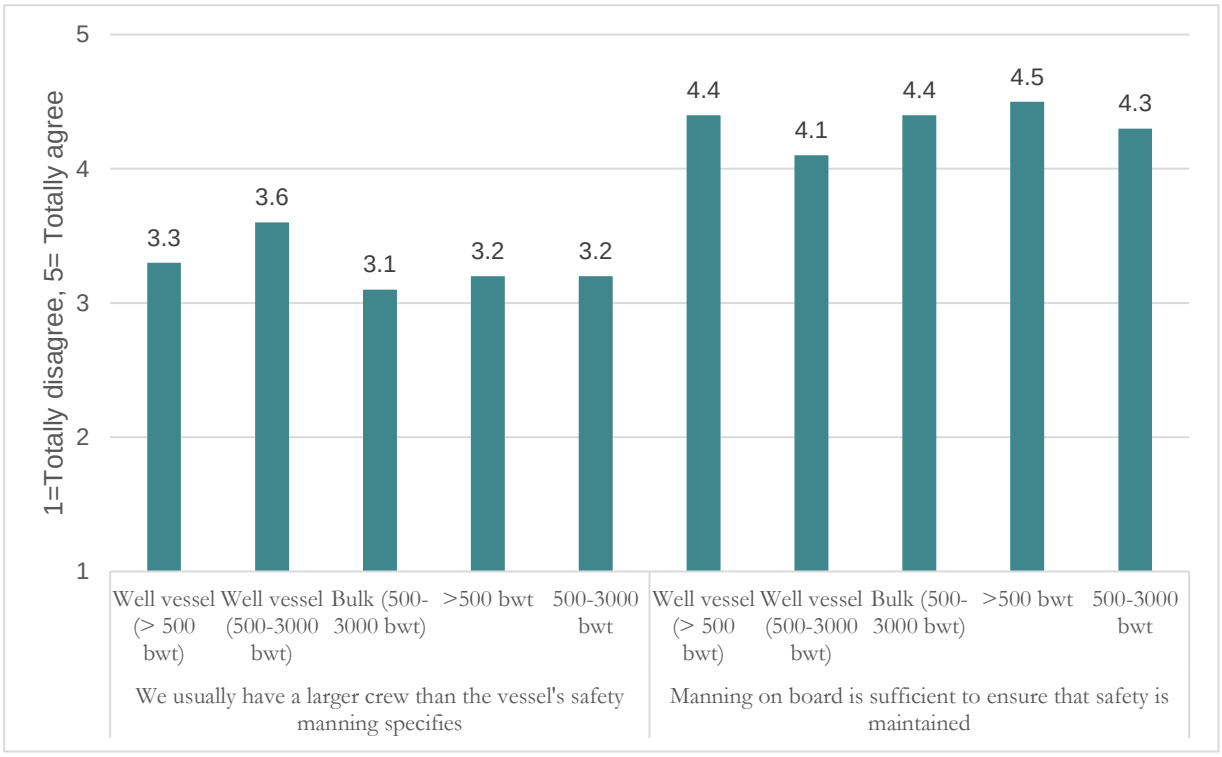


Figure 6.2: Respondents mean scores on two statements: "We usually have a larger crew than the vessel's safety manning specifies" and "Manning on board is sufficient to ensure that safety is maintained" Bulk and well vessels, and different vessel sizes.

Figure 6.2 indicates that respondents from well vessels between 500-3000 dwt respondents in general are somewhat more inclined to agree with the statement "We usually have a larger crew than the vessel's safety manning specifies". Numbers are however small. When it comes to the question "Manning on board is sufficient to ensure that safety is maintained", there are only small differences between the mean scores of the groups. In conclusion, we do not see considerable differences between the groups on these questions.

6.2.2 Port calls

Respondents were asked about the average number of port calls per week. In order to avoid counting the same vessels several times, we filtered our data according to a unique vessel identity (i.e. 50 captains). Bearing in mind that this sample is too little for comparison, Figure 6.3 shows the average number of port calls per week for different vessel types.

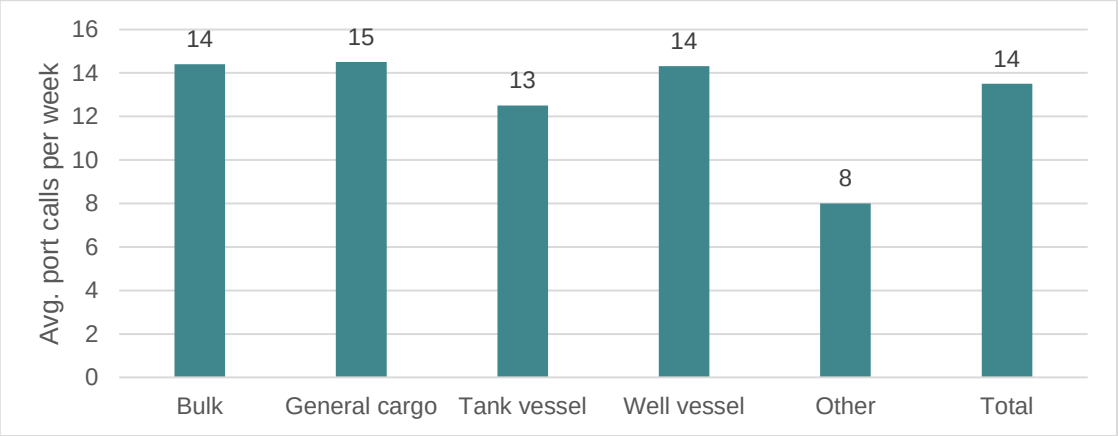


Figure 6.3: Average number of port calls per week for different vessel types. Captains (N=50).

Figure 6.3 indicates that the vessels' captains in average report of 14 port calls per week, and that there is little variation between the vessels, with one exception: "other vessels."

6.2.3 Pressure to continue working even though it is not safe

Respondents were asked to rate their agreement with the statement: "Sometimes I feel pressured to continue working, even if it is not perfectly safe". In Table 6.1, we compare mean score for different groups on this variable. The minimum value is 1 (totally disagree) and the maximum value is 5 (totally agree). The average score is 2.

Table 6.1: Means on the variable "Sometimes I feel pressured to continue working, even if it is not perfectly safe" The minimum value is 1 (totally disagree) and the maximum value is 5 (totally agree).

Value	Age group	Vessel type	Position/line of work	Port calls per week	Manning level	Organ. safety culture
1	Younger than 31 years	Bulk	Captain	1-3	1-2 people	>70
Score	2.2	2	2.1	1.9	-	3.3
2	31-40	General cargo	Deck personnel	4-6	3-4 people	70-75
Score	2.5	2.1	2.1	1.7	3	2.4
3	41-50	Tank vessel	Engine personnel	7-9	5-6 people	76-80
Score	1.9	2.5	1.8	2.1	1.9	2.2
4	51-60	Well vessel	Other	10-12	7-8 people	81-85
Score	1.7	1.9	1.9	2.2	1.9	1.7
5	Older than 60 years	Other	-	13-15	9-10 people	86-90
Score	1.7	1.8	-	1.8	-	1.3
6	-	-	-	>15	11-12 people	-
Score	-	-	-	2.3	-	-
P value	.052	.691	.642	.240	.008	.000

Table 6.1 indicates significant differences between the work pressure on vessels with different manning levels: the lower manning levels, the more work pressure. We also see an interesting relationship between stress and pressure and organisational culture: seafarers with low safety culture scores report of higher levels of stress and pressure and vice versa.

6.2.4 Which factors predict work pressure?

In Table 6.2 we show results from a hierarchical, linear regression analysis, where independent variables are included to examine factors predicting respondents' pressure to continue working even though it is not safe. The minimum value is 1 (totally disagree) and the maximum value is 5 (totally agree).

Table 6.2: Linear regression. Dependent variable: Perceived work pressure. Standardized beta coefficients.

Variables	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Age group (1=other, 2=31-40 years)	.176**	.178**	.176**	.148*	.146*	.061	.021
Vessel type (Other=1, Tank vessel =2)		.101	.100	.072	.049	.050	.042
Position (Other=1, Deck personnel =2)			.009	.021	.023	-.022	.049
Port calls per week				.181**	.179**	.107	.089
Manning level					-.140*	-.063	-.023
Org. safety culture						-.504***	-.389***
Demanding working conditions index							.316***
Adjusted R^2	.025	.030	.024	.050	.064	.297	.372

* p < 0.1** p < 0.05 *** p < 0.01

First, we see that respondents' age contributes significantly and positively to respondents' reported work pressure in Step 1-5, indicating that seafarers between 31-40 years old experience more work pressure, controlled for the other variables in the model. Age does, however, not contribute significantly in Step 6, where we include organisational safety culture.

We expected that high numbers of port calls could increase respondents' work pressure. In accordance with this, we see that the number of port calls per week contributes significantly and positively in Step 4-5 until Organisational safety culture is included in the analyses.

We would also expect manning level to decrease respondents' work pressure. In accordance with this, we see that manning level contributes negatively and significantly in Step 5, although only at the 10 %-level, to respondents' work pressure, until organisational safety culture is included in the analyses.

Organisational safety culture is the strongest predictor of respondents' reported levels of work pressure, contributing negatively and significantly (at the 1 %-level). For each increased vale on the organisational safety culture variable, the score on the respondents' perceived work pressure variable decreases with .389 points. Thus, good organisational safety culture seem to reduce respondents experience of work pressure.

Finally, Step 7 we include the demanding working conditions index. This index contributes negatively and significantly at the 1 %-level, indicating that the more often respondents experience demanding working conditions, the more they agree with the statement "Sometimes I feel pressured to continue working, even if it is not perfectly safe"

The increase in the Adjusted R^2 value in Step 7 indicates the importance of the organisational safety culture variable as a predictor of work pressure. The Adjusted R2 value was 0.064 in Step 5, indicating that this model explained 6.4 % of the variance in respondents' work pressure. The value was .297 in Step 6, when organisational safety culture was included in the analysis, indicating that the model explained about 30 % of the variance in work pressure. The value rose to .372 in Step 7, indicating that the model explained 37 % of the variation in the dependent variable.

6.3 Summing up

A vessel's safety manning is the minimum crew size and minimum qualifications required for sailing from A to B. The "operational manning" is the manning level chosen by the shipping companies, based on their considerations of the needs of their vessels; i.e. also considering other needs than just sailing from A to B (e.g. loading, unloading, maintenance). If vessels choose to only have a safe manning, it is likely that they will be understaffed when it comes to safety critical functions. A general problem mentioned by interviewees, however, is that shipping companies may perceive the safety manning as the defined standard.

Reference group members considered fatigue and manning level to be among the most important risk factors in maritime transport. They stated that the small Norwegian ships transporting goods along the coast of Norway have low manning level, considerable work pressure and scarce time. This may lead to too high workloads and fatigue.

Respondents were asked several question about the manning level on board their vessels. In order to avoid counting the same vessels several times, we filtered our data according to a unique vessel identity. We use the captains in the sample for this purpose. This sample is too little for comparison, as we need to compare manning levels for different vessel types controlled for their size. Keeping this in mind, we saw that the average manning level on vessels less than 500 dwt is 4.33, while it is 5.91 on vessels between 500 and 3000 dwt.

Respondents were also asked about the average number of port calls per week. Remembering that numbers are too small for generalization, we found that the vessels' captains on average report of 14 port calls per week, and that there is little variation between the vessels.

Respondents were asked to rate their agreement with the statement: "Sometimes I feel pressured to continue working, even if it is not perfectly safe". We conducted analyses to examine factors predicting respondents' pressure to continue working even though it is not safe, and found that organisational safety culture was the strongest predictor of respondents reported levels of work pressure. A good organisational safety culture seem to reduce respondents' experience of pressure to work even if it is not perfectly safe. Finally, we also found a relationship between work pressure and respondents' experiences of shift delays, 16-hours of continuous work and interrupted rests. The more often respondents experience demanding working conditions, the more they agree with the statement "Sometimes I feel pressured to continue working, even if it is not perfectly safe".

7 Working conditions and rest

We saw in chapter 4, that demanding working conditions and rest influence several measures of occupational safety. The second aim of the study is to survey variables influencing organizational factors in order to examine relationships between them and point to the most important factors influencing occupational safety on Norwegian vessels. In the following chapter, we primarily focus on demanding working conditions and rest, examining the variables influencing the former.

7.1 Results from interviews

We asked interviewees whether fatigue is an important risk factor. The answer was that weariness and fatigue clearly are problems at sea, although interviewees differed when it comes to whether the main factor behind fatigue at sea is the length of the period you stay on board or the daily watch schedule. A proponent of the first view, said that if you work for 12 – 13 hours a day for several weeks, it starts getting worrisome. We can all handle a hard session for two or three days, but after a long session, you are less alert. Unfortunately we have no good tool to regulate the length of periods on board in our regulations, one interviewee said. The regulations only cover daily rest, which shall be a minimum of 10 hours – but there are no limits as to how long you can stay on board over time.

A proponent of the other view suggested that the watch schedules, i.e. the partitioning of the day into work and rest hours is what creates fatigue. Even within Norway there are great variations. What creates fatigue is the accumulation of a daily rest deficit. That usually happens with the 6-6 system, where you only get 4 hours of rest during each off duty period; you build up a rest deficit. No fatigue researchers claim that you cannot be on board for six months, this interviewee said. However, the social aspect of it, being away from friends and family makes being on board for six months problematic.

A third view on the causes behind fatigue suggested by one of the interviewees is that it is the type of transport that the vessel is involved in which creates fatigue. The number of port calls is a key variable in this respect, and whether crew members are given the opportunity to rest regularly in order to recover after work. If crew members have stressful work with few possibilities to recover, they are likely to be more fatigued after long periods on board. However, if crew members regularly are able to rest and recover it is less likely that they will be more fatigued after long periods on board.

7.2 Results from the survey

7.2.1 Watch schedules and sailing periods

Respondents were asked what kind of watch schedules they have while in regular operations (Figure 7.1).

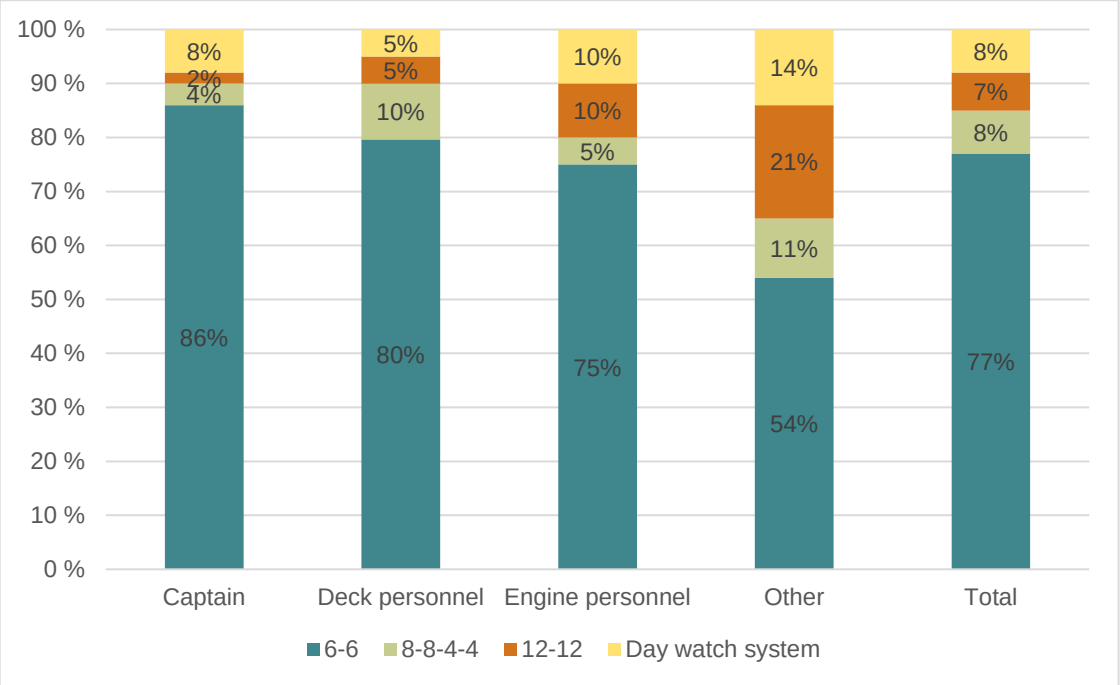


Figure 7.1: Distribution of respondents answers to the question: "What kind of watch schedule do you have while in regular operations?" Captain (N=50), Deck personnel (N=78), Engine personnel (N=20), Other (N=28), Total (N=176).

Figure 7.1 indicates that the 6-6 watch schedules is the most prevalent watch system among our respondents from all positions and lines of work on board, especially among captains. The differences are statistically significant at the 5 %-level.

Respondents were also asked how many weeks they spend on the vessels in their working periods, and how many weeks they spend off their vessels in their leisure time (Figure 7.2).

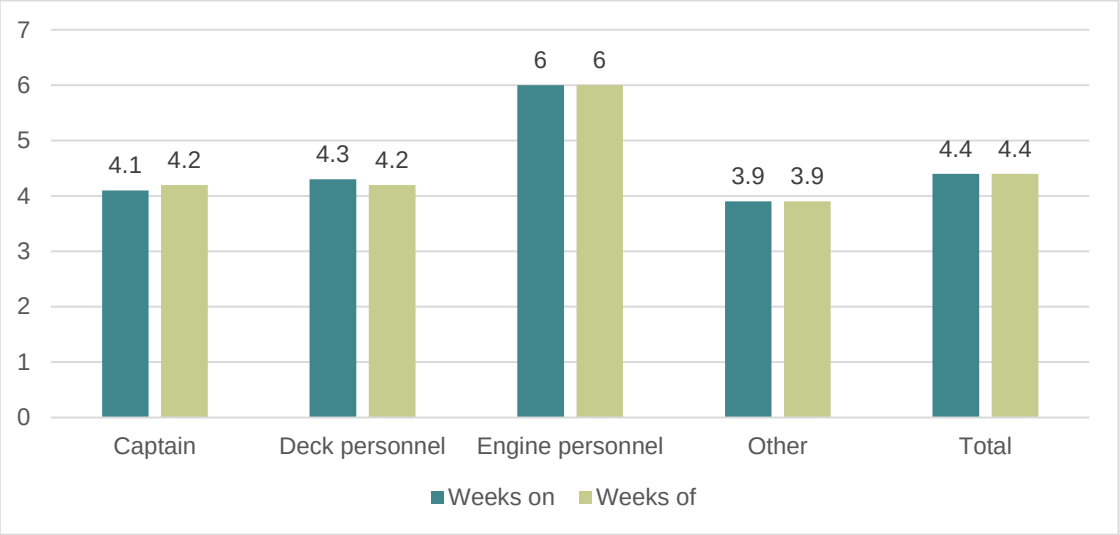


Figure 7.2: Means for weeks spent on vessels in working periods, and weeks spent off vessels in leisure time. Captain (N=50), Deck personnel (N=77), Engine personnel (N=21), Other (N=29), Total (N=177).

We see that the respondents generally stay on board for about four weeks with four weeks leave, although engine personnel stay on board for six weeks.

7.2.2 Rest on board

Respondents were asked the following question on rest on board: "I get sufficient sleep and rest on board"

Table 7.1 below, compares mean score for different groups on this question. The minimum value is 1 (totally disagree) and the maximum value is 5 (totally agree). The average score is 4.2

Table 7.1: Means on the variable "I get sufficient sleep and rest on board". The minimum value is 1 (totally disagree) and the maximum value is 5 (totally agree).

Value	Age group	Vessel type	Position/line of work	Port calls per week	Manning level	Organ. safety culture
1	Younger than 31 years	Bulk	Captain	1-3	1-2 people	>70
Score	4.1	4.2	4.2	4	-	3.4
2	31-40	General cargo	Deck personnel	4-6	3-4 people	70-75
Score	3.9	3.9	4.1	4.5	3.7	3.9
3	41-50	Tank vessel	Engine personnel	7-9	5-6 people	76-80
Score	4.2	3.6	4.1	4.1	4.2	4
4	51-60	Well vessel	Other	10-12	7-8 people	81-85
Score	4.3	4.3	4.3	4.3	4.4	4.3
5	Older than 60 years	Other	-	13-15	9-10 people	86-90
Score	4.6	4.2	-	4.2	-	4.7
6	-	-	-	>15	11-12 people	-
Score	-	-	-	3.8	-	-
P value	.564	.478	.819	.161	.324	.000

When we compare means for the statement "I get sufficient sleep and rest on board", we see that the only statistically significant differences is between respondents reporting of different organisational safety culture levels, indicating that vessels with good safety culture seem to be better at facilitating crewmembers' sleep and rest.

7.2.3 Working hours exceeding rules

Respondents were also asked: "How often do you think your working hours exceed those laid down in the rules on work and rest periods?" (Figure 7.3). We see that 24 % of the respondents answer at least every other time I am at sea.

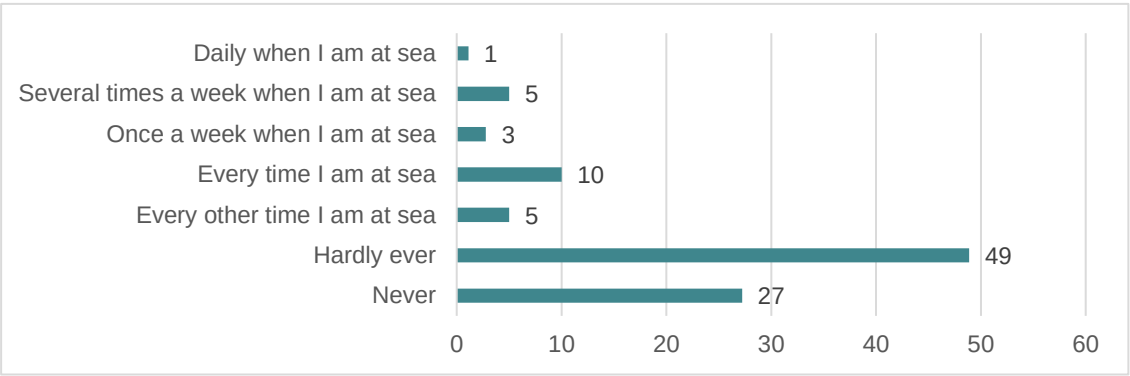


Figure 7.3: Distribution of answers given to the question: "How often do you think your working hours exceed those laid down in the rules on work and rest periods?" (N=180).

Respondents were also asked to rate the agreement with the statement: "On this vessel we work more than we report that we do" (Figure 7.4). We see that 23 % of the respondents agree with the statement, while 60 % disagree.

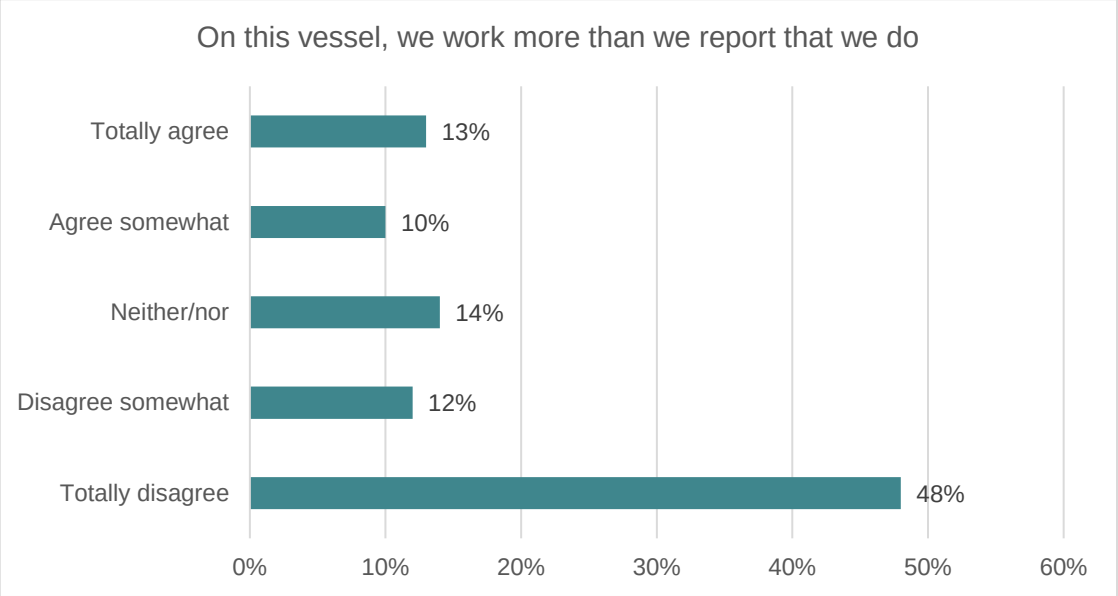


Figure 7.4: Distribution of answers given to the question: "On this vessel we work more than we report that we do" N=180).

7.2.4 Demanding working conditions index

Respondents were asked three questions on rest and working hours. We made an "Demanding working conditions index" of these questions. These questions are: "How often do you think that the following events happen while you are at sea?":

- Your shift change is delayed because of work operations, for instance port calls?
- You work more than 16 hours in the course of a 24 hour period?
- You are interrupted when you are off duty?

The following answer alternatives were available to the respondents:

1) Never, 2) Hardly ever, 3) Every other time I am at sea, 4) Every time I am at sea, 5) Once a week when I am at sea, 6) Several times a week when I am at sea, 7) Daily when I am at sea, 8) Do not know/not relevant

We made an index of these questions, by adding the three items. Answer alternative 8 "Do not know/not relevant" was excluded when we made the index.

Table 7.2 below, we compare mean scores for different groups on this variable. The minimum value is 3 (never) and the maximum value is 21 (daily when I am at sea). The average score is 6.4 points.

Table 7.2: Means on the demanding working conditions index. The minimum value is 3 (never) and the maximum value is 21 (daily when I am at sea).

Value	Age group	Vessel type	Position/line of work	Port calls per week	Manning level	Org. safety culture
1	Younger than 31 years	Bulk	Captain	1-3	1-2 people	18-69
Score	6.5	5.9	7.3	6.2	-	8.6
2	31-40	General cargo	Deck personnel	4-6	3-4 people	70-75
Score	7.5	6.2	5.8	5.8	8.3	7.2
3	41-50	Tank vessel	Engine personnel	7-9	5-6 people	76-80
Score	5.9	7	6.2	7.4	6.4	6.5
4	51-60	Well vessel	Other	10-12	7-8 people	81-85
Score	6.2	6.8	6.4	6.4	5.5	6.3
5	Older than 60 years	Other	-	13-15	9-10 people	86-90
Score	4.3	6	-	6.7	-	4.9
6	-	-	-	>15	11-12 people	
Score	-	-	-	6.5	-	
P value	.054	.589	.084	.532	.014	.000

Table 7.2 indicates significant differences between respondents with different scores on the organisational safety culture variable and on the manning level variable. Results indicate that respondents with low organisational safety culture scores experience most demanding working conditions. The same applies to respondents working on vessels manned with 3-4 people. Finally, Table 7.2 also indicates significant differences (at the 10 %-level) between respondents' with different age groups and positions/lines of work. Respondents between 31-40 years old and captains experience more demanding working conditions.

3.4.3.4. Which factors predict demanding working conditions?

In Table 7.3 we show results from a hierarchical, linear regression analysis, where independent variables are included to examine respondents' collective experiences of demanding working conditions. The dependent variable varies between 3 (never) and 21 (daily when I am at sea).

Table 7.3: Linear regression. Dependent variable: demanding working conditions index. The dependent variable varies between 3 (never) and 21 (daily when I am at sea).

Variables	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
Age group	-.136*	-.138*	-.213***	-.197**	-.201**	-.176**
Vessel type (Other=1, Tank vessel=2)		.051	.071	.057	.026	.031
Position (Captain=1, Other=2)			-.250***	-.232***	-.201**	-.253***
Port calls				.085	.085	.018
Manning level					-.168**	-.098
Org. safety culture						-.381***
Adjusted R2	.013	.009	.061	.062	.084	.217

* p < 0.1** p < 0.05 *** p < 0.01

First, we see that respondents' age contributes significantly and negatively to their responses on the index for respondents experiences of demanding working conditions.

Second, we see that that respondents' positions/lines of work contributes significantly and negatively to their responses on the index for respondents experiences of demanding working conditions. This indicates that, controlled for the other variables in the model, being a captain makes you more prone to experience demanding working conditions.

Third, not surprisingly, we see that manning level contributes significantly and negatively to respondents' responses on the demanding working conditions index. This means that for each value on the manning level variable, the value on the index decreases with .168 points, controlled for the other variables in the model. Manning level ceases however to contribute significantly when organisational safety culture is included in step 6.

Finally, we see in Step 6 that the most important predictor of respondents' experiences of demanding working conditionsis organisational safety culture. This variable contributes significantly and positively at the 1 %-level. For each value on the organisational safety culture variable, the value on the index decreases with .381 points, controlled for the other variables in the model.

Moreover, when organisational safety culture was taken into the analysis in Step 8, the Adjusted R^2 value rose to .217 indicating that the variables in the model explains about 22 % of the variation in the dependent variable. The majority of this is explained by the organisational safety culture variable, as the Adjusted R^2 value in Step 5 was .084.

7.3 Summing up

The research literature indicates that fatigue is an important safety risk in the maritime sector. Reference group members stressed that fatigue and manning level are among the most important factors influencing maritime safety in Norwegian waters, and interviewees discussed whether fatigue is a result of long periods at sea (e.g. 6-9 months), watch schedules (6-6 watch) or daily work load (many port calls).

The small-scale survey indicates that the 6-6 watch schedule is the most prevalent watch system among our respondents from all positions and lines of work on board, especially among captains. We also found that respondents generally stay on board for about four weeks with four weeks leave. They have on average 14 port calls per week.

We made an index of respondents' experiences of shift delays, 16-hours of continuous work and interrupted rests. First, we saw that the older respondents are, the more seldom they experience these things. Second, being a captain makes you more prone to experiencing of shift delays, 16-hours of continuous work and interrupted rests. Third, not surprisingly, we saw that manning level reduced the occurrence of these experiences, until organisational safety culture was included in the analysis. Finally, the most important predictor of respondents' experiences of demanding working conditions was organisational safety culture: a good safety culture reduced the occurrence of these experiences.

8 Safety management system

The second aim of the study is to survey variables influencing organizational factors in order to examine relationships between them and point to the most important factors influencing occupational safety on Norwegian vessels. We did not find the items measuring safety management systems to influence occupational safety in Chapter 4. We nevertheless examine the variables influencing safety management systems in the current chapter, as the importance of safety management systems has been highlighted in previous research.

8.1 Results from interviews

In the interviews it was stressed that all SOLAS vessels (International Convention for the Safety of Life at Sea) are required to have a safety management system (SMS). The SMS requirements (ISM code amendments 2010) states that vessels must map risk factors and activities that may involve risks and remove the risks or implement compensating measures, e.g. reduced exposure, protective equipment. Additionally, continuous improvement of the SMS is required in addition to reporting of nonconformities in order to improve the system. However, one interviewee stated that the will to report nonconformities is a general challenge.

Norwegian rules and regulations in this area offer some specifications going beyond the basic ISM code requirements. Norwegian authorities have also implemented EU rules and introduced safety management system requirements for smaller vessels

8.2 Results from small-scale survey

8.2.1 Risk assessment, procedures and training

As noted above, the AIBN underline the importance of safety management systems (SMS), consisting of three elements: 1) Risk assessments of critical operations, which provide the basis for 2) Job descriptions/procedures describing hazards and 3) A training programme preparing employees for hazards.

Respondents were asked about these elements. The first question was: "Who participates in risk assessments of work operations on your vessel?" (Figure 8.1). The answer alternatives were not mutually exclusive.

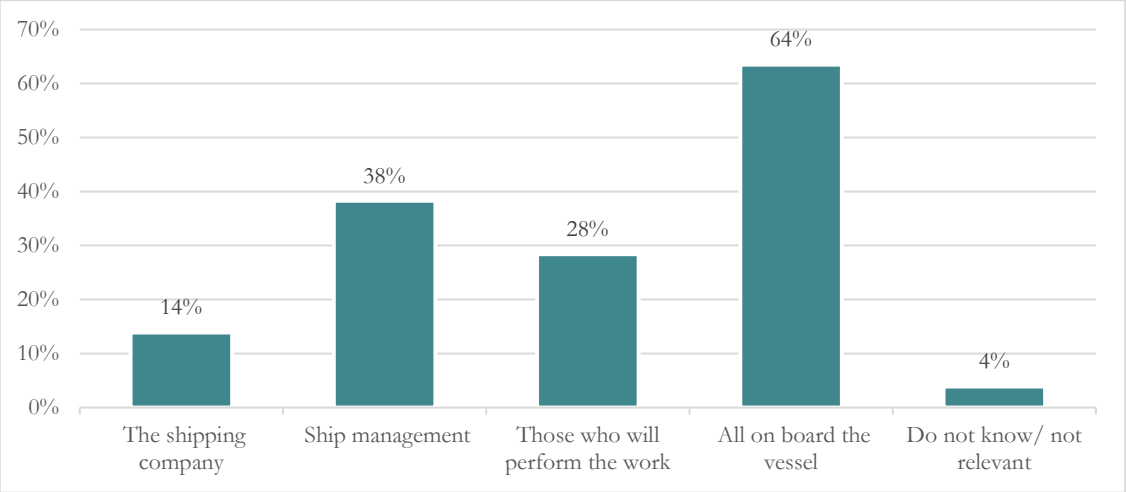


Figure 8.1: "Who participate in risk assessments of work operations on your vessel?". The answer alternatives were not mutually exclusive. N=180.

We see that the most prevalent answer is all on board the vessel.

Respondents were also asked questions about job descriptions and training: "On this vessel we have job descriptions/ procedures that describe the hazards of various work assignments" and "All crew members on board receive adequate training to work in a safe way" (Figure 8.2). The latter question is included in the organisational safety culture index.

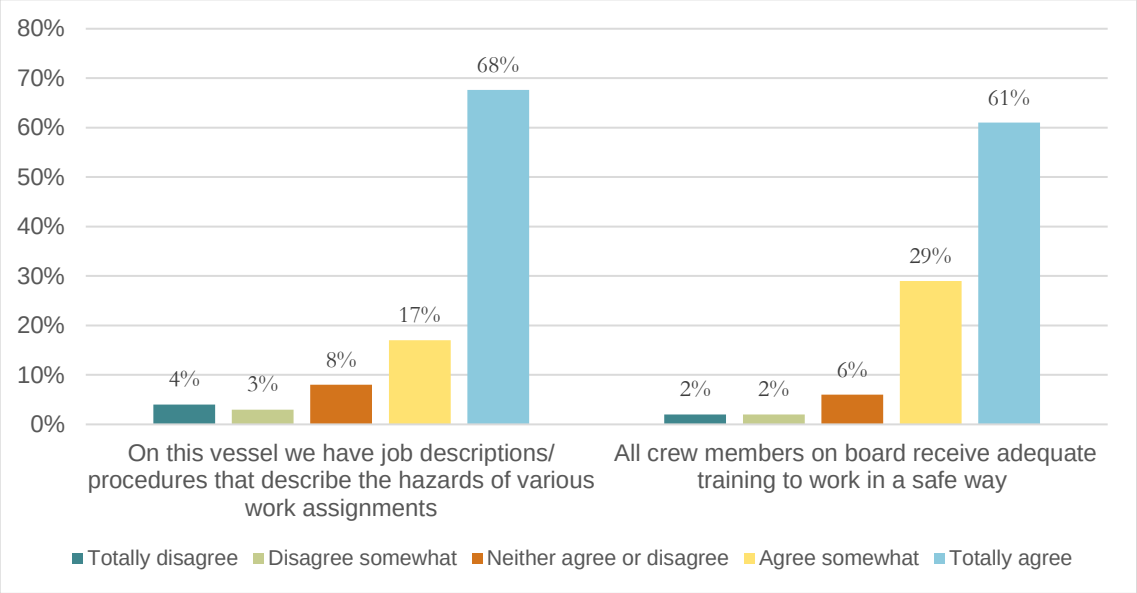


Figure 8.2: "On this vessel we have job descriptions/ procedures that describe the hazards of various work assignments" and "All crew members on board receive adequate training to work in a safe way". (N=180)

In Table 8.1 we compare the mean score for different groups on the variable: "On this vessel we have job descriptions/ procedures that describe the hazards of various work assignments". The minimum value is 1 (totally disagree) and the maximum value is 5. The mean value is 4.4 points.

Table 8.1: Means on the variable: "On this vessel we have job descriptions/ procedures that describe the hazards of various work assignments". The minimum value is 1 (totally disagree) and the maximum value is 5 (totally agree).

Value	Age group	Vessel type	Position/line of work	Manning level	Org. safety culture
1	Younger than 31 years	Bulk	Captain	1-2 people	18-69
Score	4.2	4.5	4.5	-	3.7
2	31-40	General cargo	Deck personnel	3-4 people	70-75
Score	4.3	4.2	4.5	3.8	4.2
3	41-50	Tank vessel	Engine personnel	5-6 people	76-80
Score	4.6	4.3	4	4.5	4.7
4	51-60	Well vessel	Other	7-8 people	81-85
Score	4.5	4.3	4.3	4.5	4.5
5	Older than 60 years	Other	-	9-10 people	86-90
Score	4.3	4.6	-	-	4.7
6	-	-	-	11-12 people	
Score	-	-	-	-	
P value	.501	.613	.118	.021	.000

Table 8.1 indicates that manning level and organisational safety culture are related to procedures describing hazards. The higher manning level, the more respondents agree that they have job descriptions/ procedures that describe the hazards of various work assignments. Moreover, we also see that the higher organisational safety culture scores, the more respondents agree that they have procedures describing hazards.

8.2.2 Which factors predict procedures describing hazards?

In Table 8.2 we show results from a hierarchical, linear regression analysis, where independent variables are included to examine factors predicting respondents' answer to the question: "On this vessel we have job descriptions/ procedures that describe the hazards of various work assignments". The dependent variable varies between 1 (totally disagree) and 5 (totally agree).

Table 8.2: Linear. Dependent variable: "On this vessel we have job descriptions/ procedures that describe the hazards of various work assignments". The dependent variable varies between 1 (totally disagree) and 5(totally agree). Standardized beta coefficients.

Variables	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
Age group	.095	.098	.110	.119	.122	.083
Vessel type (Other=1, Tank vessel=2)		-.042	-.058	-.036	-.023	-.024
Position (Other=1, Engine personnel=2)			**-.177****	**-.187****	**-.173****	**-.176****
Manning level				.096	.102	.040
Risk assessment ("all on board")					**.156****	.119
Org. safety culture						**.302*****
Adjusted R2	.003	-.001	.025	.027	.046	.129

* p < 0.1** p < 0.05 *** p < 0.01

First, we see that respondents' position (i.e. engine personnel) contributes significantly and negatively to their answers on the question: "On this vessel we have job descriptions/ procedures that describe the hazards of various work assignments". This indicates that engine personnel to a lesser extent than other groups on board perceive that there are job descriptions/procedures describing the hazards of their work.

In Step 5, we see that the variable "all on board participate in risk assessment" contributes significantly and positively to procedures describing hazards. It is interesting to see that these two variables are related, as we noted above that the AIBN underlines that risk assessments and procedures are two of three key element which make up safety management systems. Risk assessments ceases, however, to be significant when we include organisational safety culture in Step 6.

Finally, in Step 6 we see that the most important predictor of respondents' answers to the question "On this vessel we have job descriptions/procedures that describe the hazards of various work assignments" is organisational safety culture. This variable contributes significantly and positively at the 1 %-level. This indicates a relationship between safety culture and safety structure, between formal and more informal aspects of maritime safety.

Moreover, when organisational safety culture was taken into the analysis in Step 6, the Adjusted R^2 value rose to .129 indicating that the variables in the model explains about 13 % of the variation in the dependent variable. Most of this is explained by the organisational safety culture variable, as the Adjusted R^2 value in Step 5 was .046.

8.3 Summing up

The ISM Code requires vessel operators to implement an ISM Code compliant Safety Management System (SMS). The 2010 amendments to the ISM Code focus heavily on the identification and assessment of risk. According to the 2010 amendments, shipping companies and masters have a considerable responsibility when it comes to maintaining an updated and comprehensive SMS, focusing on proactive and regularly updated risk assessments, procedures and corrective actions.

Nævestad et al. (2015) studies all reports from the AIBN between 01.01.2009 and 01.01.2014, and find that lack of complete, written risk assessments was the most frequently occurring risk factor in the AIBN reports.

Given the AIBNs' focus on risk analyses, procedures and training as key elements in safety management systems, respondents were asked about these factors. A total of 64 % answered "all on board the vessel", when asked "Who participate in risk assessments of work operations on your vessel?". Moreover, 61 % totally agreed that "All crew members on board receive adequate training to work in a safe way", while 68 % totally agreed that: "On this vessel we have job descriptions/ procedures that describe the hazards of various work assignments".

We conducted analyses to examine factors predicting respondents' answer to the question on procedures describing hazards. First, we found that engine personnel to a lesser extent than other groups on board perceive that there are job descriptions/procedures describing the hazards of their work. Second, we found that the most important predictor of respondents' answers to the question is organisational safety culture, indicating a relationship between safety culture and safety structure, between formal and informal aspects of maritime safety.

9 Concluding discussion

9.1 Aims and methods of the study

The present study focuses on organizational influences on occupational safety on vessels registered in the Norwegian Ordinary Ship Register (NOR).

The aims of the study are to:

1) Survey organizational factors and other factors influencing occupational safety on Norwegian vessels.
2) Survey variables influencing organizational factors in order to examine relationships between them and point to the most important factors influencing occupational safety on Norwegian vessels.

The study employs three methods to fulfil the study aims:

1) interviews with sector experts
2) reference group meeting
3) survey directed at seafarers.

9.2 Occupational safety

In this study, *occupational safety* refers to the following variables:

1) Personal injuries occurring while at work (1 item).
2) Perception of risk related to work place hazards (2 items).
3) Safety compromising fatigue (1 item).
4) Procedure violations and lacking use of procedures (survey summing up 3 items).

Personal injury is the most important measure of occupational safety. Our survey indicates that 17 % of our respondents (N=180) had been injured in their work on board in the course of the last two years.

We found that the following variables influenced seafarers' risk of injuries on board:

1) Age: The older the seafarers are, the less likely they are to have been injured in the last two years.
2) Position: Deck crew/apprentices were more inclined to be injured than others
3) Vessel type: crew members of well vessels were more inclined to be injured
4) Manning level: The higher manning level, the lower was the risk of personal injuries
5) Organisational safety culture: The better safety culture the respondents report, the less likely it is that they have had an injury in the last two years.

Interestingly, we see that only the two latter variables, manning level and organisational safety culture are what we refer to as organisational factors. The three former variables predicting seafarers' risk can be attributed to individuals or vessels.

We found, however, that respondents' risk perceptions largely were predicted by organisational factors. The following variables influenced respondents' perception of risk: 1) Respondents' experiences of safety-compromising fatigue, 2) Perception of work pressure, 3) Organisational safety culture, 4) Experiences of demanding working conditions (i.e. shift delays, 16-hours of continuous work and interrupted rests).

The research literature indicates that fatigue is an important safety risk in the maritime sector, and that is rooted in framework, organisational and working conditions, as well as individual characteristics and life outside of work. Seafarers share several important work characteristics influencing fatigue, for instance long working hours and sleep disturbances, due to for instance motion, noise and night work.

Respondents were asked to rate their agreement with the statement: "Sometimes I am so tired during working hours that safety is compromised". We conducted analyses to examine factors influencing respondents' experiences of safety-compromising fatigue. First, we found that the older seafarers are, the less likely they are to report of safety-compromising fatigue. Second, deck personnel are more likely to be fatigued in manners that may compromise safety. Third, we found that having a good safety culture decreases the risk of safety-compromising fatigue. Finally, we found that respondents' experiences with demanding working conditions is the most important predictor of safety-compromising fatigue. Thus, we see that respondents' experiences with safety compromising fatigue is influenced by both individual factors and organisational factors

9.3 Organisational factors

Organisational factors are defined as formal and informal aspects of seafarers' work organizations, which may influence occupational safety. In this study, organisational factors refer to the following variables:

1) Organisational safety culture (index summing up 18 items).

2) Manning level on vessels (1 item).

3) Work pressure (1 item).

4) Demanding working conditions (index summing up 3 items).

5) Working hours and rest on board (3 items).

6) Safety management system (2 items on work procedures and risk analyses)

Organisational safety culture. We made an organisational safety culture index, consisting of 18 questions from the Global Aviation Information Network (GAIN)-scale (GAIN 2001), and we used this in our survey.

Our analyses indicate that organisational safety culture is the most important organisational factor, predicting all of the aspects of occupational safety: 1) Personal injuries, 2) Worry about risk, 3) Assessment of the safety of the work place situation, 4) Safety compromising fatigue and 5) Lacking procedure use and procedure violations. We also found organizational safety culture to be a key predictor of (other) organisational factors, e.g. 6) Work pressure, 7) Demanding working conditions and 8) Procedures describing hazards.

The importance of organisational safety culture for several safety outcomes, was also highlighted in the research literature and in the interviews. Culture, attitudes, knowledge, skills and risk understanding are factors that are important when it comes to explaining safety behaviour among crew members on board ships and the ship accident risk of vessels.

Manning level. Manning level predicts seafarers' risk of personal injuries: The higher manning level, the lower was the risk of personal injuries. Respondents were asked several question about the manning level on board their vessels. Our sample is too little for comparison and generalization, as we analysed manning numbers based on the unique vessels in our sample (calculations were made based on the captains in the sample). Keeping this in mind, we saw that the average manning level on vessels less than 500 dwt is 4.3, while it is 5.9 on vessels between 500 and 3,000 dwt.

Above, we saw that manning level predicts seafarers' risk of personal injuries: The higher manning level, the lower was the risk of personal injuries. Although differences between the shares are not statistically significant, vessels manned by 3-4 people had the highest share of crew members who had been injured in the last two years (26 %). The corresponding numbers for vessels manned by 5-6 people was 20 %, while it was 7 % for vessels manned by 7-8 people.

Data from the small-scale survey indicates that the vessels with low manning (3-4 people) score lower on many of our variables measuring occupational safety and organisational factors. Seafarers on vessels with a manning of 3-4 people rate the safety level of their work place as lower than other respondents (Mean: 7.3 versus 8.6 points) (P=0.00). Seafarers on vessels with a manning of 3-4 people also rate their organisational safety culture as lower than other respondents.

Although not all results were statistically significant, we saw that seafarers working on board vessels manned by 3-4 people reported more pressure to work even though it is not perfectly safe, they agreed less that they get sufficient sleep and rest on board, they experience more often demanding working conditions, and they report of higher levels of safety-compromising fatigue. Future research should examine occupational safety and organisational factors on vessels with low manning (3-4 people) in order to be able to implement measures to improve safety. We expand on this below.

Demanding working conditions and work pressure. Demanding working conditions (i.e. experiences of shift delays, 16-hours of continuous work and interrupted rests) was the most important predictor of safety compromising fatigue.

We made an index measuring respondents' demanding working conditions and we analysed the factors influencing this index. First, we found that older respondents are less inclined to experience these things. Second, being a captain makes seafarers more prone to demanding working conditions. Third, we saw that higher manning levels reduced the occurrence of these experiences, until organisational safety culture was included in the analysis. Finally, the most important predictor of respondents' demanding working conditions was organisational safety culture: a good safety culture reduced the occurrence of these experiences.

Results indicate a close relationship between manning level, work pressure, demanding working conditions and organisational safety culture. Respondents were asked to rate their agreement with the statement: "Sometimes I feel pressured to continue working, even if it is not perfectly safe". We conducted analyses to examine factors influencing this variable, and found that organisational safety culture was the strongest predictor. A good organisational safety culture seems to reduce unsafe work pressure. We also found a relationship between unsafe work pressure and respondents' experiences of demanding working conditions. The more often respondents experience demanding working conditions, the more they agree with the statement "Sometimes I feel pressured to continue working, even if it is not perfectly safe".

9.4 The importance of other factors for occupational safety

We also found that factors that are not organisational are important for the occupational safety of the seafarers in our sample. We also examine the influence of four *"non-organisational factors"* on occupational safety (aim 1) and on organizational factors (aim 2):

1) Seafarers' position/line of work (1 item).

2) Seafarers' age (1 item).

3) Vessel type (1 item).

4) Vessel age (1 item).

5) Number of port calls per week (1 item).

The age groups of the respondents influence several different aspects of occupational safety. We found a relationship between age and personal injuries; the older respondents are, the less likely they are to have been personally injured in the last two years. We also found a relationship between age and fatigue; older seafarers (>60 years) are less likely to have experienced safety-compromising safety, perhaps as they reported of less demanding working conditions.

Our analyses also indicate that respondents' positions/lines of work influence several different aspects of occupational safety. Deck crew and apprentices were more likely to have experienced personal injuries in the last two years. Second, senior crew members (Captain, Deck Officer, Chief Engineer) were more worried about the risks on board than other crew members. Third, engine personnel agreed less than other groups that there were job descriptions/ procedures describing hazards of work assignments. Fourth, we found a relationship between line of work and fatigue; engine personnel were more inclined to sometimes be so tired during working hours that safety is compromised than other groups on board. Finally, captains were more inclined to have experienced demanding working conditions.

9.5 Questions for future research

9.5.1 Which factors influence organisational safety culture?

We conclude that organisational safety culture is the most important safety predictor in our sample, predicting, e.g. injuries, risk perception, fatigue, procedure violations, working

conditions and work pressure. Thus, if we know how to facilitate good safety culture on Norwegian vessels, we may be able to influence several safety relevant outcomes.

We therefore conducted analyses to examine factors predicting respondents' organisational safety culture scores. We found that the variable "Sometimes I feel pressured to continue working, even if it is not perfectly safe" was the only variable which contributed significantly. As noted above, we also found that this variable is influenced by organisational safety culture. Thus, it is difficult to assess the causal relationship between these variables. Our study has been unsatisfactory when it comes to identifying the variables influencing organisational safety culture.

However, it may well be that the organisational safety culture on board the vessels that we have studied follow from the framework conditions of the sector (e.g. market, economy, manning level, work load). Thus, perhaps organizational safety culture interventions would be insufficient? Our results indicate, however, that a good organisational safety involves less demanding working conditions. Thus, perhaps safety culture interventions may help crew members reduce the impact of high workloads, low manning and fatigue? Future research should examine these questions. Below, we suggest that studies of working conditions on vessels with low manning levels could help us answer these questions. It is important to note, however, that these merely are hypotheses for further research.

9.5.2 Working conditions on vessels with low manning levels

Reference group members considered fatigue and manning level to be among the most important risk factors in maritime transport. They stated that the small NOR ships transporting goods along the coast of Norway have low manning, considerable work pressure and scarce time. This may lead to too high workloads and fatigue, they suggested. Increase in the administrative burden were also emphasized as factors that may lead to fatigue on board Norwegian vessels.

As noted above, data from the small-scale survey indicates that the vessels with low manning (3-4 people) score lower on many of our variables measuring occupational safety and organisational factors. Seafarers on vessels with a manning of 3-4 people rate the safety level of their work place as lower than other respondents. They also rate their organisational safety culture as lower, they report of more pressure to work even though it is not perfectly safe, they agreed less that they get sufficient sleep and rest on board, they experience more often demanding working conditions, and they report of higher levels of safety-compromising fatigue.

These results could perhaps be interpreted as data supporting the hypothesis coined by our interviewees and references group members; suggesting that the small NOR ships transporting goods along the coast of Norway have low manning, considerable work pressure and scarce time, resulting in negative safety outcomes.

It is important to note that we do not examine whether manning levels are too low on these vessels, we merely compare occupational safety and organisational factors. When interpreting results, it is also important to note that numbers are small in the sample of vessels manned by 3-4 people (N=19), although results indicate a tendency of higher scores on variables measuring occupational safety and organisational factors with increasing values on the manning level variable. Thus, results must be interpreted with caution and further research is required to examine the importance of manning level for occupational safety and organisational factors.

Why and how do manning levels matter for occupational safety? Why do vessels with low manning score lower on safety outcomes and variables measuring organisational factors. The qualitative data indicates, as mentioned, that economic framework conditions are an important explanation. But is this because more work pressure is caused by challenging economic framework conditions? Moreover, to what extent is it possible to reduce the impact of challenging framework conditions by means of safety culture interventions?

Additionally, it is relevant to ask the vessels with lower manning have fewer resources available for managing safety than larger vessels? Finally; perhaps implementing formal safety management systems is seen as less important on small crew vessels, as crew size allows for coordination and management to take place through direct informal contact? Our results indicate that the higher manning level the vessels have, the more respondents agree that they have job descriptions/ procedures that describe the hazards of various work assignments. These questions should be examined in future research.

9.5.3 Is company size an organizational risk factor?

One of the main results presented above is that vessels with low manning level (3-4) people score lower than other vessels on several organisational factors. A previous study of work-related accidents (Nævestad et al. 2015), also suggest that small crews may be a work-related risk factor in the maritime sector, although this study defines small crews as one person. This report found that one person on board vessel was a frequently mentioned risk factor in the reports from the Accident Investigation Board Norway, often involving accidents with small fishing vessels manned with one person, who is typically the owner.

Nævestad et al. (2015) suggest that future research should examine the consequences of company size for safety. The AIBN-reports studied by Nævestad et al. (2015) often seem to find that small companies have underdeveloped and/or unclear organisational structures, for instance with one person filling several perhaps contradictory roles (e.g. owner/transport operator). We do, however, not know the prevalence of such organisational structures in organisations that have not been involved in accidents. Nevertheless, the importance of company size was also indicated in some of the other data sources that Nævestad et al. (2015) rely on.

Future research should examine whether the implementation of safety management systems require a certain company size, as several AIBN reports point to underdeveloped safety management systems in small transport organisations. Do small companies have poorer administrative resources for managing risk than larger companies, and what are the consequences of this for safety?

Finally, it should be noted that from a societal perspective it is interesting to ask whether authorities regulating transport safety should pay most attention to small companies with high risk or big companies with low risk. It is not always given where the highest potential for prevention of work-related transport accidents is. However, given that most companies in Norway are small or intermediate, special attention should probably be devoted to safety measures in smaller companies.

9.5.4 How important are safety management systems for occupational safety?

According to the 2010 amendments to the ISM code, shipping companies and masters have a considerable responsibility when it comes to maintaining an updated and comprehensive Safety management system (SMS), focusing on proactive and regularly updated risk assessments, procedures and corrective actions. The AIBN points to three key elements in safety management systems: 1) risk analyses, 2) procedures and 3) training. Respondents were therefore asked about these factors.

We conducted analyses to examine factors predicting respondents' answer to the question on procedures describing hazards, and found that the most important predictor of respondents' answers to the question was organisational safety culture,

Additionally, we made an index of three statements about procedure violations and lacking use of procedures. Again, we found that organisational safety culture was the most important predictor. A good safety culture reduces the occurrence of procedure violations and lacking use of procedures. These results indicates a relationship between safety culture and safety structure; between formal and informal aspects of maritime safety.

Nævestad et al. (2015) study all reports from the Accident Investigation Board for maritime transport in Norway (AIBN) between 2009 and 2014, and find that lack of complete, written risk assessments was the most frequently occurring risk factor in the AIBN reports. Although accident investigations often conclude that proper risk assessments would have identified the relevant risks, it is not given that vessels which have not been involved in accidents on average have better SMS than those which have had accidents. More research is needed to examine the importance of SMS for safety.

In a systematic review of the effectiveness of SMS in the transport sectors, Thomas (2012) concludes that little empirical research evidence has been presented to determine the impact on safety of a structured SMS. Thomas' (2012) review found 2.009 articles, but only 37 of these were directly relevant to the objectives of his investigation. Although several of the 37 reviewed studies found that organisations with a certified SMS had significantly lower accident rates, there was a lack of agreement about which components of a safety management system individually contributed the most to safety performance. Thus, we may conclude that SMS seem important for safety, but that more research is needed to examine this, including *how* SMS is important for safety (i.e. identifying the SMS elements influencing safety).

10 References

Alderton, T. & Winchester, N. (2002). Globalisation and de-regulation in the maritime industry. Marine Policy, 26(1), pp. 35–43.

Allen, P., Wadsworth, E. & Smith, A. (2008). Seafarers' fatigue: a review of the recent literature, International maritime health, Vol. 59, pp. 81-92.

Antonsen, S. (2009a). The relationship between culture and safety on offshore supply vessels, Safety Science, Vol. 47. Issue 8, pp. 1118-1128.

Antonsen, S. (2009b).Safety Culture And The Issue Of Power, Safety Science, Vol. 47(2), pp. 183-191.

Cox, S.J. & Flin, R. (1998). Safety Culture: Philopher's Stone or a Man of Straw?, Work & Stress, Vol 12, No 3, pp. 189.

Flin, R., Mearns, K., O'Connor, P. & Bryden, R. (2000). Measuring safety climate: identifying the common features, Safety Science 34 (2000), pp. 177-192.

Guldenmund, F.W. (2000). The Nature of Safety Culture: a Review of Theory and Research, Safety Science, vol. 34, pp. 1-14.

Guldenmund, Cleal, F. B. & Mearns, K. (2013). An exploratory study of migrant workers and safety in three European countries, Safety Science, Volume 52, pp. 92–99.

Hale, A.(2000). Editorial: Culture's Confusions, Safety Science, vol. 34, pp. 1-14.

Hetherington, C., Flin, R. & Mearns, K. (2006). Safety in shipping: The human element. Journal of Safety Research, 37(4), pp. 401-411.

Hovi, I. B. & Hansen, W. (2011). Rammebetingelser i transport- og logistikkmarkedet. Betydning for kostnadsnivå og konkurransekraft, TØI-rapport 1150/2011, Oslo: Transportøkonomisk institutt.

Håvold, J.I. (2000). Culture in maritime safety, Maritime Policy & Management 27 (1), pp. 79-88.

Håvold, J. I. (2003). National cultures, safety culture and risk: a study of seafarers working for Norwegian shipping companies. Ålesund University College Memo.

Håvold, J. I. (2005). Safety-culture in a Norwegian shipping company. Journal of Safety Research, 36, pp. 441-458.

Håvold, J.I. & E Nesset (2009). From safety culture to safety orientation: validation and simplification of a safety orientation scale using a sample of seafarers working for Norwegian ship owners Safety Science 47 (3), 305-326

Håvold, J.I. (2010b), Safety culture and safety management aboard tankers Reliability Engineering & System Safety 95 (5), pp. 511-519.

Håvold, J.I. (2010c). Safety culture aboard fishing vessels, Safety science 48 (8), pp. 1054-1061.

Håvold, J.I., Nesset, E. & Strand, O. (2011). Safety Attitudes and Safety Ambivalence among officers from the Philippines and Norway, Safety Science Monitor 15 (1), pp. 1-15.

Lamvik, G. & Ravn, J.E. (2004). Living safety in drilling: How does national culture influence HES and working practice? A cultural comparison of working practices among offshore entrepreneurs in South East Asia and the North Sea – what are the differences and what is there to learn?, Trondheim: Sintef Industrial Management.

Lützhöft, M., Thorslund, B., Kircher, A. & Gillberg, M. (2007). Fatigue at sea - A field study in Swedish shipping (No. 586A). Linköping: Swedish National Road and Transport Research Institute (VTI).

MAIB (2004). Bridge watch keeping safety study: Marine Accident Investigation Branch, UK.

Mostad, L.T. (2009). Håndtering av målkonflikter i bøyelast: Et casestudie av hvordan rederi og oljeselskap tilrettelegger for at sikkerhet kan prioriteres av ledende offiserer ombord på bøyelastere, Masteroppgave, Senter for teknologi, Innovasjon og Kultur, Universitetet i Oslo.

Norwegian Maritime Authority (2014). Fokus på risiko. Sjøfartsdirektoratets årlige risikovurdering, gjennomført våren 2014. Sjøfartsdirektoratet Haugesund, september 2014.

Nævestad, T.-O. (2010). Cultures, crises and campaigns: examining the role of safety culture in the management of hazards in a high risk industry, Ph.D. dissertation, Centre for Technology, Innovation and Culture, Faculty of Social Sciences, University of Oslo.

Nævestad, T.-O. & T. Bjørnskau (2012). How can the safety culture perspective be applied to road traffic?, Transport Reviews, 2012, 32(2), pp. 139-154.

Nævestad, T.-O., Caspersen, E., Hovi, I.B., Bjørnskau, T. & Steinsland, C. (2014). Ulykkesrisikoen til norskopererte godsskip i norske farvann, TØI-rapport 1333/2014, Oslo: Transportøkonomisk institutt.

Nævestad, T.-O., Elvebakk, B. & Bjørnskau, T. (2014). Traffic safety culture among bicyclists – Results from a Norwegian study, Safety Science, 2014, 70, pp. 29-40.

Nævestad, T.-O., Phillips, R.O., Elvebakk, B., Bye, R.J. & Antonsen, S. (2015). Work-related accidents in road sea and air transport: prevalence and risk factors, TØI report 1428/2015, Oslo: Transportøkonomisk institutt.

Nævestad, T.O. (2016). Safety in maritime transport: Is flag state important in an international sector?, TØI report 1500/2016, Oslo: Transportøkonomisk institutt.

Perrow, C. (1999). Normal Accidents: Living with High-Risk Technologies, Princeton, New Jersey, Princeton University Press.

Phillips, R.O. (2015). A review of definitions of fatigue. And a step towards a whole definition. Transport Research Part F. 29, pp. 48-56.

Phillips, R.O., Nævestad, T.-O. & Bjørnskau, T. (2015). Fatigue in operators of land- and sea-based transport forms in Norway. Literature review and expert opinion. Fatigue in Transport Report III. TØI-rapport 1395/2015.

Phillips, R.O. (2014a). An assessment of studies of human fatigue in land and sea transport TØI-rapport 1354/2014.

Phillips, R.O. (2014b). What is fatigue and how does it affect the safety performance of human transport operators? TØI-rapport 1351/2014.

Pidgeon, N. & O'Leary, M. (2000). Man-Made Disasters: why technology and organisations (sometimes) fail. Safety Science, 34, pp. 15-30.

Psarros, G., Skjong, R., & Eide, M. S. (2009). Under-reporting of maritime accidents. Analysis & Prevention. Vol. 42(2), pp. 619-25.

Reason, J. (1997). Managing the Risk of Organisational accidents, Aldershot: Ashgate.

St.meld. nr. 31 (2003-2004). Vilje til vekst – for norsk skipsfart og de maritime Næringer http://www.regjeringen.no/nb/dep/nhd/dok/regpubl/stmeld/20032004/stmeldnr-31-2003-2004-/2.html?id=404553.

Størkersen, K.V., Bye, R.J. & Røyrvik, J.O.D. (2011). Sikkerhet i fraktefarten. Analyse av drifts- og arbeidsmessige forhold på fraktefartøy, NTNU Samfunnsforskning AS, Studio Apertura, Trondheim: NTNU.

Appendixes

Appendix 1: Interview guide

Appendix 2: Small-scale survey

Appendix 3: Information about the survey

Appendix 1: Interview guide

I) Introduksjon

Transportøkonomisk institutt gjennomfører en undersøkelse som heter Safe Foreign Transport, som er finansiert av Forskningsrådets Transikk program. Prosjektet startet i januar 2013 og varer ut april 2016.

Prosjektets hovedmål er å vurdere om økningen av utenlandske aktører som transporterer gods på veg og sjø i Norge har effekt på ulykkesrisiko, og bidra med kunnskap som norske myndigheter kan bruke for å utvikle risikoreduserende tiltak.

Vi har tidligere gitt ut rapporter om trafikkarbeid og risiko. Nå jobber vi med en sluttrapport som skal gi svar på tre spørsmål:

1) hva er sikkerhetskonsekvensene av internasjonalisering til sjøs?
2) Hva er betydningen av ulike risikofaktorer og sikkerhetsutfordringer?
3) Hvilke tiltak kan myndighetene iverksette for å møte disse?

Vi bruker følgende metoder for å svare på spørsmålene:

A) Litteraturstudie,
B) Ekspertintervjuer
C) Liten spørreundersøkelse.

Det er selvfølgelig frivillig å delta og du kan trekke deg fra undersøkelsen når du ønsker. Informasjonen du gir oss behandles anonymt. Det du sier skal ikke kunne knyttes til deg. Vi kommer til å referere til deg som «sektorekspert» i rapporten. Vi er ikke ute etter din arbeidsplass «offisielle syn» på saken, men dine egne erfaringer og tanker.

Du får fremstillingen til gjennomlesning, slik at du kan kommentere og rette opp i eventuelle feil før rapporten publiseres. I tillegg understreker vi at hensikten med intervjuene er å supplere informasjonen fra de andre datakildene vi bruker i studien og gjøre oss oppmerksomme på ulike sammenhenger og hypoteser vi kan studere videre. Vi oppmuntrer derfor de vi intervjuer til å «tenke høyt» basert på sin egen erfaring og kunnskap.

II) Ulykker og risiko

1) Har du inntrykk av at skip fra ulike flaggstater har ulik risiko for skipsulykker i norske farvann?
2) Synes du at flaggstat er en meningsfull indikator på ulykkesrisiko?
3) Har du inntrykk av at skip fra ulike operatørstater har ulik risiko for skipsulykker i norske farvann?
4) Har du inntrykk av at mannskap fra ulike land har ulik risiko for skader?

III) Risikofaktorer og sikkerhetsutfordringer

I det følgende skal vi gå gjennom en del risikofaktorer som har blitt undersøkt i forskningen på internasjonalisering og sikkerhet til sjøs, og så skal jeg spørre deg hvorvidt disse forholdene kan være aktuelle på skip i norske farvann, og i så fall hvordan de kan ha konsekvenser for sikkerhet. Hvis du ikke har synspunkter på eller kunnskap om et tema, hopper vi over det og går til neste.

5) Nasjonal sikkerhetskultur:

- Tror du at det finnes kulturelle forskjeller mellom grupper av mannskap med ulik nasjonalitet på skip i norske farvann?
- Hva går disse forskjellene i så fall ut på?
- Og har slike forskjeller konsekvenser for sikkerhet, tror du?

6) Kommunikasjon

- Har du inntrykk av at ulike morsmål mellom mannskapsgrupper og dårlige engelskkunnskaper har konsekvenser for sikkerhet i norske farvann?

7) Kompetanse og opplæring:

- Har du inntrykk av at mannskapsgrupper med ulike nasjonaliteter har ulik opplæring og kompetanse?
- Har dette konsekvenser for sikkerhet?
- Har norske sjøfolk bedre kompetanse enn utenlandske til å seile i norske farvann?

8) Lange arbeidsperioder og fatigue

- Kan du si noe om forskjeller i arbeidsperioder for norske og utenlandske sjøfolk?
- Hva skyldes de ulike lengdene og hva er konsekvensene, tror du?

9) Sikkerhetsstyringssystemer

- Har du kunnskap om sikkerhetsstyringssystemer: 1) risikoanalyser, 2) prosedyrer og 3) opplæring) på ulike skip og om kvaliteten på dem eventuelt varierer?
- Årsaker til variasjon på kvalitet?

10) Arbeidsforhold og bemanning

- I hvilken grad er det ulik bemanning på skip som seiler under norske og utenlandske flagg?

11) Konkurranse

- I hvilken grad konkurrerer norske og utenlandske skip på det samme markedet?
- Har dette konsekvenser for sikkerheten?

12) Teknologi og utstyr

- Er det forskjeller i skipenes alder, teknologi og utstyr, når man sammenlikner den norske flåten med de utenlandskregistrerte skipene som også seiler i norske farvann?-
- Har dette konsekvenser for sikkerhet?

13) Implementering og håndhevelse

- I hvilken grad foreligger det ulike regler på skip som seiler under ulike flagg i norske farvann, f.eks. som gjelder bemanning?
- Har dette konsekvenser for sikkerhet?

IV) Syn på nåværende regulering av maritim sikkerhet

14) Nasjonal implementering og håndhevelse

- Synes du at den nasjonale implementeringen og håndhevelsen av internasjonale sikkerhetsregler fungerer godt nok?
- Hvorfor/hvorfor ikke? –og hva bør gjøres?

15) Havnestatskontroller

- Synes du at havnestatskontrollene fungerer godt nok til å luke ut skip med høy risiko?
- Hva bør evt. gjøres for å forbedre dette?
- I hvilken grad nektes skip med høy risiko å gå inn i norske havner i dag?

16) Klasseselskap

Kvaliteten på klasseselskapene varierer sterkt.

- Har dette konsekvenser i norske farvann?
- Går det skip fra de dårligste klasseselskapene i norske farvann?
- Kan det forhindres?

V) Syn på mulige framtidige tiltak

17) Internasjonal implementering og håndhevelse

- Er det en god ide om IMO overtar implementering og håndheving fra flaggstater. (lik utdanning av inspektører til havnestatskontroll)

18) Tiltak mot flaggstatene med høyest risiko

- Hvilke tiltak bør settes inn mot flaggstatene med høyest risiko?
  - Bøter til skip som blir holdt igjen.

19) Tiltak for å sikre god kommunikasjon

Kommunikasjon er en viktigs sikkerhetsutfordringen på skip med flere nasjonaliteter.

- Er det realistisk å kreve et bestemt nivå av engelskkunnskaper (og test?) av mannskapene og at evt. rederiene skal gi opplæring?
- I hvilken grad gjøres dette av rederier og i nasjonal opplæring i dag?

Appendix 2: Small-scale survey

Spørreskjema om sikkerhetskultur og sikkerhet til sjøs

Med finansiering fra Norges Forskningsråd gjennomfører Transportøkonomisk Institutt en undersøkelse om sikkerhet og sikkerhetskultur på land og sjø.

Undersøkelsen på landsiden er gjennomført, nå er turen kommet til sjøtransporten. Undersøkelsen retter seg mot de ansatte om bord. For å få et best mulig resultat er det viktig at så mange som mulig besvarer spørsmålene.

Transportøkonomisk institutt (TØI) går i undersøkelsen inn på sikkerhetskultur og andre forhold som kan påvirke sikkerhet til sjøs (feks. arbeidstid, trøtthet, kommunikasjon, stress, kompetanse og bemanning). Undersøkelsen går ut til alle rederier som er medlemmer av Fraktefartøyenes Rederiforening (Kystrederiene). **Spørsmålene skal besvares av alle som arbeider om bord på skip**.

Undersøkelsen fokuserer ikke på personer, skip eller rederier. Resultatene rapporteres kun som gjennomsnittsverdier på gruppenivå. Hensikten med denne delen av prosjektet er å kartlegge sikkerhet og sikkerhetskultur i fraktefarten, og vurdere betydningen av nasjonalitet for sikkerhet blant mannskap og mellom skip. Det tar om lag 15-20 minutter å svare på undersøkelsen.

Det er frivillig å delta. Opplysningene behandles konfidensielt. Den tekniske gjennomføringen av spørreskjemaundersøkelsen foretas av MiPro. Forskerne får utlevert data fra MiPro uten tilknytning til e-post/IP-adresse.

På forhånd takk! Spørsmål eller kommentarer kan rettes til: Tor-Olav Nævestad, Transportøkonomisk institutt, e-post: ton@toi.no.

	Spørsmål	**Svaralternativer**
1) Bakgrunnsspørsmål		
1	Kjønn	
2	Hva er din nåværende stilling?	1) Kaptein 2) Dekksoffiser 3) Dekksmannskap 4) Maskinsjef 5) Maskinoffiser 6) Maskinmannskap 7) Forpleining 8) Lærling 9) Annet

	Spørsmål	**Svaralternativer**
3	Hvilken fartøystype tilhører fartøyet du nå jobber på?	1) Bulk 2) Stykkgods 3) Tank 4) Brønnbåt 5) Supply båt 6) Stand by fartøy 7) Ankerhåndteringsfartøy 8) Annet, spesifiser
4	Hvor mange jobber på fartøyet?	
5	Hvor mange personer jobber i rederiet, omtrent?	
6	Hva er størrelsen på fartøyet du er på nå?	1) Mindre enn 500 dwt 2) 500-3000 dwt 3) Mer enn 3000 dwt
7	I hvilket skipsregister er fartøyet ditt registrert?	1) NOR 2) NIS 3) Antigua & Barbuda 4) Bahamas 5) Bermuda 6) Gibraltar 7) Kypros 8) Hong Kong Liberia 9) Marshall Islands 10) Panama 11) Singapore 12) Annet, spesifiser……
7	I hvilket land ligger rederiet hvor du er ansatt?	…..
	Omtrent hvor mange ansatte er det i rederiet du jobber i?	….
8	Hvor mange års erfaring har du fra sjømannsyrket?	1) Mindre enn ett år 2) 1-3 år 3) 4-10 år 4) 11-15 år 5) Mer enn 15 år

	Spørsmål	**Svaralternativer**
9	Hva er din nasjonalitet?	1) Norsk 2) Annet nordisk land 3) Annet land fra det vestlige Europa 4) Annet land fra sentral/øst Europa 5) Asia 6) Amerika 7) Annet land enn de øvrige kategorier
10	Hva er din alder?	1) Yngre enn 31 år 2) 31-40 3) 41-50 4) 51-60 5) Eldre enn 60 år
SIKKERHETSKULTUR MED GAIN-INDEKS		
Spørsmål om sikkerhet i bedriften. Her følger noen spørsmål om sikkerhet i bedriften. På en skala fra 1-5 der 1 er helt uenig og 5 helt enig, hvordan stiller du deg til følgende påstander?		
1) Ledelsens innstilling til og fokus på sikkerhet: Fartøysledelsen/rederiet		
1	Fartøysledelsen oppdager mannskap som ikke arbeider på en sikker måte	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
2	Fartøysledelsen gir ofte ros til mannskap som arbeider sikkert	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
3a	Fartøysledelsen er klar over de viktigste sikkerhetsproblemene vi har om bord	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
3b	Rederiet er klar over de viktigste sikkerhetsproblemene vi har om bord	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
4	Fartøysledelsen stanser farlige arbeidsoppdrag og aktiviteter	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
5a	Fartøysledelsen betrakter sikkerhet som svært viktig i alle arbeidsoppdrag og aktiviteter om bord	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
5b	Rederiet betrakter sikkerhet som svært viktig i alle arbeidsoppdrag og aktiviteter om bord	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
2) Ansattes innstilling til og fokus på sikkerhet		
6	Mine kolleger om bord gjør alt de kan for å unngå uønskede hendelser og ulykker	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig

	Spørsmål	**Svaralternativer**
7	Mine kolleger om bord rapporterer vanligvis om alle sikkerhetsmessige mangler og farlige situasjoner som de opplever i arbeidet	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
3) Rapporteringskultur og reaksjoner på hendelsesrapportering		
8	Det finnes rutiner (prosedyrer) om bord slik at jeg kan rapportere om sikkerhetsmessige mangler eller avvik	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
9	Etter at en ulykke eller et uhell har skjedd om bord blir det tatt forholdsregler slik at dette ikke skal skje igjen	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
10	Alle feil og mangler som blir rapportert blir utbedret i løpet av kort tid	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
11	Alle om bord har nok av muligheter til å komme med forslag vedrørende sikkerhet	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
4) Trening/opplæring i sikkerhetstenkning		
12	Alle ombord får tilstrekkelig opplæring til å arbeide på en sikker måte	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
13	Alle nyansatte får tilstrekkelig opplæring for de arbeidsoppgavene de skal gjøre	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
14	Alle om bord blir informert om enhver endring som kan påvirke sikkerheten	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
5) Generelle sikkerhetsspørsmål i den aktuelle organisasjon		
15	Sikkerheten på dette fartøyet er bedre enn på andre fartøy	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
16	Sikkerheten om bord er generelt godt ivaretatt	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
Nasjonalitet, språk, kommunikasjon og sikkerhet		
1	Hvor mange nasjonaliteter arbeider om bord på ditt fartøy (fra Sjøfartsdirektoratet/Safetec)	1) Én eller to nasjonaliteter 2) Tre til fem nasjonaliter 3) Flere enn fem nasjonaliteter
2	Omtrent hvor stor andel av kollegene dine har en annen nasjonalitet enn deg selv?	1) 0-24 % har annen nasjonalitet, 2) 25-49 % har annen nasjonaliet. 3) 50-74 % har annen nasjonalitet, 4) 5) 75-100 % av kollegene har annen nasjonalitet

	Spørsmål	**Svaralternativer**
3	Hvilket arbeidsspråk benyttes på ditt fartøy? (fra Sjøfartsdirektoratet/Safetec)	1) Norsk 2) Engelsk 3) Annet, spesifiser….
4	Forekommer det språklige misforståelser mellom ulike nasjonaliteter om bord?	1) Aldri 2) Nesten aldri 3) Annenhver gang jeg er ute 4) Hver gang jeg er ute 5) En gang i uka når jeg er ute 6) Flere ganger i uka når jeg er ute 7) Daglig når jeg er ute 8) Vet ikke/ikke relevant
5	Opplever du farlige situasjoner på grunn av språklige misforståelser mellom ulike nasjonaliter om bord?	1) Aldri 2) Nesten aldri 3) Annenhver gang jeg er ute 4) Hver gang jeg er ute 5) En gang i uka når jeg er ute 6) Flere ganger i uka når jeg er ute 7) Daglig når jeg er ute 8) Vet ikke/ikke relevant
6	Har du i ditt arbeid opplevd farlige situasjoner på grunn av «kulturelle forskjeller» mellom ulike nasjonaliteter?	1) Aldri 2) Nesten aldri 3) Annenhver gang jeg er ute 4) Hver gang jeg er ute 5) En gang i uka når jeg er ute 6) Flere ganger i uka når jeg er ute 7) Daglig når jeg er ute 8) Vet ikke/ikke relevant
7	Blanding av flere nasjonaliteter på skip har negative konsekvenser for sikkerheten	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant
8	Utenlandskflaggede skip i norske farvann har dårligere sikkerhet enn norskregistrerte skip	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig
9	Kan du begrunne svaret ditt med et eller flere stikkord	……
Bemanning, fatigue		

	Spørsmål	**Svaralternativer**
1	Hvilken type vaktordning har du når dere er i vanlig operasjon? (Sjøfartsdirektoratet/safetec)	1) 6-6 2) 8-8-4-4 3) 12-12 4) Trevaktsystem 5) Dagvaktsordning 6) Annet, spesifiser
2	Hvilken type seilingsperiode/skiftordning har du? (Sjøfartsdirektoratet/safetec)	1) Uker 2) Måneder 3) Kontrakt
3	Hvor mange uker er du på, og hvor mange uker er du av? (Sjøfartsdirektoratet/safetec)	……. …..
4	Hvor mange måneder er du på og hvor mange måneder er du av? (Sjøfartsdirektoratet/safetec)	……. ……
5	Vennligst spesifiser total bemanning ombord	…..
6	Vi har til vanlig flere i besetningen enn det som er fastsatt i sikkerhetsbemanningen for fartøyet (Sjøfartsdirektoratet/safetec)	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant
7	Bemanningen om bord er tilstrekkelig til at sikkerheten ivaretas (Sjøfartsdirektoratet/safetec)	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant
8	Hvor ofte tror du at arbeidstiden din overskrider arbeids- og hviletidsreglene?	1) Aldri 2) Nesten aldri 3) Annen hver gang jeg er ute 4) Hver gang jeg er ute 5) En gang i uka når jeg er ute 6) Flere ganger i uka når jeg er ute 7) Daglig når jeg er ute 8) Vet ikke hva reglene sier
9	Hvor ofte arbeider du mer enn 16 timer i løpet av et døgn? (Sjøfartsdirektoratet/safetec. Med endrede svaralternativer)	1) Aldri 2) Nesten aldri 3) Annen hver gang jeg er ute 4) Hver gang jeg er ute 5) En gang i uka når jeg er ute 6) Flere ganger i uka når jeg er ute 7) Daglig når jeg er ute 8) Vet ikke hva reglene sier

	Spørsmål	**Svaralternativer**
10	Hvor ofte blir du avbrutt under din frivakt? (Sjøfartsdirektoratet/safetec. Med endrede svaralternativer)	1) Aldri 2) Nesten aldri 3) Annen hver gang jeg er ute 4) Hver gang jeg er ute 5) En gang i uka når jeg er ute 6) Flere ganger i uka når jeg er ute 7) Daglig når jeg er ute 8) Vet ikke hva reglene sier
11	Hvor ofte er det mulig, ut fra bemanningen om bord, å ha to navigatører på bro? (Sjøfartsdirektoratet/safetec. Med endrede svaralternativer)	1) Kontinuerlig 2) I en kortere periode (under fire timer) 3) Aldri uten å bryte hviletidsbestemmelser 4)Aldri, vi har kun én navigatør om bord
12	Når har dere dedikert utkikk på broa? (Sjøfartsdirektoratet/safetec)	1) Alltid 2) Når det er mørkt 3) Vanskelige værforhold 4) Vanskelig seilas 5) Nedsatt sikt 6) Ukjent farvann
13	Den pålagte hviletiden overholdes alltid av bropersonellet om bord (Størkersen et al 2011)	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) vet ikke/ikke relevant
14	Den pålagte hviletiden overholdes alltid av dekkspersonellet om bord (Størkersen et al 2011)	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) vet ikke/ikke relevant
15	Jeg får tilstrekkelig søvn og hvile om bord (Størkersen et al 2011)	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) vet ikke/ikke relevant
16	Det hender at jeg er så trøtt i arbeidstiden at det går på sikkerheten løs (Størkersen et al 2011)	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) vet ikke/ikke relevant
17	Bemanningen om bord er tiltstrekkelig til at sikkerheten ivaretas (Størkersen et al 2011)	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) vet ikke/ikke relevant
18	Omtrent hvor mange timer i løpet av en vanlig uke bruker du hviletiden til arbeidsoppgaver?	Fritekst antall timer
19	Her om bord jobber vi mer enn det som står oppført i arbeidsplanen	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) vet ikke/ikke relevant
	Økonomi, effektivitet, konkurranse og sikkerhet	
1	Det hender at jeg føler meg presset til å fortsette å jobbe, selv om sikkerheten kan være truet (Størkersen et al 2011)	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant

	Spørsmål	**Svaralternativer**
2	Konkurransen mellom rederiene gjør at vi av og til må bryte sikkerhetsrutinene (Størkersen et al 2011)	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant
3	Rederiet prioriterer alltid sikkerhet fremfor økonomi	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant
4	Fartøysledelsen prioriterer alltid sikkerhet fremfor økonomi	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant
5	Mannskapet prioriterer alltid sikkerhet fremfor økonomi	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant
	Alder og kvalitet på utstyr og fartøy	
1	På mitt fartøy har manglende vedlikehold og dårlig utstyr/teknologi ført til farlige situasjoner (Omformulert fra Sjøfartsdirektoratet/Safetec)	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) vet ikke/ikke relevant
2	Hvilket år omtrent er fartøyet bygd?	1) Før 1980 2) 1980-1985 3) 1986-1991 4) 1992-1997 5) 1998-2003 6) 2004-2009 7) 2010-2015
	Havneanløp, tidspress	
1	Omtrent hvor mange havneanløp har fartøyet du jobber på i løpet av en vanlig uke?	Fritekst: antall
2	Det oppstår gjerne farlige situasjoner når vi ligger til havn på grunn av stress og tidspress	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) vet ikke/ikke relevant
3	Hvor ofte blir vaktskiftet ditt utsatt på grunn av arbeidsoperasjoner, eksempelvis havneanløp? (Sjøfartsdirektoratet/safetec. Med endrede svaralternativer)	1) Aldri 2) Nesten aldri 3) Annen hver gang jeg er ute 4) Hver gang jeg er ute 5) En gang i uka når jeg er ute 6) Flere ganger i uka når jeg er ute 7) Daglig når jeg er ute 8) Vet ikke hva reglene sier
	Kompetanse, nasjonalitet og sikkerhet	
1	Norske sjøfolks kompetanse gjør dem bedre i stand til å seile i norske farvann enn andre	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant

	Spørsmål	**Svaralternativer**
2	Det er ofte høy trafikktetthet i farvann vi vanligvis seiler i	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) vet ikke/ikke relevant
3	Det er ofte utfordrende værforhold i farvann vi vanligvis seiler i	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) vet ikke/ikke relevant
	Nasjonal kultur	
1	Det forekommer situasjoner hvor det er nødvendig å utsette seg for fare for å få jobben gjort (Størkersen et al 2011)	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant
2	Det å ta opp sikkerhetsforhold blir sett på som unødvendig mas av mannskapet om bord (Størkersen et al 2011)	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant
3	Jeg kritiserer gjerne fartøysledelsens beslutninger, dersom jeg er uenig	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant
4	Det er min egen skyld, hvis jeg blir skadet i arbeidet	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant
5	Det er uklokt å si fra til fartøysledelsen dersom jeg har gjort en feil, eller nesten opplevd en ulykke i arbeidet	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant
6	Det er uhøflig å si til kolleger at de bør arbeide på en annen og sikrere måte	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant
7	Dersom jeg ikke klarer å utføre en arbeidsoppgave til tidsfristen, kan fartøysledelsen tenke at jeg ikke mestrer jobben min	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) Vet ikke/ikke relevant
	Mål på sikkerhetsnivå	
1	Har du i løpet av de to siste årene blitt skadet mens du arbeidet om bord?	1) nei, 2) ja, en liten skade som jeg ikke krevde medisinsk bistand, 3) ja, en skade som krevde medisinsk bistand, 4) ja, en skade som krevde medisinsk bistand og sykemelding
2	Har fartøyet vært involvert i skipsulykker (for eksempel: grunnstøting, kollisjon, brann, kontaktskade) i løpet av de to siste årene?	1) Ja, 2) nei
3	Ble personskaden rapportert til Sjøfartsdirektoratet?	1) Ja, 2) Nei, 3) Vet ikke
4	Ble skipsulykken rapportert til Sjøfartsdirektoratet?	1) Ja, 2) Nei, 3) Vet ikke

	Spørsmål	**Svaralternativer**
5	I hvilken grad bekymrer du deg når du tenker på risikoen forbundet med arbeidet om bord? (Størkersen et al 2011)	1) Svært bekymret, 2) noe bekymret, 3) verken/eller, 4) Lite bekymret, 5) ikke bekymret, 6) vet ikke/ikke relevant
6	Alt i alt, hvordan vil du vurdere sikkerheten i din arbeidssituasjon? (Størkersen et al 2011)	Svært dårlig 1 2 3 4 5 6 7 8 9 Svært bra 10
	Risikoanalyser og prosedyrer	
1	Hvem deltar i risikovurderinger av arbeidsoperasjoner på ditt fartøy? (Sjøfartsdirektoratet/safetec.)	1) Landorganisasjonen 2) Fartøysledelsen 3) De som skal utføre arbeidet 4) Alle om bord på fartøyet 5) Andre 6) Vet ikke/ikke relevant
2	På dette fartøyet har vi arbeidsbeskrivelser/prosedyrer som beskriver farene ved ulike arbeidsopprag	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) vet ikke/ikke relevant
3	Det å bryte prosedyrene får sjelden konsekvenser om bord (Størkersen et al 2011)	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) vet ikke/ikke relevant
4	Jeg benytter aldri skrevne prosedyrer i arbeidet om bord (Størkersen et al 2011)	1) helt uenig, 2) ganske uenig, 3) verken enig eller uenig, 4) ganske enig, 5) helt enig, 6) vet ikke/ikke relevant
	Tusen takk for at du tok deg tid til å svare på spørsmålene!	
	Har du kommentarer til undersøkelsen?	

Appendix 3: Information about the survey

Survey on safety culture and safety at sea

The Institute of Transport Economics is conducting a survey on safety culture and safety at sea and in land based transport.

The survey on land based transport has now been completed, and the time has come to look at sea transport. The survey is aimed at employees on ships. In order to ensure a high quality, it is important that as many ship employees as possible answer the survey.

The Institute of Transport Economics examines safety culture and other factors that may influence maritime safety (e.g. working hours, fatigue, communication, stress, competence and manning). The survey is distributed to all shipping companies which are members of Fraktefartøyenes rederiforening (Kystrederiene). **The questions in the survey must be answered by people working on ships.**

The survey does not focus on individuals, vessels or shipping companies. The results are only reported as mean scores at group levels. The purpose of this part of the survey is to map safety and safety culture in short sea cargo transport, and to examine whether nationality influences safety among crew members and vessels. You will need 15-20 minutes to answer the survey.

Participation is voluntary. The information is treated confidentially. The technical implementation of the survey is conducted by MiPro. The researchers obtain data from MiPro without information about IP-adresses or e-mails.

Thank you very much in advance! Questions or comments can be directed to: Tor-Olav Nævestad, Institute of Transport Economics, e-mail: ton@toi.no.

Spørreskjema om sikkerhetskultur og sikkerhet til sjøs

Med finansiering fra Norges Forskningsråd gjennomfører Transportøkonomisk Institutt en undersøkelse om sikkerhet og sikkerhetskultur på land og sjø.

Undersøkelsen på landsiden er gjennomført, nå er turen kommet til sjøtransporten. Undersøkelsen retter seg mot de ansatte om bord. For å få et best mulig resultat er det viktig at så mange som mulig besvarer spørsmålene. Vi ber derfor om at rederiene videreformidler lenken til spørreskjemaet til alle sine ansatte. Det arbeides med å oversette spørreskjemaet til engelsk, men i første omgang sendes den norske versjonen.

Transportøkonomisk institutt (TØI) går i undersøkelsen inn på sikkerhetskultur og andre forhold som kan påvirke sikkerhet til sjøs (feks. arbeidstid, trøtthet, kommunikasjon, stress, kompetanse og bemanning). Undersøkelsen går ut til alle rederier som er medlemmer av Fraktefartøyenes Rederiforening. **Spørsmålene skal besvares av alle som arbeider om bord på skip.**

Undersøkelsen fokuserer ikke på personer, skip eller rederier. Resultatene rapporteres kun som gjennomsnittsverdier på gruppenivå. Hensikten med denne delen av prosjektet er å kartlegge sikkerhet og sikkerhetskultur i fraktefarten, og vurdere betydningen av nasjonalitet for sikkerhet blant mannskap og mellom skip. Det tar om lag 15-20 minutter å svare på undersøkelsen.

Det er frivillig å delta. Opplysningene behandles konfidensielt. Den tekniske gjennomføringen av spørreskjemaundersøkelsen foretas av MiPro. Forskerne får utlevert data fra MiPro uten tilknytning til e-post/IP-adresse.

På forhånd takk! Spørsmål eller kommentarer kan rettes til: Tor-Olav Nævestad, Transportøkonomisk institutt, e-post: ton@toi.no.

Institute of Transport Economics (TØI)
Norwegian Centre for Transport Research

Established in 1964, the Institute of Transport Economics is an interdisciplinary, applied research centre with approximately 70 professionals. Its mission is to develop and disseminate transportation knowledge that has scientific quality and practical application.

A private, non-profit foundation, TØI receives basic funding from the Research Council of Norway. However, the greater part of its revenue is generated through contract research. An important part of its activity is international research cooperation, mostly in the form of projects under the Framework Programmes of the European Commission.

TØI participates in the Oslo Centre for Interdisciplinary Environmental and Social Research (CIENS) located near the University of Oslo. See www.ciens.no

TØI covers all modes of transport and virtually all topics in transportation, including road safety, public transport, climate change and the environment, travel behaviour, tourism, land use and urban planning, decision-making processes, freight and travel demand, as well as general transport economics.

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