Prosper at Sea: A Proactive Approach to Safety

Stina Hellesund and Vilde Eriksen

MAPSYK360, masterprogram i psykologi,

Studieretning: Sosial- og kognitiv psykologi

ved

UNIVERSITETET I BERGEN

DET PSYKOLOGISKE FAKULTET

SPRING 2020

Antall ord: 17109

Veileder: Evelyn-Rose Saus, Universitetet i Bergen

Biveileder: Bjørn Sætrevik, Universitetet i Bergen

The present study follows the American Psychological Association's 6th edition manual style.

Abstract

Offshore vessels represent one of the most dangerous working environments in the Norwegian offshore industry (e.g. Dahl, Fenstad, & Kongsvik, 2014). In the present study, we have adopted a proactive safety approach using the broaden-and-build theory (Fredrickson, 1998), as the theoretical framework, in which we identify factors that reduce safety, to encourage mitigation of their adverse effects. Our study aims to contribute with a positive approach to maintain safety. We investigate the effects of positive individual characteristics (psychological capital, safety climate, job satisfaction) and cognitive factors (situation awareness and risk perception) on proximal safety outcomes (reporting attitudes and risk behavior) in a safety-critical organization. Using a single wave survey design, 127 employees on board offshore vessels responded to our pre-registered survey. To summarize our results, a multiple linear regression confirms a positive prediction of psychological capital and safety climate on situation awareness (H1), supporting the broaden-and-build effects of positive affect, however, job satisfaction was a non-significant predictor, violating our hypothesized assumption. Secondly, a simple linear regression confirmed a positive relationship between situation awareness and risk behavior (H2). Finally, a mediation analysis revealed that the positive relationship between safety climate and reporting attitudes is partially mediated through job satisfaction (H3). Exploratory regression analyses showed small relationships of situation awareness and risk perception; as well as risk perception and risk behavior. The results suggest that to improve safety, shipping companies should invest in proactive interventions for their crew, which may increase cognitive adaptability, extended knowledge capacities and social cohesiveness.

Keywords: situation awareness, psychological capital, safety climate, safety-critical organizations, broaden-and-build theory

Sammendrag

Offshore-skip representerer et av farligste arbeidsmiljøene i den norske offshore-industrien (e.g. Dahl, Fenstad, & Kongsvik, 2014).. I dette studiet har vi benyttet en proaktiv sikkerhetstilnærming ved å benytte broaden-and-teorien (Fredrickson, 1998) som vårt teoretiske rammeverk, hvorpå vi identifiserer faktorer som reduserer sikkerhet, for å promotere skadebegrensning av deres påvirkning. Studiets mål er å bidra med en positiv tilnærming til sikkerhetsbevaring. Vi undersøker effektene av positive individuelle karakteristikker (psykologisk kapital, sikkerhetsklima, jobbtilfredshet) og kognitive faktorer (situasjonsbevissthet og risikopersepsjon) på tilnærmede sikkerhetsutfall (rapporteringsholdninger og risikoatferd) i en sikkerhetskritisk organisasjon. Ved bruk av enkeltbølgesundersøkelsesdesign, svarte 127 ansatte om bord offshore-skip på vår pre-registrerte studie. For å oppsummere resultatene, ble et predikerende positivt forhold av psykologisk kapital og sikkerhetsklima opp mot situasjonsbevissthet, som støttet effektene av broaden-and-build-teorien av positiv affekt gjennom en multippel lineær regresjonsanalyse (H1). Jobbtilfredshet derimot, var ikke en signifikant predikator av situasjonsbevissthet i motsetning til våre forventinger. Videre bekreftet en enkel lineær regresjonsanalyse et positivt forhold mellom situasjonsbevissthet og risikoatferd (H2). Til sist avslørte en mediasjonsanalyse at det positive forholdet mellom sikkerhetsklima og rapporteringsholdninger er delvis mediert av jobbtilfredshet (H3). Eksplorerende regresjonsanalyser viste svake assosiasjoner mellom situasjonsbevissthet og risikopersepsjon; og mellom risikopersepsjon og risikoatferd. Resultatene våre peker mot at for å forbedre sikkerheten, så burde rederier investere i proaktive intervensjoner for deres ansatte, som vil kunne føre til økt kognitiv fleksibilitet, forbedret kunnskap og sosial samhørighet.

Nøkkelord: situasjonsbevissthet, psykologisk kapital, sikkerhetsklima, sikkerhetskritiske organisasjoner, broaden-and-build-teorien

Acknowledgments

We initiated contact with the shipping company at a festive dinner. The shipping company in question kindly offered to provide us access to their crew and their accident statistics. As time went by, we indulged ourselves in a literature review that resulted in our admiration for the proactive approach to safety and the positive perspective on strengthening individuals as a method of accident prevention. We feel privileged to have been given the opportunity to design and execute our very own research. We would like to thank our supervisors for contributing with valuable insights throughout the process, and for their constructive feedback. We would like to raise a special thanks to the welcoming, witty, and wonderful management group at the shipping company. Without you, this study would never have been possible to execute. We would also like to raise a huge thanks to the employees who chose to participate in our survey.

Thank you, Simen Bø, for organising our thoughts when they reached their peak of chaos. Thank you, Laurence Blair, for proof-reading our rusty English – without you, this paper would not spark as much elegance. Thank you Nanna Karen Gilberg Skram for motivating us through the process and contributing with your reflections. We would both like to thank our dear families for the support you have provided us with. You are very much appreciated.

Contents

Prosper at Sea: A Proactive Approaches to Safety

In 2012, the Norwegian fleet was comprised of 557 offshore vessels, making the offshore sector one of the largest growth areas in the shipping industry (Norwegian Shipowners Association; NSA, 2014). In recent years, there has been a significant globalization of offshore markets, in which half of operating revenues are derived from outside the Norwegian continental shelf, in regions such as Latin America, Asia, and Africa (NSA, 2014). Considering the growth of the offshore industry, the role of safety management and identifying the factors essential for maintaining safety is increasingly important.

Several researchers have argued that the offshore vessels represent one of the most dangerous working environments in the offshore sector in Norway (Dahl, Fenstad, & Kongsvik, 2014; Kongsvik, Fenstad, & Wendelborg, 2012). According to the Norwegian Maritime Directorate (2011), around 750 injuries and 12 fatalities on offshore vessels were reported between the 2000 to 2010. During this period, several high casualty accidents occurred. For instance, in 2000, a collision involving Nordfrakt caused six fatalities, and the sinking of Steinfalk caused three fatalities. In 2003, the capsizing of Kongsting caused four deaths, and the capsizing of Rocknes in 2004 caused eighteen deaths. Lastly, the capsizing of the anchor handling vessel, Bourbon Dolphin, caused eight fatalities in 2007 (Norwegian Maritime Directorate, 2011). Although the frequency of accidents and fatalities in Norway are decreasing (Norwegian Maritime Authority, 2018), it nevertheless remains important to develop applicable knowledge of safety factors in the offshore industry, and to investigate significant causal factors to prevent future accidents.

Three main types of offshore vessels are included in this study: Platform Supply Vessel, Anchor Handling Tug Supply Vessels, and Construction Support Vessels. These vessels serve different functions: for instance, Platform Supply Vessels mainly transport oil field products and supplies to offshore drilling and production installations. The majority of

their cargos consist of fuel, drilling mud, cement, water, and chemicals for drilling operations (Dahl, Fenstad, & Kongsvik, 2014; Norwegian Shipowners Association, 2014). Anchor Handling Tug Supply vessels are used to set anchors for drilling rigs and towing mobile rigs and equipment from one location to another. They are equipped with winches and machinery tailored to anchor handling operations (Dahl et al., 2014; Norwegian Shipowners Association, 2014). Lastly, Construction Support Vessels are comprised of several different vessels designed for underwater operations and construction work, such as diving vessels, well stimulation vessels, pipelaying vessels, construction support vessels, and multipurpose support vessels. These vessels often work with field development for operations and production, as well as installing and repairing subsea installations (Norwegian Shipowners Association, 2014).

The primary tasks for employees on offshore vessels include lifting operations of large containers, handling bulk loading hoses under tough conditions, operating high-tension cranes and wires, navigating vessel locations, supporting and maintaining the vessels' machines, and rescuing personnel after vessel evacuation (Dahl, Fenstad, & Kongsvik, 2014). Ideally, employees in safety-critical organizations such as the offshore industry should be vigilant in their working environment to maintain safety (Valdersnes, Eid, Hystad, & Nilsen, 2017). As an offshore employee, it is important to have control over every situation and stay alert during all operations, as they are working in hazardous and challenging environments, and dealing with complex technology (Dahl et al., 2014). However, employees in offshore vessels work in tough conditions with long hours and solitary shifts. Working onboard for several weeks at a time, employees live at their workplace, with limited contact with people outside of their working environment. Employees report experiencing long shifts, boredom, fatigue, lack of motivation, high stress levels, feeling restrained by enclosed work facilities, and feeling as if they are never off work, even when their shift is over (e.g. Ulleberg & Rundmo, 1997;

Valdersnes et al., 2017). Such factors influence employees' mental and physical health, motivation, and their working performance abilities, thus increasing the risk of accidents.

Accidents as Human Error

Human error may be understood as injuries and events caused by limitations in human information processing systems, resulting in a mismatch between individual behavior and the demands of the system (Rundmo, 2018). Initially, Reason (2000) demonstrated two ways of viewing human error: the person approach and the system approach. The person approach emphasizes that deviating mental processes, such as inattention, forgetfulness, poor motivation, carelessness, recklessness, and negligence, are the primary cause of unsafe actions. In contrast, the system approach is based on the idea that humans are fallible, and errors are expected to occur in any organization (Reason, 2000). Furthermore, the system approach emphasizes the view that errors are consequences of recurrent error traps in the workplace. According to this approach, when system defenses fail, inquiries should concern how and why they failed, rather than who is to blame. In other words, the person approach distinguishes error as a moral issue in which someone is responsible for the event, while the system approach focuses on the dynamic nature of the conditions in which humans operate, rather than individual accountability (Reason, 2000). In accordance with the system approach, Dekker (2001) suggested that improvements to safety originate from an understanding of how system defenses are connected, as safety is not an inherent quality of any system but created by people at all levels of an operational organization. A central characteristic of this new view of human error is that systems themselves essentially are contradictions between multiple goals that are attended at the same time (Dekker, 2001). Further, Dekker emphasized the importance of acknowledging that individuals' behavior is rational when they find themselves in a certain situation, although it may be deemed erroneous when analyzed in hindsight and

outside of the situation. By understanding human error as a result of weaknesses in the systems' defense layers, we can better investigate why an accident occurred to get a better understanding of how to develop safety in the organization.

Unexpected versus Unforeseen Accidents

Safety-critical situations and accidents are defined as the negative consequences of unexpected and unforeseen events (Rundmo, 2018). Unexpected events are similar to previous accidents, and the information we gain from the event can be used to foresee the severity and causal factors for future events. Operators in safety-critical situations often use their knowledge and experience from previous accidents to understand, predict, and prevent future events (Rundmo, 2018). However, it can be hard to predict when incidents may occur, as accidents occur infrequently. Unforeseen events, on the other hand, are unpredicted events that have not previously occurred, and can be seen as a side effect of an organization's operational planning (Rundmo, 2018). It may be difficult to predict the specific characteristics, causal factors and the severity of unforeseen events, and it is hard to foresee the probability of occurrence due to a lack of experiences from similar negative outcomes and events (Rundmo, 2018). Human errors, unforeseen and unexpected events, and active and latent failures tell us something about *what* characterizes an accident and *why* they occur.

Safety Barriers and The Swiss Cheese Model

Organizations have many defensive layers whose function is to protect from hazards. Reason (1990) illustrated the potential threats to safety through the Swiss cheese model, consisting of several layers (i.e. safety barriers) in which the holes (i.e failed defenses), as they are continually opening, shutting, and relocating, represent possible threats to the safety layers in the organization. When holes of the cheese layers align, they allow a straight trajectory to form, making accidents and hazards more likely to occur (Reason, 2000). The

holes emerge as a result of active failures (e.g. unsafe actions, such as slips, fumbles, mistakes, and procedural violations conducted by employees) and latent failures (i.e. dormant conditions created by designers and management; Reason, 2000). The latent failures can lie dormant for long periods of time, until they at one point affect the system negatively, by either having an error-provoking effect on the workplace (e.g. time pressure, operator fatigue, operators' inexperience, inadequate equipment) or causing long-lasting weaknesses in the systems (e.g. untrustworthy alarms, unworkable procedures, and design and construction deficiencies; Reason, 2000). Due to the unpredictable nature of active failures, they will be hard to foresee, while latent conditions are easier to identify and predict. Consequently, understanding and resolving latent conditions is essential for a proactive approach to maintaining safety, and the Swiss cheese model is a helpful tool to achieve an understanding of when accidents could occur (Reason, 2000). Moreover, with the assumption that active failures are linked to errors of individual factors (e.g. situation awareness, decision-making, risk perception, and risk behavior), investigating this relationship may give us valuable information about why accidents caused by active failures occur, and how to reduce their prevalence. In the offshore industry it is essential to maintain safety barriers to prevent accidents (Bergheim, Nielsen, Mearns, & Eid, 2015).

Safety-Critical Organizations

Safety-critical organizations involve work settings that are prone to accidents, injuries, stress, and other harmful health outcomes (Hystad, Bartone, & Eid, 2014). The offshore industry is identified as incorporating many safety-critical organizations, in which employees operate in hazardous settings that require intensive use of technology, stressful working environments, complex operations, and high professional knowledge, while concurrently being vulnerable to human and organizational errors and challenges (Tharaldsen, Olsen, &

Rundmo, 2008; Hystad et al., 2014). Notably, both offshore installations and vessels are located far out to sea, limiting the accessibility of fire rescue and medical aid, which may cause additional stress to hazardous situations (Høivik, Tharaldsen, Baste, & Moen, 2009). One of the hazardous risks related to the working conditions at offshore installations is the involvement of flammable substances in the production, which can result in fires and explosions (Høivik et al., 2009). Safety-critical organizations need to be better prepared than other organizations for accidents, which is why it is important to investigate which factors compose possible threats to the safety barriers in an organization. Due to the high potential of risks connected to safety-critical organizations, many organizations have focused on accident prevention by facilitating resources towards the improvement of employee safety at the workplace (Hystad et al. 2014), such as implementing safety protocols and procedures (Nielsen, Mearns, Matthiesen, & Eid, 2011) as well as training of personnel (Tharaldsen et al., 2008).

Psychological Capital

Psychological capital (PsyCap) emerged in the field of positive organizational behavior, as a construct indicating positive work motivation in an organization (Hystad, Bartone & Eid, 2014; Bergheim, Nielsen, Mearns, & Eid, 2015). PsyCap consists of positive characteristics that are recognized as resources of an organizational motivation that reinforce safety-focused behavior in safety-critical organizations, such as the offshore industry (Eid, Mearns, Larsson, Laberg, & Johnsen, 2012). Employees with high levels of PsyCap can use these positive resources as a toolbox when faced with challenges. PsyCap consists of four personality dimensions: hope, self-efficacy, resilience, and optimism (abbreviated HERO; e.g. Eid et al. 2012, Hystad et al., 2014).

According to Snyder, Irving, and Anderson (1991) hope consists of two components: a tendency to invest energy into goal-directed behavior (i.e. agency) and envision pathways to succeed. Individuals with high levels of hope, in comparison to those with low levels, employ a more goal-oriented motivation and behavior to succeed at a specific task in a given context to reach their goals. Further, they have a greater capacity to develop alternative pathways to reach their goals when faced with obstacles (Snyder et al., 1991; Avey, Wernsing, & Luthans, 2008; Eid, Mearns, Larsson, Laberg, & Johnsen, 2012; Newman, Ucbasaran, Zhu, & Hirst, 2014). Likewise, employees with more hope address a task or challenge that encourages the motivation needed to achieve success (Avey et al., 2008).

Self- efficacy is based on Bandura's social cognitive theory (e.g Avey, Wernsing, & Luthans, 2008; Newman, Ucbasaran, Zhu, & Hirst, 2014), and can be defined as "The employee's conviction or confidence about his or her abilities to mobilize the motivation, cognitive resources, or courses of action needed to successfully execute a specific task within a given context" (Stajkovic & Luthans, 1998, p. 66). Individuals with high levels of self-efficacy have more confidence in their ability to control the outcomes in a safety-critical situation, and to succeed in the difficult challenges they encounter (Newman et al., 2014; Eid, Mearns, Larsson, Laberg, & Johnsen, 2012). Furthermore, to enhance employee's self-efficacy, the focus should be placed on mastering tasks, role modeling, and increasing social support (Avey et al., 2008).

Resilience is defined as "the positive psychological capacity to rebound, to 'bounce back' from adversity, uncertainty, conflict, failure, or even positive change, progress and increased responsibility" (Luthans, 2002 p. 702). Although resilience resembles other positive constructs (e.g. hardiness, self-efficacy, and hope), there are some notable differences. For instance, self-efficacy is considered proactive, while resilience on the other hand can be considered reactive. Resilience can be similar to the pathways of hope, but it does not contain

the dimensions of hope (Luthans, 2002). Highly resilient employees have a strong ability to positively adapt and thrive in challenging situations (Avey, Wernsing, & Luthans, 2008). Hystad, Bartone, and Eid (2014) suggested that resilient employees contribute to increasing positive safety-focused attitudes and behaviors, through their commitment and motivation for positive work outcomes, despite conflicts and temptations to be time-efficient at the expense of safety procedures.

Lastly, optimism refers to the tendency to think positively about the future, and the ability to recognize the value of change to improve safety in certain situations (Eid, Mearns, Larsson, Laberg, & Johnsen, 2012; Hystad, Bartone, & Eid, 2014). Optimistic individuals make individual attributions of positive expectancies of achieving success, even when faced with challenges, or in processes of organizational change (Avey, Wernsing, & Luthans, 2008; Newman, Ucbasaran, Zhu, & Hirst, 2014). These positive expectancies work as motivators when pursuing goals and resolving safety-critical situations (Seligman, 1998; Newman et al., 2014). Furthermore, the conceptual framework of optimism is based on the theory that individuals experiencing positive outcomes and success are likely to make internal attributions, while negative outcomes and failures are likely to be explained by external and unstable attributions (Seligman, 1998; Avey et al., 2008). Based on this notion, optimistic employees experiencing a failure might remain motivated to succeed, as the failure is not attributed to their ability, but rather to a specific challenge that is unlikely to occur again (Avey et al., 2008).

The positive resources that form PsyCap are considered more stable than emotions, but less fixed than personality traits (Luthans, Avey, Avolio, & Peterson, 2010; Bergheim, Nielsen, Mearns, & Eid, 2015). Thus, the four constructs that constitute PsyCap are considered to be relatively stable, yet open for development (Luthans, Avolio, Avey, &

Norman, 2007), which indicate that the features can be improved by training (Newman, Ucbasaran, Zhu, & Hirst, 2014; Bergheim, Nielsen, Mearns, & Eid, 2015).

Schaubroeck, Riolli, Peng, and Spain (2011) conducted a cross-sectional survey of US armed forces personnel who had been exposed to traumatic events. They found that PsyCap was able to predict health outcomes (anxiety, phobic anxiety, somatization, and depression), and appraisal of stress (challenge, threat, and loss) in the soldiers 15 months after traumatic exposure. For instance, individuals in the same military unit with higher levels of PsyCap reported lower levels of threat and loss, and higher levels of challenge. Their findings suggest that although individuals with higher PsyCap will experience feelings of threat and loss, however, their perceptions of how stressful the situation is, will differ. Furthermore, they found that PsyCap was positively related to positive affect, which the authors propose may be a partial indication of the broaden-and-build tendency of positive emotionality as resilience traits (Schaubroeck, Riolli, Peng, & Spain, 2011).

The relationship between psychological captial and safety. Previous research has found that the motivational states of PsyCap are related to organizational effectiveness and desired work outcomes (Newman, Ucbasaran, Zhu, & Hirst, 2014), as well as job performance and satisfaction (Luthans, Avolio, Avey, & Norman, 2007). These factors may feasibly contribute to maintaining safety at the workplace.

As previously mentioned, Avey, Wernsing, and Luthans (2008) found that the employees' positive resources (PsyCap and positive emotions) can reduce the negative reactions associated with the impairment of organizational change, such as cynicism and deviance. Additionally, the results indicate that the employee's positive resources are associated with positive attitudes and behavior (i.e. emotional engagement and organizational citizenship), indicating that individuals with higher levels of PsyCap may facilitate a

proactive approach for positive organizational change, which is critical for employees acceptance and commitment for effective improvements of organizational systems (Avey et al., 2008). Based on this short review, individuals with higher PsyCap play an integral part in fostering positive employee motivation, as well as facilitating employees' positive resources, which can reduce adverse outcomes of safety-critical situations (e.g. limiting risk behavior), as well as strengthening the employees' positive reactions (i.e. promoting a positive safety climate and improving reporting attitudes). Furthermore, as employees with higher PsyCap experience more positive affect, we can expect that they utilize a wider array of thought-behavior repertoires, which in turn may result in additional positive attitudes and behavior. Arguably, individuals with higher PsyCap may be better at handling changes in their work environment concerning working conditions or organizational safety regulations by being more motivated and open for change. Moreover, by utilizing positive resources, the employees might be better at acknowledging the value of organizational change to increase safety, as well as being more encouraged to comply with the safety regulations of their work environment.

Safety Climate

Organizational climate involves employees' evaluations and shared perceptions of selected features of their work environment, such as policies that define strategic goals, procedures that provide guidelines to achieve specified goals, and practices that relate to the enactment of policies and procedures (Zohar, 2000; Zohar, 2010). Moreover, an organization has many goals, procedures, and practices, which form multiple domain-specific climates, such as safety climate (Zohar, 2000). Organizational climate has been found to impact individual work motivation, effort, and performance, indicating that employees who view

their work environment as safe will be more involved, committed, and motivated to perform well in their work (Brown & Leigh, 1996).

A related construct is safety culture, which is considered a complex and stable phenomenon that reflects on individual values, norms, assumptions and expectations concerning safety that are shared by the team (Mearns, Flin, Gordon, & Fleming, 1998). Safety climate, on the other hand, is used to describe individuals' perceptions, attitudes and beliefs about the risks and safety in an environment (Mearns & Flin, 1999). Employees' perception of the management's commitment to safety and safety priorities is based on the enactment of the existing procedures and regulations (Zohar, 2000). Consequently, it has been argued that the main difference between safety culture and safety climate is that safety culture entails how individuals behave within an organization, whilst safety climate reflects on how it feels to be a member in an organization (Mearns et al., 1998).

Notably, it is argued that safety culture should be assessed with the use of qualitative methods, such as interviews, observations and fieldwork, whilst safety climate is usually measured in the form of questionnaires (Tharaldsen, Olsen, & Rundmo, 2008). Measuring safety climate through this form of research provides a "snapshot" of the current state of the safety culture in the organization (Mearns, Flin, Gordon, & Fleming, 1998; Mearns & Flin, 1999; Tharaldsen et al., 2008).

Safety climate is a resource that makes the employees feel safer by reducing the negative effects of their work environment through its capacity to motivate safe behavior, thus making the workplace more stable and controllable (Nielsen, Mearns, Matthiesen, & Eid, 2011). Correspondingly, lower levels of safety climate contribute to an unstable work situation, thus making the employees feel less safe due to the greater risk of a hazardous incident occurring (Nielsen et al., 2011).

Neal, Griffin, and Heart (2000) found that knowledge and motivation mediated the relationship between safety climate and safety performance, meaning that an improvement of employees' knowledge and safety motivation can strengthen the relationship between safety climate and performance. Understanding the shared perceptions of safety-related issues across workgroups and organizations can offer cues of expected behavior and outcomes related to safety (Griffin & Curcuruto, 2016). Previous research has shown that safety climate influences safety motivation, risk behavior, and safety outcomes (e.g. Griffin & Curcuruto, 2016). Similarly, Jiang, Lavaysse, and Probst (2018) also demonstrated the well-established positive relationship between safety climate and safety behavior, as well as a negative relationship between safety climate and risk perception, and accident frequency. Hystad, Bartone, and Eid (2014) conducted a study in which the importance of leadership's influence on safety climate was highlighted. They observed that those who worked in teams with authentic leaders tended to assimilate their leaders' emotions, attitudes, and motivation towards executing safety-focused behavior.

Job satisfaction and safety climate. Job satisfaction is defined as an affective or emotional reaction to how employees feel or the attitudes they hold about their current job tasks and work environment (Nielsen, Mearns, Matthiesen, & Eid, 2011). Previous studies have demonstrated that tough working conditions are negatively related to job satisfaction, for instance, employees who experience more workplace stressors tend to be less satisfied with their job (Sullivan & Bhagat, 1992). Equally, such tendencies have been found in safety-critical organizations. For instance, findings reveal that offshore personnel who encounter more job-related stress are less satisfied with their job (Ulleberg and Rundmo, 1997).

Also, employees with high levels of safety climate tend to be more satisfied with their job (Nielsen, Mearns, Matthiesen, & Eid, 2011). Employee satisfaction is related to the degree

an organization prioritizes the security needs in the workplace (i.e. safety climate). For instance, if there are inconsistencies between the organization and employees' perception of safety and the organization fails to meet the needs of the employees, it may result in less favorable attitudes and lower job satisfaction (Morrow & Crum, 1998).

Risk Perception

Risk perception refers to an individual's perception of the likelihood of the occurrence of a specific hazardous event, as well as how concerned they are with the outcomes of such an event (Nielsen, Mearns, Matthiesen, & Eid, 2011). In 2017, the Norwegian Maritime Authority found that six out of 25 hazardous accidents on vessels were considered high-risk events, such as collisions, grounding, capsizing, fire, falls overboard, and crush and impact injuries. Accordingly, to get an accurate understanding of employees' risk perception, it is essential to measure the perceived likelihood of an event by portraying scenarios that are likely to occur in their job environment. Risks and dangers in the offshore industry are composed of a combination of hazardous situations that can be shared with other safety-critical organizations and, as those specific to the maritime industry (Nielsen et al., 2011). Although extremely hazardous situations are rare, they are still considered a consistent threat to safety (Nielsen et al., 2011). Examples of possible risks and dangers involve threats to the structural installation, fires, explosions, blowouts, accidents associated with the transport of personnel and supplies, dangers associated with drilling operations, diving accidents, and falls (Rundmo, 1996b, Nielsen et al., 2011).

Rundmo (1996b) conducted a study in which employees in the offshore industry were asked to rate their risk perceptions concerning "regular occupational incidents" (e.g. falling objects or crushing by machinery) and major accidents (e.g. fires, explosions, and blowouts). Results showed that 64 % of the employees felt safe concerning regular occupational

incidents. Moreover, with respect to major accidents and disasters, 66 % of the employees reported feeling safe.

Mearns, Rundmo, Flin, Gordon, and Fleming (2004) compared risk perceptions across two groups with different nationalities, namely Norwegian and British offshore workers. Their findings suggested that risk perception is more influenced by safety climate and their experiences, than culture and location. Although being exposed to the same working environment, the employees demonstrated differing evaluations of organizational and psychosocial conditions.

Risk perception and safety. Tharaldsen, Olsen, and Rundmo (2008) found a negative relationship between the overall scores of risk perception and safety climate, suggesting that employees with higher perceived risks have more negative perceptions of safety climate. More specifically, the sub-dimensions of safety climate that showed a negative correlation with risk perception were system comprehension, safety management and involvement. Moreover, they found a positive relationship between risk perception and accident rates: when accident rates are high, the employees also view the potential risk of accidents as high (Tharaldsen et al., 2008). Correspondingly, the negative relationship between risk perception and safety climate was also supported by Hystad, Bartone, and Eid (2014) indicating that the employees who recognize the safety climate as positive will perceive the likelihood of accidents occurring as lower. Their findings suggest that more accidents occur when the employees perceive safety climate as negative.

Further, Rundmo (1995) found that employees at offshore installations who had previously been injured, as well as employees with higher accident records tended to feel less safe, had fewer positive perceptions of safety climate, and experienced more job stress than they did before the accident. Similarly, another study demonstrated that those who had

experienced a near-miss reported having higher levels of risk perception, as well as lower safety climate and job satisfaction (Nielsen, Mearns, Matthiesen, & Eid, 2011). Interestingly, this trend was not found among those who had experienced accidents. Moreover, Rundmo (1996a) suggested that having inaccurately biased perceptions of risk (i.e. having a risk perception that does not correspond to the actual threats of the environment) could cause miscalculations of potential hazardous situations, which could result in unfortunate risk behavior, actions, and decisions.

Furthermore, Mearns and Flin (1995) reported that the perceived risks and organization stressors contributed to accidents and injuries among offshore employees. Moreover, the results showed that job satisfaction, safety attitudes, and safety climate affected the employees' risk perception. Moreover, Mearns and Flin (1995) theorized the socio-cognitive model of risk perception (displayed in Figure 1), in which both social and cognitive factors contribute to risk behavior and accidents in the workplace. At the basic perceptual level, it is important to get a comprehensive picture of the critical situation by identifying the hazard and gathering information from the situation. Knowledge of possible risks and consequences, experiences of how to deal with and cope with the hazard, and the frequency of previous accidents help to form the individual's assessment of the critical situation. A combination of the risk assessment, job satisfaction, and safety climate is likely to determine the attitude to the risk. Later, the risk attitudes will then determine the possible course of action, for instance, an accident is likely to occur if the operator executes unsafe acts, mistakes, and violations of the safety protocols. Contrastingly, by acting carefully and making safety-focused choices one can avoid the accident (Mearns & Flin, 1995). Therefore, the socio-cognitive model of risk perception illustrates how both cognitive factors (e.g. situation awareness and risk perception) and social factors (e.g. safety climate, job satisfaction, risk behavior) are important for safety outcomes.

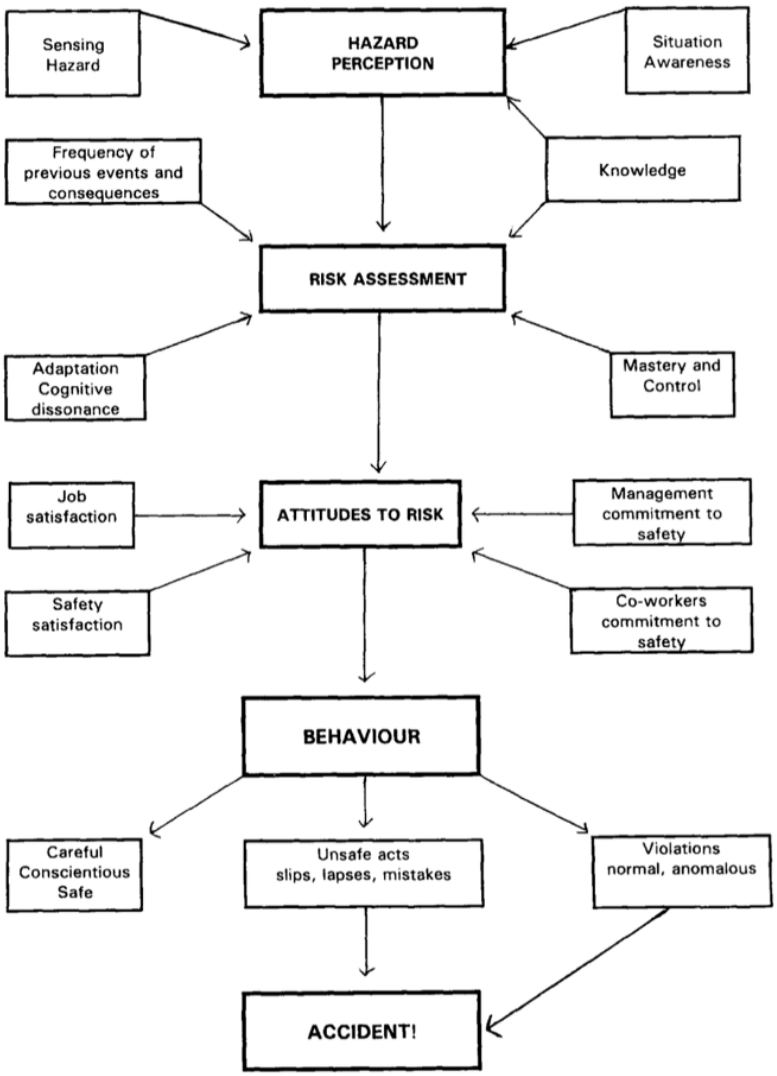

Figure 1. The socio-cognitive model of risk perception in hazardous work environments. The figure displays how socio-cognitive factors influence the risk perception process from hazard perception to accident. Socio-cognitive factors affect the risk perception process, displayed by the arrows pointing towards the levels of risk perception which they affect. Retrieved from "Risk Perception and Attitudes to Safety by Personnel in the Offshore Oil and Gas Industry: a Review" by K. Mearns and R. Flin, 1995, *Journal of loss prevention in the process industries, 8,* p. 300. Copyright 1995 by Elsevier Science Ltd.

Risk Behavior

In the present study, we have decided to use the term risk behavior to describe the tendency to perform unsafe actions to complete work tasks quickly. Specifically, risk behavior entails the act of ignoring safety regulations, engaging in prohibited actions, incorrect work-task execution, and sloppy use of protective equipment (Rundmo, 1996a). We argue that the term risk behavior accurately labels the intention and conceptualization of performing unsafe behavior. The conceptualization of risk behavior arguably has shortcomings in that researchers use different terminology to describe similar concepts (Neal & Griffin, 2004). Some researchers have used terminology with a positive approach, such as safety behavior (Neal & Griffin, 2004; Hjellvik, Aga, & Sætrevik, in press) or safety performance behavior (Christian, Bradley, Wallace, & Burke, 2009), which is focusing on behavior that may contribute to safety (Neal & Griffin, 2004). Meanwhile, terminology with an negative approach is being applied by others, for instance, risk behavior (Rundmo, 1996a), unsafe actions (Sætrevik & Hystad, 2017), and risk-taking behavior (Sandhåland, 2017), which focus on the likelihood of participating in behavior that prevents safety at the workplace. Although the concepts are generally the same, the variety of terminology and measures being used to explain the same phenomenon complicates the ability to track the scientific development in this area of safety science.

Risk behavior is fairly common: Mearns, Flin, Gordon, and Fleming (1998) found that nearly half of the participants in their study admitted that they seldom or sometimes partook in risk behavior, involving shortcuts, bending the rules, and feeling that the job was carried out better by ignoring some rules. Furthermore, Rundmo (1996a) demonstrated that employees who feel less safe will be more likely to participate in risky behavior. Additionally, employees ignoring safety rules and regulations, and carrying out forbidden activities predicted objective risk in the workplace (Rundmo, 1996a). It is important to notice that this

relationship between risk perception and risk behavior does not entail causality. The relationship between risk behavior and risk perception is complex: while some researchers have assumed that risk behavior is the result of poor perception of risk (Rundmo, Tharaldsen, & Olsen, 2007), others have found that employees who participate in risk behavior have an accurate perception of risk (Flin, Mearns, O´Connor, & Bryden, 2000).

In regard to safety attitudes, Mearns, Rundmo, Flin, Gordon, Fleming, and Mark, (2004) found that employees from the United Kingdom were more in agreement than Norwegian employees of feeling pressured to put production before safety, and they also tended to agree with statements of having control over their own safety behavior. Norwegian employees, on the other hand, tended to have more fatalistic attitudes towards accidents than British employees, indicating that the employees believe there little that can be done to prevent accidents.

Nevertheless, Mearns and colleagues (2004) compared high accident installations (HAI; installations with a high number of accidents) with low accident installations (LAI; installations with a low number of accidents) to investigate the employees' view of safety and safety performance. The results showed that employees on the HAIs were in more agreement with the statements of prioritizing operational goals before safety goals than employees on LAIs. Also, employees on HAIs relied on themselves to detect possible errors in the safety systems as opposed to relying on their colleagues (Mearns et al., 2004). These findings indicate that employees who emphasize production goals rather than safety regulations, as well as exhibiting deviant behavior by ignoring the organization's safety protocols, might result in being more exposed to injuries, accidents and near misses at the workplace.

Furthermore, Hobbs and Williamson (2002) argued that employees who violate and avoid safety rules and regulations may experience more work-quality accidents, meaning incidents that occur as a result of maintenance-quality problems that affect work operations.

They categorized such errors as skill-based errors, which occur when the employees have the necessary skills and knowledge, but their attention is diverted from the task, which is more likely to result in workplace injuries.

Situation Awareness

In 1995, Endsley depicted a model of situation awareness which is commonly accepted as an eloquent concept to describe the phenomenon of the process of "knowing what is going on" in a dynamic environment. Situation awareness entails the mere understanding of the situation as well as the integrated meaning of the present elements when personal goals are taken into account, and it constitutes the basis upon which decisions are being made. Dynamic environments are characterized by the need of making many decisions across a given period of limited time. The successful operation of such environments is dependent on accurate and continuous analysis of the situation. However, as situations increase in complexity, the more difficult it is for the operator to acquire situation awareness and making appropriate decisions in dynamic environments. Such situations have a wide range from everyday activities such as walking or driving in heavy traffic, to piloting an airplane or working in high-risk environments in the offshore industry.

In the present study, we have decided to utilize Endsley's (1995) conceptualization of situation awareness because we argue that her description of the phenomenon is the most useful in our context of research. Endley's conceptualization of situation awareness is not unchallenged, however, several theorists have postulated corresponding explanatory frameworks with different perspectives (e.g. the perceptual cycle model by Smith & Hancock, 1995; and the activity theory model by Bedny & Meister, 1999; see Woods & Sarter, 2010 for review). Different theoretical and methodological perspectives have been applied in different spheres of human performance. Patrick and Morgan (2010) argue that to enable researchers to

grasp the complexity of psychological processes involved in the operations of dynamic systems, situation awareness is insufficient by itself. They specify that to enable detailed analyses of task performance, one will need to conduct a detailed task-specific analysis that accompanies the situation awareness evaluation. As Patrick and Morgan mention, situation awareness does not introduce any additional psychological constructs, rather it incorporates already postulated ones. Nevertheless, it is highly challenging to correctly distinguish and assess the scope of each process underlying the situation awareness. Rather, the conceptualization of situation awareness provides researchers in field settings with an adequate proxy of the underlying constructs it entails, taken into account the time-consuming process of task-analyses and the diversity of tasks performed by operators who are selected for their study.

Furthermore, Endsley (1995) emphasizes that there are individual varieties regarding one's ability to acquire situation awareness, given the same input. This is due to individual differences in experiences, abilities, and training, as well as other factors that function as cognitive filters through which information is selected for further attention and interpretation of the environment. Therefore, situation awareness is task- and person-dependent.

According to Endsley (1995), situation awareness is a term applied to the state of knowledge in which one has completed the necessary situation assessments required to perceive and process the information available in the environment. Situation awareness is essential in many environments. Situation awareness, decision-making, and performance are all part of the operation of any situation, and these elements affect each other through feedback loops. However, it is important to note that they are separate constructs. Situation awareness is the foundation upon which an operator makes a decision. For example, a well-trained operator may make a wrong decision if their situation awareness is incorrect, and performance may be affected negatively by a wrong decision.

Endsley (1995) divided situation awareness into three levels: Level 1 entails the perception of relevant elements in the environment; Level 2 entails the synthesis of Level 1-elements to create comprehension, and finally, Level 3 entails the projection of future events based on the current situation. These levels constitute interdependent processes that hinge on the lower-levels' success in order to succeed themselves.

Situation awareness has proven to be highly applicable in naturalistic settings to the series of underlying psychological processes and products of which situation awareness consists (e.g. Klein et al., 2003). Usually, dynamic situations in which situation awareness is crucial to select an appropriate course of action to be selected do not happen in a vacuum consisting only of an operator and a few environmental elements. Rather, they happen in intricate and advanced systems consisting of automated actors, colleagues and, shifting and competing goals, all of which demand continuous cognitive processing of the operators in the system (Endsley, 1995). Accordingly, it is possible to study situation awareness in several ways, examples of which include shared- and distributed situation awareness. Firstly, shared situation awareness refers to the degree to which members of a team share mental representations of concerns that are relevant for the whole team (Endsley, 1995). Distributed situation awareness on the other hand, refers to a situation awareness held by all components in a system (Stanton et al. 2006). This approach assumes that cognitive processes occur at the system-level rather than just the individual level. Additionally, it holds that situation awareness is held by both human and non-human elements (i.e. technological devices such as a smoke detector) of the system.

Situation awareness and human error. Lack of sufficient situation awareness is often characterized as the source of accidents caused by human error: Sneddon, Mearns, and Flin (2006) conducted a study in which they used accident reports from the offshore drilling

industry to investigate at which levels of situation awareness the accident originated. Their results showed that 66.7 % occurred at Level 1.20 % at Level 2, and 13.3 % at Level 3. However, due to the reporting default mode of blaming the lack of Level 1 situation awareness, they claim that the other levels may have been underreported. Sneddon and colleagues (2006) reported that the main reasons for the failure to detect critical signals were distractions, removing focus from the current task, as well as an inability to prioritize information resulting in information overload. Furthermore, Sneddon, Mearns, and Flin (2013) found that lower levels of their construct work situation awareness was a strong indicator of participation in risk behavior. Their findings highlight the importance of holding accurate situation awareness in the event of critical situations, otherwise, employees may be more likely to execute unsafe actions.

Previous studies have shown that expectations held by the operator regarding the system environment, guide their attentional focus towards important elements (e.g. lack of an expected sound; Woods & Hollnagel, 2006). In other words, top-down processes in which previously acquired knowledge about the system's qualities and characteristics, dictates how attention shifts across time, space, and function (Woods & Sarter, 2010). Further, Woods and Sarter (2010) explain how in a physical environment, humans can focus on what they deem interesting in their visual field. Although this relationship may seem uncomplicated, the fact is that what is deemed interesting depends on the relationship between elements within their environment, as well as the operator and system's goals and expectancies. Hence, control of attention is a fluent and active analysis, constantly in search of what is interesting as well as re-defining interestingness based on context-dependent criteria.

Situation awareness and naturalistic decision-making. The naturalistic decision-making community arose in the 1980s with ground-breaking descriptions of how people in

real-world settings make decisions (Klein, 2008). Orasanu and Connolly (1993) described naturalistic decision-making as the decision-making process commenced in situations where problems are ambiguous and goals are shifting and competing, where action feedback loops are informing the operator about their action's consequences, time pressure, and multiple active components (e.g. work colleagues and moving elements). Up until that point, the majority of theoretical understandings on the topics of human decision-making and judgments were based on research conducted in laboratory settings (Klein, 2008). Naturalistic decision-making researchers sought to investigate how people in complex situations made decisions. Such research was set in field settings, examining professional groups (e.g. firefighters; Klein, Calderwood, & Clinton-Cirocco, 2010), with high stakes in instances when operations were characterized as successful. This wave of research in naturalistic decision-making resulted in parallel discoveries that decisions in such settings were not made by the use of analytical option comparisons, but rather that people used their prior experiences to form a mental representation of the situation to rapidly characterize the situation, a characteristic titled skilled intuition (see Kahneman & Klein, 2009, for a full review). In other words, findings from naturalistic decision-making research shifted the conception of decision-making as domain-independent, to an understanding that decision-making is hugely knowledge-dependent, and therefore expertise-dependent (i.e. domain-dependent; Klein, 2008). Additionally, the process of decision-making was conceptually expanded to include a prior process of perception and recognition (i.e. situation assessment; Klein, 2008).

Klein, Calderwood, and Clinton-Cirocco (2010) conducted a revolutionary study within the field of naturalistic decision-making. They studied experienced firefighters who were in situations with severe time-pressure with the need for rapid decision-making. They found that the firefighters' ability to manage decision points was dependent on their ability to recognize the situation they were in, as a typical case of their existing prototype-repertoire

that they had developed through work experience. Prototype situations consisted of causal explanations of the situational dynamics, which supplied them with situation-specific expectancies, and suggestions of courses of actions. Klein and colleagues (2010) found that in most cases, these firefighters only considered one action-option before deciding to proceed. As a result of this study, the recognition-primed decision model was created. This model explains how experts in a specific field can make intuitive and suitable decisions with the help of very little time, as part of their skill. Simon (1992) defines intuition as a speedy form of problem-solving in which people are unable to describe the processes conducted to produce the answer. Furthermore, Simon (1992) described this phenomenon to occur in situations where adequate and valid cues are available (i.e. recognition), which subsequentially triggers access to information stored in memory, and this information provides the answer. Thus, intuition is a kind of recognition.

Reporting Attitudes

Organizations in the maritime industry have developed extensive reporting systems, which include reporting all minor incidents, near-misses, accidents, and equipment defaults and failures. However, there are cultural differences between companies concerning the use of different reporting systems, and often such systems lack a strong theoretical core regarding psychological factors (Gordon, Flin, & Mearns 2005). Furthermore, Gordon and colleagues concluded that systems lack human error coding and that the personnel's understanding of psychological factors related to accidents was unsatisfactory. Reason (2000) argues that it is essential to develop a good reporting culture to effectively manage risks in an organization. Without reporting procedures and detailed analysis of events, it would be hard to assess what factors contributed to the events to identify possible errors in work operations and organizational system defaults. Therefore, it is crucial to report all incidents on board, as this

may be considered the most efficient and recognized form of communication between the vessels and the management. Developing positive reporting attitudes and substantial reporting systems are essential for notifying incidents, clarifying the instigation of an event, and making sure important details of the event do not get lost in communication.

Employee attitudes towards safety play an essential role in influencing the degree to which employees comply with the safety regulations and protocols in an organization (Hjellvik et al., in press). Early psychological research showed that specific behavioral intentions predicted behavior, and this relationship was dependent on the attitude towards the act, the so-called theory of planned behavior (Ajzen, 1991), as well as the perceived expectations of the work environment (Ajzen & Fishbein, 1973). In other words, the likelihood of an employee executing the specific behavior is dependent on their behavioral intention, their attitudes and the perceived expectations from their co-workers and the management.

As mentioned above, Reason (2000) suggested that latent failures are easier to foresee, making it possible for a proactive approach to accidents by identifying the recurrent errors and system failures in the organization. Based on this information, we can presume that having established sufficient protocols for reporting accidents and near misses, as well as positive attitudes towards reporting can help identify the system failures breaching the safety barriers in the organization. Employees may not inherently see the value of reporting near-misses since it did not result in an accident, however, identifying these smaller active failures may uncover underlying system failures that can generate accidents in the future. Therefore, reviewing reports on accidents and near misses are essential for creating a proactive system for identifying and reducing accidents (Psarros, Skjong, & Eide, 2010).

Kongsvik, Fenstad, and Wendelborg (2012) found a positive relationship between safety climate and levels of reporting, suggesting that employees with a positive safety

climate are more likely to report accidents and near misses. When controlling for the perceived pressure towards efficiency demands, the quality of feedback from the shipping company, and short-term contracts, only the safety climate component regarding the employee's opinion on how safety is prioritized on board was significant.

The reliability of self-reporting reflects the employees' ability and motivation to report accurately (Hjellvik, Aga, & Sætrevik, in press). The reliability of the reporting systems, compliance to the management's safety regulations, and risk behavior may be affected by desirability bias, in which some employees may report themselves more favorable in terms of the preferred attitudes and behavior of the management (Hjellvik et al., in press). Negative attitudes towards reporting systems might be a result of lackadaisicalness or ignorance regarding the importance of reporting incidents. Since the management requires reporting for all incidents, employees reporting a more favorable attitude may wish to present themselves as complying with the organizational rules and requirements. We suggest that including reporting attitudes in the present study will yield valuable information about the employees' perspectives of the organizational reporting systems, and how the interaction of reporting attitudes and safety values may represent safety on board offshore vessels.

Social Desirability Bias

The idea of including desirable responding is to detect responders that are trying to give an unrealistically good impression of themselves, instead of choosing responses that reflect their true feelings (e.g. Grimm, 2010). It is suggested that detecting the extent of the desirability bias in surveys is essential for data quality and producing ethical and valuable results, thus, one should include desirability testing as often as possible (Grimm, 2010). Desirability bias is the tendency to underestimate the likeliness of engaging in undesirable actions and overestimate the likeliness of engaging in desirable actions (Chung & Monroe,

2003). Research has demonstrated that higher desirability bias is associated with unethical actions, suggesting that employees are more likely to underestimate the likelihood of performing unethical actions (Chung & Monroe, 2003).

High scores would indicate that the responders have endorsed most of the highly desirable items, which are highly improbable to happen in real life. However, it is important to note that the negative side to removing high scores is that one may also remove the most disciplined respondents that naturally score higher, because they are mixed with the deceiving responders.

In the current study, participants from a single shipping company are included. For instance, measuring the employees' attitudes towards reporting systems, and whether they comply with the safety procedures in an organization, may coax the employees into responding more desirably. In the current study, we have included desirability responding to control for employees who present themselves inaccurately.

The Broaden-and-Build Theory

In the present study, we have adopted a proactive safety approach using the broaden-and-build theory as the theoretical framework, to interpret the results and implications of our findings. In 1998, Fredrickson postulated the broaden-and-build theory of positive emotions and affect.

It suggests that the experience of positive emotions and affect extend an individual's momentary attention capacities and cognition, and thus facilitates flexible and creative thinking. Thereupon, the broadened cognition will support successful adaptation to stress, and will with the aid of time, build lasting positive psychological resources (especially resilience characteristics). Examples of such are adaptive coping strategies, positive personality traits, and enhanced social support (e.g. Gloria, Faulk, & Steinhardt, 2013; Danner, Snowdon, &

Friesen, 2001). Fredrickson's theory emphasizes the importance of positive affect's signaling effect to the body of optimal functioning to maintain homeostasis, as well as being responsible for producing optimal functioning both at present of the positive emotion's occurrence and in a long-term perspective, by promoting the individual to seek out new information and maintain social relations. According to Fredrickson's theory, the opposite pattern can be observed in individuals who experience low levels of positive affect (see Kuhl, 2000 for review), in which they tend to have narrower scopes of attention and cognition. This is thought to be caused by the fight-or-flight response, which functions by restricting an individual's cognitive span to ensure quick decisions to immediately alleviate the perceived adversity (Gloria et al., 2013). Although this response is adaptive in critical situations that pose as life- and health-threatening, it may have a negative effect when activated by stressors characterized by their longevity and consistent nature, such as negative aspects present in offshore workers' day-to-day life (e.g. long work periods at sea, separation from family, and omnipresent concerns regarding safety; Ulleberg & Rundmo, 1997; Valdersnes, Eid, Hystad, & Nilsen, 2017). Gloria and colleagues (2013) demonstrated the building-effects of positive affect. They conducted a cross-sectional study among teachers and found that positive affect had a direct negative effect on burnout and simultaneously a direct positive effect on resilience. Furthermore, they also found that positive affect completely mediated the relationship between work stress and resilience, confirming the power of positive affect in predicting successful adaptation to stress.

Isen, Daubman, and Nowicki (1987) conducted an experimental study in which they induced positive, neutral, and negative affect in participants before they completed two well-known tasks of creative problem solving, both of which required divergent and convergent thinking (The candle task by Duncker, 1945; and Mednick's Remote Associates Task, 1962). Isen and colleagues (1987) compared the performance of the groups and found that positive

affect drastically improved creative performance, while neutral and negative affect did not affect performance. It is plausible to surmise that positive affect activated individuals' ability of cognitive flexibility. Subramaniam, Kounios, Parrish, Jung-Beeman, and Mark (2009) confirmed the findings from the Remote Associates Task, as well as discovering that participants in a positive mood were more likely to report a sensation of insight when the answer occurred to them.

Several suggestions have been presented to explain why positive affect improves creative thinking. One is Kuhl's (2000) affect-modulation hypothesis, which claims that positive affect promotes activation of associative networks, whereas negative affect restricts activation. Increased activation in associative networks would help explain increased creativity in the form of divergent thinking. Several studies (e.g. Gasper, 2004; Gasper & Clore, 2002; Bauman & Kuhl, 2005) have shown that positive affectivity also influences processing-mode, whereby positive affectivity makes people favor a global processing style (e.g. reporting that the stimuli presented is an overall shape, for instance, a square is made up of smaller geometric shapes, such as triangles), and negative affectivity produces a local processing preference (e.g. reporting that stimuli presented are a collection of geometric shapes, not mentioning what shape they comprise). Although affectivity can impact processing-mode, the effect is context-dependent.

Gasper (2004) found that the effect only persisted in situations where participants were presented with ambiguous stimuli, and it was thereby concluded that affect alters ambiguous judgment situations and hence, does not consistently guide attention. Finally, affect did not have an influence on processing-mode when feelings were deemed task-irrelevant by the participants. Nevertheless, affect's influence on processing-mode should not be dismissed: Bauman and Kuhl (2005) conducted a series of experiments on local versus global processing patterns, in which they discovered that participants induced with positive affect had a greater

ability to switch from their dominant response alternative (i.e. global) to their non-dominant response alternative (i.e. local) when task-requirements granted they had to. These results demonstrate how positive affect also facilitates cognitive flexibility by easing the access to different cognitive perspectives. A plausible implication of such an effect, is the possibility that positive affect may reduce the likelihood of avoiding cognitive fixation during problem-solving- and judgment-tasks. Correspondingly, Bolte, Goschke, and Kuhl (2003) found that positive affect improved the ability to make intuitive judgments in a word-coherence task.

In addition to the broadening- and building-effects of positive affect, positive emotions have also been found to have an "undoing effect" of negative emotions. For example, Fredrickson and Levenson (1998) found that the experience of certain negative emotions, in accordance with their well-established association with action tendencies, increased cardiovascular activity. More importantly, they found that a subsequent experience of induced and naturally occurring positive emotions had the effect of recovering those cardiovascular arousal indicators. In brief, such findings support the notion of the undoing effect, by demonstrating how positive affect has the potential to quell adverse physiological processes.

The Aim of our Study

This study investigates the interaction of several positive individual factors, and how they may affect each other, as well as how they may affect proximal safety measures (situation awareness, risk behavior, and reporting attitudes). Furthermore, the present study aims to contribute with a framework that demonstrates how operators' positive individual factors as well as positive influences in the work-environment may help prevent accidents at several organizational levels (i.e. management-, team-, and individual-level). We suggest that the broaden-and-build effect of positive affect is present in safety-critical organizations, by broadening offshore workers' attention scope and building resilience over time. Acquiring an

abundant thought-behavior repertoire should provide operators in critical organizations with a broadened attention of details in their environment and a diverse set of decision-options, providing them with a greater chance of deciding a satisfactory solution to the problem. Furthermore, there is reason to suspect that the resilience-building effect of positive affect will provide the employees the means to overcome negative experiences and influences, such as previous accidents and the omnipresent stress related to their workplace.

This study aims to identify cognitive, affective, and personality factors that contribute to safer offshore operations. Our study aims to provide a proactive toolbox to determine which individual factors might predict safety outcomes and to suggest ways in which they may be improved. We investigate the relationships between psychological capital, safety climate, situation awareness, risk perception, risk behavior, reporting attitudes, and job satisfaction in a Norwegian offshore shipping company. While controlling for desirable responding bias, we wish to determine how much these variables employ an effect on the shipping company's propensity to experience accidents. Our findings may have use in improving training, recruitment and selection, and optimize safety protocols.

To reduce the number of accidents in the offshore industry, it is important to identify underlying factors that contribute to the development of incidents. We believe that knowledge of the underlying factors contributing to the development of an accident will enable proactive and reactive actions, leading to a reduction of accident rates.

As discussed above, safety climate, job satisfaction, risk perception, and risk behavior have been associated with a decrease of injuries and accidents in previous studies and are considered important factors in maintaining safety on board offshore vessels. Building on previous research, we are interested in detecting interactions between the individual factors (e.g. PsyCap and safety climate) and cognitive information-processes (e.g. situation

awareness and risk perception), and how they may lead to a better understanding of the important features for avoiding major accidents and maintaining safety.

Hypotheses

Hypothesis 1. We predict that employees who utilize their positive resources and optimistic characteristics, experience their working environment as more positive and more supportive of safety protocols, and are more satisfied with their work tend to have a better understanding and control in a safety-critical situation. From this we draw hypothesis 1: higher levels of psychological capital, safety climate, and job satisfaction will predict an increase in situation awareness.

Hypothesis 2. We predict that employees who have an accurate assessment and awareness of safety-critical situations and who demonstrate more control in such situations will be less likely to participate in unsafe actions that may provoke an accident, due to their capacity to understand such situations and the potential hazardous outcomes. From this, we suggest hypothesis 2: Situation awareness will have a negative effect on risk behavior.

Hypothesis 3. We predict that employees working in an environment that reflects their personal safety values and priorities are likely to positively influence their attitudes regarding reporting regulations and systems in the organization. Accordingly, employees' contentment of the work situation will strengthen their motivation to comply with reporting systems. From this, we introduce hypothesis 3: Safety climate and reporting attitudes will be positively related, and their relationship will be partially positively mediated by job satisfaction.

Methods

Participants

The sample consisted of 127 seafarers working in a Norwegian offshore shipping company operating worldwide. The mean age of respondents was 41.2 (*SD* = 1.97), with a range of 18-65. The average length of their seafaring career was 20.6 years (*SD* = 1.26). The majority of the sample was Norwegian (53.5 %), followed by Oceanian (21.3 %), Nordic (7.1 %), Argentinian (6.3 %), other European (7.1 %), Canadian (3.9 %), and others (0.8 %).

Sex was not recorded to ensure the perceived anonymity of all participants, seeing as only a small minority in the shipping company is female. No incentives were provided as a means of reimbursement. Other demographic variables, such as the department of work, work role, length of career, length of shift (in weeks), type of vessel, and employment status, are presented in table 1.

Table 1

Demographic Variables

Variable	*N*	*%*
Type of vessel		
PSV	34	26.8
AH	51	40.2
Subsea	42	33.1
Department of work		
Deck	26	20
Engine	41	32.3
Bridge	55	43.3
Galley	5	3.9
Work role		
Captain	31	24.4
Chief Officer	15	11.8
2nd/ 3rd Officer	24	18.9
Able Bodied Seamen	11	8.7
Chief Engineer	24	18.9
Engineer	14	11.0
Electrician	3	2.4
Cook/Steward	5	3.9
Weeks on board		
Less than 1 week	32	25.2
1-2 weeks	42	33.1
3-4 weeks	41	32.3
5-6 weeks	11	8.7
More than 6 weeks	1	0.8
Employment status		
Permanent	104	81.9
Temporary	20	15.7
Apprentice	3	2.4

Note. The table shows categories, number of participants (*N),* and percentages of participants (*%)* of the demographic variables.

Measures

Safety Climate. Safety climate was measured using the Brief Safety Climate Questionnaire (NORSCI-11; Nielsen, Eid, Hystad, Sætrevik, & Saus, 2013). The measure consists of 11 items concerning the perceptions of safety climate in the workgroup. The scale is divided into three subscales: i) individual intention and motivation, comprised of four

items; ii) management prioritization, comprised of four items; and iii) safety routines, comprised of three items. Sample items include: “Safety has top priority when I do my job”; “In practice concern for production precedes the concern for health, environment and safety”; and “The safety deputies’ suggestions are taken seriously by the management”. The responses were scored on a 5-point Likert scale, ranging from 1 = strongly disagree, to 5 = strongly agree. Four negatively formulated items were reversed. The sum of every item creates a second-order factor that measures the employees’ general feelings of safety. See Appendix A for the full questionnaire. The Cronbach’s Alpha for the overall safety climate scale was α = .69, with a skewness of -0.11 and kurtosis 0.18.

Psychological capital. Psychological capital was measured using the PsyCap questionnaire (PCQ-24; Luthans, Avolio, Avey, & Norman, 2007). The construct consists of four dimensions: hope, efficacy, resiliency, and optimism. The measure contains 24 state-like items suitable for the workplace. Each dimension contains six items. Samples of the items include: “If I should find myself in a jam at work, I could think of many ways to get out of it (hope); “I feel confident in representing my work area in meetings with management” (efficacy); “I usually take stressful things at work in stride” (resiliency); and “I always look on the bright side of things regarding my job” (optimism). The responses were scored on a 6-point Likert scale, ranging from 1 = strongly disagree, to 6 = strongly agree. Three negatively formulated items were reversed. See Appendix B for the full questionnaire. The Cronbach’s Alpha for the overall PsyCap scale showed a high reliability (α = .86), with a skewness of 0.31 and kurtosis of 0.41.

Job satisfaction. Job Satisfaction was measured using the short version job satisfaction scale (Nielsen, Mearns, Matthiesen, & Eid, 2011). The scale consists of five items, a sample includes: “I feel fairly satisfied with my present job”. Two items negatively formulated items were reversed. The responses were scored on a 5-point Likert scale, ranging

from 1 = strongly disagree, to 5 = strongly agree. See appendix C for the full questionnaire. The scale had a high reliability (Cronbach's Alpha = .86). For the total job satisfaction scale skewness was -0.82, and kurtosis 1.6.

Situation awareness. Situation awareness was measured using the Situation Awareness Inventory (Sætrevik, 2013). The scale contains 13 items, asking to what extent the employees have accurate representations of safety aspects in their work environments. The scale is composed of three subscales, in accordance with Endsley's (1995) conceptualization of situation awareness. Level 1 consists of four items and refers to the perceptual stage of situation awareness. Level 2 consists of five items and refers to the comprehension stage of situation awareness. Level 3 consists of four items and refers to the projection stage of situation awareness. Samples of the items include: " I notice when an unsafe situation is about to arise at my workplace" (level 3); "I know which information is relevant for safety and which information is not relevant for safety" (Level 2); and "I sometimes lose track of safety due to receiving too much information at the same time" (Level 1). Five negatively formulated items were reversed. The responses were scored on a 5-point Likert scale, ranging from 1 = completely disagree, to 5 = completely agree. See Appendix D for the full questionnaire. The internal consistency of the overall scale was satisfactory (Cronbach's Alpha = .79). For the total situation awareness scale skewness was 0.32 and kurtosis 0.60.

Risk perception scenarios. Risk perception was measured using seven work-related scenarios, based on the risk perception inventory (Hellesøy, 1985). To obtain a comprehensive measure, the scenarios were doubled up, one that inquired their likeliness of being involved in a work-related accident (you-scenarios), and a second that inquired the likeliness that colleagues else would be (colleague-scenarios). The items used in the current study were used by Valdersnes, Eid, Hystad, and Nielsen (2017) and consist of seven scenarios related to ordinary occupational accidents and rare hazards and major accidents. The

responses were scored on a 6-point Likert scale, ranging from 1 = very unlikely, to 6 = very likely. See Appendix E for all the items. The you-scenarios had a Cronbach's Alpha of α = .88, with a skewness of 0.54 and kurtosis of 0.09. While the colleague-scenarios had a high reliability of α = .91, skewness of 0.35, and kurtosis of 0.18.

Risk behavior. Risk behavior was measured using an eight-item scale (Sætrevik & Hystad, 2017), developed to investigate the likelihood of employees participating in unsafe actions that can reduce safety. The items have been adapted from a review of relevant literature (e.g. Nielsen, Eid, Hystad, Sætrevik, & Saus, 2013) as well as some of the items that may overlap with items from the Safety Behavior scale developed by Rundmo (1994) to ensure that it was context-relevant. An example of the items includes: "I have exposed myself or others to danger in order to get the job done". Further, an additional item: "Being busy at port makes it difficult for me to maintain safety", was included in our survey. If this item were removed from the scale, the Cronbach's Alpha of the scale would be reduced to a = .74. Three negatively formulated items were reversed. The responses were scored on a 5-point Likert scale, ranging from 1 = strongly disagree, to 5 = strongly agree. See Appendix F for the full questionnaire. In the current study, the total risk behavior scale had a high reliability of α = .77, with a skewness of 0.21, and kurtosis of -0.36.

Two negatively formulated items in the scale were removed from the survey due to the strong similarity of items with the safety climate (NORSCI-11) scale. Since the participants responded to these items in the safety climate scale, these items were included in the analysis to create a total score of the risk behavior scale. These items were: "I urge colleagues to stop work that I believe is being carried out in a risky way"; and "I stop work if I think it may be dangerous for me or others to continue".

Screening of accident prevalence the past year. Three items regarding participants' previous experience with accidents and near misses. Items include: "Have you personally

been in a work-related accident involving personal injury on board your vessel during the last 12 months"; "Have you had a near accident/near miss on board your vessel during the last 12 months"; and "Have you observed others who have had a work-related accident involving personal injury on board your vessel during the last 12 months?" Responses were recorded with yes and no.

Desirability bias. It is important to include desirable responding bias to control for the individuals scoring high on this measure, because it may confound the results by concealing relationships between variables. Desirable responding was measured using the short version of the Balanced Inventory for Desirable Responding (BIDR-16; Hart, Ritchie, Hepper, & Gebauer, 2015), developed from BIDR-40 (Paulhus, 1991). The measure consists of 16 items, in which eight items refer to the self-deceptive enhancements subscale and eight items refer to the impression formation subscale.

An example of a self-deceptive enhancement items is: "Am not always honest", while an item concerning impression formation includes: "Never cover up mistakes". The responses were scored on an 8-point Likert scale, ranging from 1 = strongly disagree, to 8 = strongly agree. The negatively formulated items were reversed. See Appendix G for the full questionnaire. The internal consistency for the total BIDR-16 score in the current study was relatively low (α = .68), skewness was 0.05, and kurtosis was 0.15.

Reporting attitudes. Reporting attitudes were measured using 14 items (Hjellvik, Aga, & Sætrevik, in press). Some of the items (inspired by Probst & Graso, 2013; e.g.: "Since it's impossible to prevent all unwanted events, we shouldn't spend too much resources on reporting"), refer to the assumed consequences of reporting accidents and near misses. Other items refer to the motivation to report incidents and the perceived usefulness of reporting systems, such as: "I am not motivated to report near-misses". The items have been developed through previous survey data collections, however, note that the items used in the current

study have somewhat different wording than Hjellvik, Aga, and Sætrevik. The responses were scored on a 5-point Likert scale, ranging from 1 = Strongly disagree, to 5 = Strongly agree. Negatively formulated items were reversed. One of the items from the reporting attitude scale: "Reports from accidents or dangerous situations are often 'embellished'", was excluded from the survey due to a strong similarity with an item from the safety climate (NORSCI) questionnaire, however, it was included in the analyses. See Appendix H for the full questionnaire. The Cronbach's alpha for the overall score was α = .68, with a skewness of -0.40, and kurtosis of 0.32.

Design and Procedure

This project was approved by the Norwegian Centre for Research Data (Norsk Senter for Forskningsdata). Following this, we completed the pre-registration of the project, including our hypotheses, planned analyses, and instruments we included in the survey (Authors, 2019). Participants were recruited via emails sent to 120 crew members in senior positions working on board 40 different vessels in a large Norwegian shipping company. These included captains, first and second officers, and chief engineers. Emails were sent to the crews' professional emails over the span of two shifts to ensure that all the seafaring employees of the shipping company were able to complete the survey while on board. The employees were ensured that participation was completely anonymous. Emails contained information regarding the research project and a participation hyperlink that guided them to the project's SurveyXact webpage. Upon agreeing to participate, participants were given more extensive information about the content of the project, and they were informed about the implications of participation. Participants were informed of their rights to, at any time, withdraw from the study, edit or delete their responses without having to justify their decision to do so (see Appendix I). The second page contained information about the use of their

personal identification markers that would enable them to at a later point withdraw or edit. Completion of the survey was expected to take 30 minutes. Following completion of the survey, the final page contained a debriefing document (see appendix J). Responses from participants were automatically recorded and available for the researchers via SurveyXact. The shipping company never gained access to the employees' responses, to protect the participants from being held liable, on the ground of their responses, by the company. The analyses were conducted using SPSS Windows version number 25, and for the mediation analysis to test hypothesis 3, Hayes' (2017) model 4 was used in PROCESS version 3.3 in SPSS.

The original dataset included all 460 seafarers who had opened the link form the recruitment email. Of these, 290 had exited the site before proceeding to the next page, and a further 42 participants were removed from the dataset due to incomplete answers of the survey. Inspection of the identification markers indicated that one participant had completed the survey twice. A decision was made to remove the response recorded the second time, indicated by the length of shift. Consequently, the data set used for analyses consisted of 127 participants' responses. Further five participants were excluded from the analyses due to extreme scores of social desirability relative to the rest of the sample, indicated by scores higher than two standard deviations away from the mean. Outliers were not removed from the dataset, as they were not considered extreme outliers.

Exploratory Analyses

Exploratory analyses were included in the study. First, we investigated whether the employees' situation awareness predicted their risk perception, regarding the likelihood of risks involving themselves. Following this, we executed a corresponding analysis to examine if situation awareness predicted their risk perceptions regarding their colleagues' likelihood of

experiencing accidents. Secondly, we included an analysis to investigate if risk perception predicted risk behavior. As previously discussed, this relationship is complex and has previously shown dubious results. We expected that the relationship between risk perception and risk behavior could give us information on whether the employees' perception of risk is associated with the frequency of risk behavior displayed in the company.

Deviations from Pre-Registration

The study was pre-registered on the Open Science Framework's website before data analyses were initiated. The registration describes the hypotheses, data collection, and planned analyses, as it is meant to warrant transparency and meticulousness of the scientific process. However, due to unforeseen time delays, we made some alterations in the study which deviates from the pre-registration (Authors, 2020). Importantly, these alterations were made before viewing and analyzing the data. With time limitations by delaying the distribution of the survey, and the vastness of this study, we decided to exclude the following variables: hardiness, The Big five personality traits and accident frequency. Following these alterations, hypotheses 4 and 5 will not be tested in this project. Hypothesis 4 stated: a multiple regression analysis where psychological capital and situation awareness are independent variables, and risk behavior is the dependent variable were excluded. Hypothesis 5 stated: a multiple regression where situation awareness is the independent variable, accident frequency is the dependent variable, and the relationship is moderated by risk behavior. We had to deviate from the pre-registration on some parts of the data collection and analyses due to unforeseen issues. An updated pre-registration was therefore uploaded to the Open Science Framework's website before initiating the data analyses (See appendix K).

Results

Confirmatory Analyses

To test the first hypothesis, as described in the pre-registration, a multiple linear regression was performed to test whether psychological capital, safety climate, and job satisfaction would predict situation awareness. A significant regression equation was found, $F(3, 118) = 22.3$, $p < .001$. Participants' assessments of situation awareness are equal to 13.93 + .229 (PsyCap) + .261 (safety climate) - .075 (job satisfaction). Two predictor variables contributed significantly to the prediction of situation awareness: PsyCap ($\beta = 0.49$, $p < .001$), and safety climate ($\beta = 0.26$, $p < .005$). Job satisfaction was not a significant predictor ($\beta = -0.05$, $p = .613$). Altogether 36.2% of the variability in situation awareness was predicted by knowing scores of all three independent variables. The effect size was large with $f_2 = .57$. This indicates that the factors overall predicted the level of situation awareness. However, job satisfaction did not have a significant contribution, leading to hypothesis 1 to be partially supported. The results yield support to the hypothesized association between predictor variables PsyCap and safety climate and situation awareness, the outcome variable. The non-significant relationship between job satisfaction and situation awareness violated our hypothesized prediction. The Pearson Correlation coefficients of hypothesis 1 is displayed in Figure 2.

Model Displaying Results of Hypothesis 1.

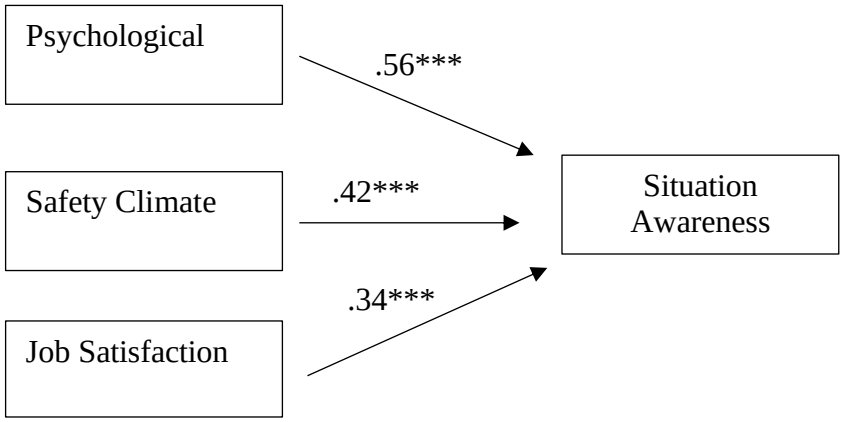

Figure 2. The model displays the Pearson correlation coefficients between the predictor and the outcome variables in the multiple linear regression.

***$p < .001$.

To examine hypothesis 2, as described in the pre-registration, a simple linear regression was carried out to test if situation awareness predicted the participants' predisposition to perform risk behavior. The results of the regression indicated that the prediction equation was significant, F (1, 120) = 41.6, $p < .001$. Situation awareness was a significant predictor of risk behavior ($\beta = -0.49$, $p < .001$), and situation awareness explained 25.8 % of the variance in situation awareness. There was a positive predictive relationship between situation awareness and risk behavior, yielding support to hypothesis 2. The Pearson correlation coefficient of hypothesis 2 is displayed in Figure 3.

Model Displaying Results of Hypothesis 2

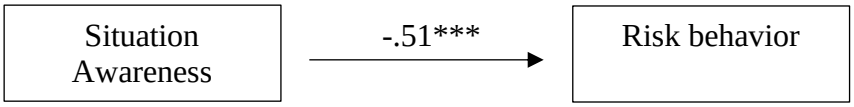

Figure 3. The model displays the Pearson correlation coefficient between the predictor and the outcome variables in the simple linear regression.

****p* < .001.

To test hypothesis 3, as described in the pre-registration, a single mediation analysis was conducted to determine whether safety climate predicted reporting attitudes mediated through job satisfaction. Step one showed that the regression of safety climate on the mediator (job satisfaction) was significant, β = 0.247, CI = .138-.355. Step 2 of the mediation model, the regression of safety climate ignoring the mediator (i.e. the direct effect), was significant, β = 0.515, CI = .307-.723. Step 3 revealed that the relationship between job satisfaction and reporting attitudes is significant, when controlling for safety climate, β = 0.549, CI = .229-.870. Step 4 of the analysis revealed that safety climate was still a significant predictor of reporting attitudes when including job satisfaction as the mediator (i.e. the total effect) in the model, β = 0.651, CI = .450-.851, t = 6.42, p < .001. The model explains 25.6 % of the variance in reporting attitudes, which indicates that the relationship between safety climate and reporting attitudes is partially mediated through job satisfaction. Thus, findings support hypothesis 3. The Unstandardized beta coefficient of hypothesis 3 is displayed in Figure 4.

Model Displaying Results of Hypothesis 3

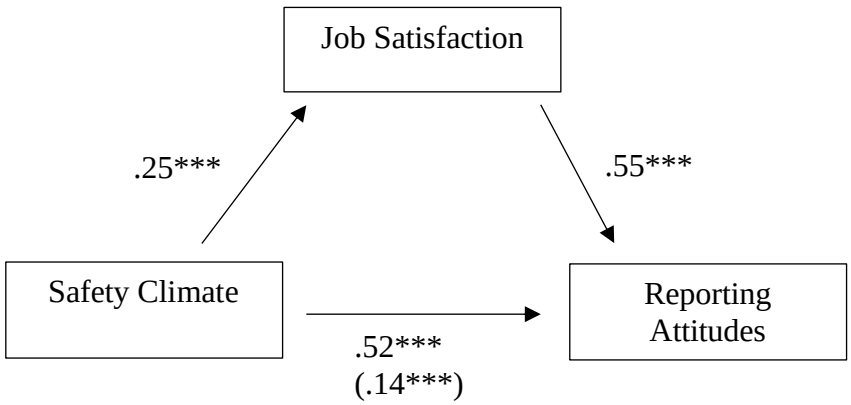

Figure 4. The model displays the standardized regression coefficients for the relationship between safety climate in reporting attitudes as mediated by job satisfaction. The standardized regression coefficient between safety climate and reporting attitudes, controlling for job satisfaction. The indirect effect is in parentheses.

*** $p < .001$.

Exploratory Analyses

Two of the exploratory analyses concerned risk perception both regarding the participants' likelihood of experiencing seven specific work-related personal injuries and secondly their colleagues' likelihood of experiencing the same injuries. The frequency distributions of the responses are presented in Table 2, exhibiting the reported likelihood of accident scenarios affecting themselves (i.e. scenario 1) and their colleagues (i.e. scenario 2), which represent the level of perceived safety in each work-related accident scenario.

Table 2

Risk perception

Type of scenario	Safe	
	Scenario 1	Scenario 2
Struck by objects in motion (e. g. cargo)	94.2	79.5
Trapped, crushed or squeezed	90.1	80.4
Cuts or contact with sharp or pointed elements	66.4	48.4
Contact with hazardous Substances	74.7	52.4
Man overboard	92.6	86.9
Slips, trips, falls	50.8	36.9
Electrical hazard, fire, explosion	81.2	77.1

Note. Percentage of the participants who felt safe (i.e. those who responded either very unlikely, unlikely, or somewhat unlikely, to the questions concerning their perceived likelihood of being affected by accident scenarios displayed above). The participants responded to the likelihood of these types of accidents concerning themselves (scenario 1) and their colleagues (scenario 2).

Testing how situation awareness affects employees' risk perception is essential for the understanding of the controversial nature of risk perception. To achieve a greater understanding of how situation awareness affects the perceived likelihood of themselves

being involved in an accident (scenario 1), versus their colleagues (scenario 2). Simple regression analyses of the two perceptual risk scenarios were therefore conducted. In the first simple regression analysis, situation awareness score was used to predict the scores on risk perception scenario 1, regarding personal risks of being harmed at work, measured on a scale indicating the perceived likelihood of occurrence. A significant negative regression equation was found, $F(1, 120) = 6.2$, $p < .05$, where situation awareness score explained 4.9 % of the variance in personal risk perception. Employees' assessment of their work-related risks was equal to 30.8 - .281 (situation awareness score).

Correspondingly, a simple linear regression was calculated to predict employees' assessments of the likelihood of colleagues experiencing the identical work-related accidents based on situation awareness score. A significant negative regression equation was found, $F (1, 120) = 6.9$, $p < .01$, where situation awareness explained 5.4 % of the variance in risk perception. Employees' assessment of their colleagues' work-related risks was equal to 37.3 - .338 (situation awareness score).

We decided to explore the complex and controversial nature of the relationship between risk perception and risk behavior, in light of the findings from hypothesis 2, which determined that situation awareness negatively predicted risk behavior. To elaborate on these findings, we sought to determine whether the participation in risk behavior may be caused by an inaccurate risk perception, indicated by a lack of situation awareness, as established through the first two exploratory analyses. Therefore, a simple linear regression was conducted applying risk perception as the predictor of risk behavior. The results revealed a very small, but significant positive effect, $F (1, 120) = 7.9$, $p < .01$, where risk perception explained 6.1 % of the variance in risk behavior. The employees' likelihood of partaking in risk behavior was equal to 13.7 + .19 (risk perception).

Discussion

To investigate the protective effects of positive individual characteristics on accident prevention on board offshore vessels, we examined how PsyCap, safety climate, job satisfaction, and reporting attitudes, relate to factors known as antecedents of accident rates, namely situation awareness and risk behavior. A major strength of the present study is that we controlled for social desirability bias, a factor known to endow distorted responses on self-reported items that represent an inclination to communicate an adulterated response to present a more likable version of oneself. Generally, our results yield support to the notion that improving and promoting the acquisition of positive individual characteristics will result in a reduction of accident rates. Our findings support the broaden-and-build theory (Fredrickson, 1998) as well as the social exchange theory (Blau, 1986) in a safety-critical organization.

Summary of Findings

The present study found positive predictive effects of PsyCap and safety climate on situation awareness, with a considerable effect size. This adds additional support to the notion that PsyCap and safety climate influence the ability to achieve accurate situation awareness. There was an absence of a relationship between job satisfaction and situation awareness, as predicted by our first hypothesis. Thus, the findings did not support the theoretical assumption that job satisfaction influenced situation awareness, resulting in only partial support of our first hypothesis.

Our findings support the well-established negative relationship between individuals' situation awareness and their willingness to partake in risk behavior, supporting our second hypothesis. This indicates that employees with an accurate situation awareness are less likely to engage in unsafe behavior. Possibly, this could be due to the employees accurately

perceiving and comprehending the information and associated risks in the given situation and therefore, acting accordingly.

Our results for the mediation analysis, demonstrates that the relationship between safety climate and reporting attitudes is partially mediated through job satisfaction, supporting our third hypothesis. In other words, employees who consider safety concerns to be of great relevance, as well as being more likely to agree with the management's safety prioritizations (i.e. safety climate) are more inclined to have a positive attitude towards and willingness to report accidents and unwanted incidents (i.e. reporting attitudes). This positive relationship increases moderately when employees are simultaneously satisfied with their work-situation (i.e. job satisfaction), meaning that employees with higher levels of safety climate and job satisfaction are more likely to have positive reporting attitudes than colleagues who only have a high level of safety climate but not job satisfaction.

Findings from Exploratory Analyses

The first exploratory analysis revealed a weak negative association between situation awareness and risk perception, indicating that for every unit the employee's situation awareness increase, the perceived likeliness that a hazardous event will occur decreases. In other words, employees with adequate prerequisites to acquire situation awareness are less likely to perceive threats of possible accidents affecting them. These findings may reflect the employees' understanding of a situation, which affects the subsequent assessment of potential risks in their work environment. This tendency is essential to understand how perceived feelings of threat may be influenced by the ability to achieve the requirements to maintain safety: perception of safety cues, understanding how actions affect the outcomes, and project knowledge to attain a trajectory of situation development.

Correspondingly, the second exploratory analysis showed a weak negative prediction of situation awareness on risk perception concerning the employee's colleagues. Similar to the first exploratory analysis, these findings indicate that as employee's situation awareness increases, the perceived likeliness, and concern over a hazardous incident affecting their colleagues decreases. Thus, we suggest that employees with an accurate understanding of the overall situation will perceive it less likely that an accident will affect their colleagues.

The last exploratory analysis established a weak positive prediction of risk perception on risk behavior, contributing to research on the controversial and complex relationship on this topic. We suggest that the relationship between risk perception and risk behavior is a consequence of inaccurate situation awareness. More specifically, we suggest that situation awareness facilitates accurate risk perception, as indicated by the congruence from hypothesis 2 and our two previous exploratory analyses. In other words, having realistic expectations of the consequences of one's behavior increases the employees' ability to perform accurate calculations of potential hazards. Furthermore, our results support the findings from Rundmo (1996a), indicating that employees who feel less safe are more likely to engage in unsafe actions.

Implications of our Findings

The findings revealed in the present study highlighted aspects of offshore workers' characteristics and abilities that can be utilized in proactive interventions to maintain and advance safety. A proactive approach to safety is enabled through the knowledge of underlying contributing factors of accidents. It would in practice entail implementing education and training opportunities, defining beneficial recruitment standards for operative jobs, constructing helpful design at the workplace, and finally by adjusting organizational structures that coincide with this knowledge.

Implications of results from hypothesis 1 for safety. PsyCap has previously been found to have a positive effect on several safety outcomes (e.g. Schaubroeck, Riolli, Peng, & Spain, 2011). Explanations offered to explain this relationship vary from reducing stress perception levels (Schaubroeck, Riolli, Peng, & Spain, 2011), to emotional engagement and organizational citizenship even in the face of negative reactions to organizational change (Avey, Wernsing, & Luthans, 2008), and PsyCap's ability to function as a buffer against worries concerning accidents in circumstances when risks are perceived as low (Valdersnes, Eid, Hystad, & Nilsen, 2017). Our results do not grant much opportunity to examine exactly what facets of PsyCap that can account for the observed positive relationship with situation awareness. However, there is reason to consider the impact of PsyCap's established correlation to positive affect (e.g. Schaubroeck et al., 2011) on the relationship. In terms of the broaden-and-build theory (Fredrickson, 1998), it is likely that, for the most part, the broadening-effect will have the most considerable effect on Level 1 of situation awareness, namely the perception-phase. It is important to note that this would only be the case if the operator experienced positive affect at the moment that the critical situation was experienced. In particular, this influence may be due to the expanded scope of attention and cognition because of heightened engagement in their immediate environment and cognitive flexibility allowing operators to switch between global and local processing-modes (Bauman & Kuhl, 2005). Furthermore, positive affect improves creative performance (Isen, Daubman, & Nowicki, 1987) and cognitive flexibility (Bauman & Kuhl, 2005) that will support adaptations to encountered stress. Therefore, we suggest that the positive attributions of PsyCap influence the employee's cognitive flexibility when faced with a safety-critical situation, from which their momentary attention capacities and broadened cognition facilitates problem-solving. On the other hand, employees with a negative PsyCap may have a narrower scope of attention and lower cognitive flexibility, which may result in a less accurate understanding of the

safety-critical situation due to local processing of the hazardous cues and therefore not being able to comprehend the overall situation.

The building-effect (e.g. Gloria, Faulk, & Steinhardt, 2013) may also have played an important role, mostly concerning situation awareness Level 2 and 3 (i.e. the comprehension and projection phases respectively), by improving the employees' ability to acquire prerequisites of situation awareness. For example, if an operator has previously experienced critical situations that they reacted to with a problem-focused coping strategy rather than an emotion-focused coping strategy, which has been found to be associated to PsyCap (Schaubroeck, Riolli, Peng, & Spain, 2011). In such a case, a problem-focused coping strategy can be deemed adaptive, because it provides ample learning opportunities, such as knowledge related to the system in which they operate. Specifically, the knowledge would provide information of protype situations (Klein, Calderwood, & Clinton-Cirocco, 2010), as accidents are considered deviations from normal operation. This knowledge can subsequently afford top-down cognitive guidance in future similar situations. If this is the case, the pre-existing knowledge-repertoires would accelerate the recognition phase included in the recognition-primed decision-making model (Klein et al., 2010).

Ostensibly, the positive relationship between safety climate and situation awareness can be explained by the notion that those who consider safety to be a crucial element in their work-environment may be more inclined to attentively observe their work-situations to avoid accidents. They may also benefit more from training than colleagues with lower levels of safety climate due to a more dedicated focus. Furthermore, training outcome is presumably dependent on engagement. The shipping company from which we obtained our sample, have previously invested in training specialized to improve situation awareness, and this may help explain why safety climate predicts situation awareness.

In the sense that PsyCap comprises traits that are known to contribute to positive affect (e.g. Schaubroeck, Riolli, Peng, & Spain, 2011), and that safety climate augment positive affect, our results support the broadened effect of Frederickson's (1998) broaden-and-build theory. We suggest that part of the explanation of the observation of PsyCap coupled with safety climate's positive relationship to situation awareness, lies in the broadening- and building-effects of positive affect on situation awareness. Based on our results, we can suggest that employees who use a broadened spectrum of positive cognitive resources are better equipped to understand the overall situations and predict the development of safety-critical situations. This may be explained by the employees' goal-oriented behavior and motivation, positive cognitive attributions, and their ability to find alternate pathways to succeed when faced with obstacles. Similarly, exhibiting positive attributions and expectancies to overcome a challenging situation, as well as employees with the ability to adapt and thrive in a safety-critical situation (i.e. resilience) may be more likely to overcome the situation.

Implications of results from hypothesis 2 for safety. Our results show that situation awareness predicted risk behavior. This finding confirms previous findings that those who have an understanding of situations and their possible consequences do not engage in as much risk behavior as those who have a less accurate perception and understanding of situations (e.g. Sneddon, Mearns, & Flin, 2006). Particularly, the predictive quality of situation awareness suggests that risk behavior is performed as a result of a lack of understanding of critical work situations (corresponding to Level 1 and 2 of situation awareness) and the inability to correctly project assumptions of how the situation will develop (i.e. Level 3 of situation awareness), as a consequence unsuccessful achievement of Level 1 and 2 situation awareness. Miscalculations of future events can lead to uninformed and unintentional decisions to conduct dangerous behaviors (Rundmo, 1996a). This notion is further

strengthened by our exploratory analyses, which revealed that situation awareness negatively affects risk perception, both concerning the individual and their colleagues, and that a risk perception corresponding to a feeling of unsafety predicts participation in risk behavior. Together, these results suggest that situation awareness may as a buffer between a misaligned risk perception and the participation in risk behavior.

We suggest that risk behavior and situation awareness is connected to active failures, examples of which include unsafe acts (such as slips, fumbles, and mistakes) and procedural violations (Reason, 2000). This assumption builds on the notion that under circumstances with poor situation awareness, it could be easier to miscalculate one's behavioral consequences, as mentioned above. We suggest that shipping companies should attempt to reduce unsafe actions through interventions that aim to reduce active failures by altering their employees' abilities to achieve accurate situation awareness. This would in turn improve the decision-making process, as decisions are made upon the basis of information available through situation awareness.

Employees on board offshore vessels may experience safety-critical situations in which they need to make rapid decisions under time-pressure. In accordance with recognition-primed decision-making (Klein, Calderwood, & Clinton-Cirocco, 2010), operators rely on the cognitive repertoires they have acquired from previous work experiences. Previous research has demonstrated that specific training programs intended to facilitate the acquisition of accurate situation awareness simultaneously result in improved decision-making (e.g. Johnsen, Espevik, Saus, Sanden, & Olsen, 2015). Thus, to make accommodations for allowing employees to acquire more accurate situation awareness would ease the decision-making processes.

Crucially, unsafe actions do not always lead to accidents, and it is difficult to determine the point in which active failures will occur: for instance, determining when

adapting work tasks and taking shortcuts will result in negative consequences and hazardous situations. However, there will be a higher threat of a safety-critical situation occurring with a higher frequency of risk behavior. Therefore, identifying the underlying reasons for active failures is essential for creating a proactive approach to reduce future events. Active failures caused by operators should arguably be incorporated into the system. If one can identify the underlying decision-making processes and situational understanding, it may be easier to develop safe behavior that limits hazardous outcomes.

Implications of results from hypothesis 3 for safety. Our results confirm the previously established positive relationship between safety climate and safety behavior (e.g. Ayim Gyekye, 2005; Griffin & Curcuruto, 2016). Findings from the mediation can be explained by the notion that employees working in a safety-critical organization who feel as though the management prioritizes safety ta an appropriate degree, will probably increase their satisfaction with their job.

Specifically, the positive relationship between safety climate and reporting attitudes and between job satisfaction and reporting attitudes, can be understood in the light of the social exchange theory (Blau, 1986). According to Blau, expressions of positive affect, concern, and consideration from others create a sense of indebtedness in the receiver, and a corresponding obligation to return the gesture. In this regard, prosocial behavior initiated by one individual will facilitate additional prosocial behavior in others. In the offshore context, reporting of safety-dependent circumstances (i.e. accidents and near misses) can be understood as prosocial behavior in the sense that it reflects caring behavior (e.g. Yagil & Luria, 2010). In other words, the act of executing thorough reporting can be interpreted both as a kind gesture and as a gesture that is motivated by the expectation that the favor will incline others to reciprocate.

A well-established reporting system is important for detecting and identifying accidents and near misses in the organization. Following the established safety protocols and reporting systems are essential for detecting possible weaknesses in safety management systems, such as latent failures (Reason, 2000). As mentioned previously, latent failures can lie dormant in the organizational system barriers over long periods of time until they at some point influence an accident by error-provoking effects or continuing weaknesses in the system (Reason,2000). For instance, identifying consequences of unreliable alarms or counterproductive procedures, or identifying errors that constrain operations from being performed safely, such as an operator's lack of experience, time pressure, and inadequate equipment, will make interventions in the workplace possible. Based on our findings, we suggest that employees with positive perceptions of the management's safety prioritization, with the motivation to follow the organizational safety protocols, and exhibiting positive safety values will have more positive attitudes towards reporting accidents and near misses.

Developing a positive safety climate and reporting attitudes may establish a positive reporting culture, in which employees comprehend the value of reporting all accidents and near misses to reduce future accidents. A positive reporting culture is also dependent on good and effective communication, in which both the employees and the management convey and comprehend valuable information of the strengths and weaknesses of the current system in the organizations.

Limitations

There are several limitations to the current study that may affect the generalizability of our results. The response rate of our survey was lower than initially expected, which causes the total number of participants to be too low for what is required to run analyses in quantitative research, especially analyses comparing means between groups (e.g. ANOVAs).

The low number of participants could be the result of several factors. For instance, since the survey was distributed at the beginning of December, the data collection may have been affected by the holidays. Additionally, to reach both Norwegian and international participants, we decided to distribute the English version of the survey. Although English is the official language onboard offshore vessels, the majority of the sample population was Norwegian. Feedback from participants indicated that they did not feel confident enough to complete the survey in their second language.

The nature of the cross-sectional single wave survey design strictly limits our ability to infer causal links between our variables. We therefore advice that findings from the current study should interpreted with caution. We suggest that future research looking at the same relationship that we have, conduct longitudinal survey designs. This would provide ample opportunity to see how the relationships behave over the span of time. An additional benefit of the longitudinal approach is that it yields opportunity to investigate effects of naturally occurring variabilities, such as for example an accident. Findings from such a finding would have high ecological validity.

Furthermore, without our knowledge, the shipping company administered a separate survey as part of their safety monitoring, two weeks before the administration of our study. This may have lessened the crew's motivation to complete our survey.

Furthermore, the sample population in the current study was from a single shipping company. To increase the diversity of the sample population in the study, we included both offshore vessels located on the Norwegian continental shelf and those located globally. Concerning department of work and work role distributions in our sample, there was an evident majority of bridge personnel and leader-type work positions (i.e. captains, officers and chief engineers). It is probable that this skewness is caused by the fact that these were the work role positions who received the participation email directly from us. This imbalance

limits our ability to generalize our findings beyond those employees in high positions. Results may therefore not reveal the most stressed employees in lower ranked work roles, due to their lacking participation. Karasek (1979) postulated the job strain model, which describes the individual's stress response based on the interplay of two dimensions, namely job demands and the individual's decision-making latitude when faced with these demands. In this setting, decision latitude is the constraint that allows for transforming stress, which is conceptualised here as "potential energy", into action energy, thereby circumventing an adverse internalisation of the stress. The job strain model has been found do predict adverse health outcomes when employees experience high strain and low decision-making opportunities (Kalimo, Tenkanen, Härmä, Poppius, & Heinsalmi, 2000). We advise that future research replicate the results in a larger and more diverse sample population, including a global offshore vessel environment including several shipping companies, to determine the reliability of our findings and to better estimate generalizability of the results across different cultures and locations.

We would have appreciated the opportunity to explore and report subscales of the instruments included in the survey. However, due to low coherence values in the safety climate, reporting attitudes, and the desirability bias scales, we were unable to uncover trends in each subcategory. For instance, one may detect variations between the PsyCap dimensions, safety climate categories, and the levels of situation awareness. We suggest that future research should consider using different instruments with satisfactory reliability scores.

The majority of the results in the current study contained small effects, which may affect the generalizability of our results. For instance, human emotions and behavior are complex where multiple factors can explain and confound the relationship between such variables. A large variability may explain why we have low effect sizes on most of our findings. It is important to note that we only found markedly small effect sizes when

investigating the relationship between situation awareness and risk perception, as well as the relationship between risk perception and risk behavior. Therefore, we should be careful to draw firm conclusions from the results of the first two exploratory analyses, as there may be several other unidentified factors affecting these relationships. However, a lower variability level does not negate the fact that most of the analyses were significant, demonstrating an existing relationship between the variables. Therefore, based on our results we can make inferences about the trends and relations between individual factors that may contribute to preventing accidents in our sample size, even if the results may not apply to all offshore vessels.

Although accident and incident frequencies would be beneficial to include in this study (as we originally intended, see appendix K for deviations from pre-registration), finding reliable data is time-consuming as injuries and accidents are sporadic (Hjellvik, Aga, & Sætrevik, in press).

Internal validity of instruments. The present study used a single wave survey design. A major limitation of survey design is the risk of incohesive instruments. Our survey constituted several instruments, and it was crucial to determine the internal validity of these. Cronbach's alpha is the most common form of measuring the internal consistency of items in a survey measure, assessing the average reliability of an instrument (e.g. Hystad, Bartone, & Eid, 2014; Bonett & Wright, 2015). However, Sijtsma (2009) argues that Cronbach's alpha generates underestimates of the reliability of the averages. Bonett and Wright (2015) argues that there is no universal minimally acceptable reliability value and propose that the reliability value should be determined by the type of application and the population reliability value. Tharaldsen, Olsen, and Rundmo (2008) suggest that alpha scores are sensitive to the number

of items in a scale, therefore, the lower number of items in the scales can to some extent explain the low alphas in safety climate, reporting attitudes and desirability bias.

Previous research using the brief safety climate scale (NORSCI-11) have reported acceptable reliability (e.g. Nielsen, Eid, Hystad, Sætrevik, & Saus, 2013; Nielsen, Hystad, & Eid, 2016). As discussed above, the Cronbach's alpha for the overall safety climate scale in the current study was lower than appreciated. Most of the items in the NORSCI-scale appeared to be worthy of retention, resulting in a decrease of the alpha if deleted. The only exception was item eight: "Lack of maintenance has resulted in reduced safety". One can argue that the removal of the item would be beneficial to reach acceptable reliability. Exploring this option revealed that the removal of the item did not have a large impact on the alpha or the planned analyses. Based on this, we decided to keep the item in the measure.

Hjellvik, Aga, and Sætrevik (in press) reported a high reliability of their reporting attitude scale. It is uncertain why the Cronbach's alpha in the current study deviates from previous studies, potentially, the wording of the items could have impacted the reliability, as Hjellvik et al., (in press) use a slightly different wording than the present study. After a closer look at the Cronbach's alpha of the overall reporting attitudes scale, most of the items appeared to be worthy of retention, except for two items, item five and 13: "Incident investigations are used to find out who is to blame for the incident" and "I report trivial matters that have no impact on safety, just because I'm expected to report a given number of incidents". Based on this, future researchers should be wary of these items and consider removing them to reach acceptable reliability.

For the desirability bias scale, Hart, Ritchie, Hepper, and Gebauer (2015) reported low internal consistency in their analysis. They argued that the low internal consistency could be due to the wide range of representations within the subscales. Most of the items in the desirability bias scale appeared to be worth retaining. The only exception was item number

14: “Avoid listening”. Arguably, the item is awkwardly phrased, which raises the question of whether the item was consistently interpreted across our respondents.

Concluding Remarks

Accidents in the offshore industry can have extensive consequences on human lives, the environment, and the economy of shipping companies they affect. The present supports the broadening-and building-effects of positive individual factors, as specified by the broaden-and-build theory (Fredrickson, 1998), in the offshore industry. If offshore shipping companies were to implement solutions that result in increasing employees’ resources through positive affect, as per our suggestions. Thus, safety could be maintained and accidents prevented proactively, resulting in improved safety across the offshore vessel fleet across the world. A reduction of accident frequency would assure a more sustainable operation in the offshore industry, and it would entail fewer human injuries and losses, it would protect the environment through a reduction of pollution in the sea, and it could spare offshore shipping companies from costs associated with replacing damages on their fleet. Our findings are applicable in other safety-critical organizations as the variables examined are present in professions of as doctors, nurses, aircraft pilots, and fire-fighters to mention a few. Future research on the topics covered in the present study should include accident and incident frequencies to ensure a reliable measure of the safety outcomes and a measure of positive affect, to better determine the effects of the broaden-and-build theory’s assumptions.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211. doi:https://doi.org/10.1016/0749-5978(91)90020-T

Ajzen, I., & Fishbein, M. (1973). Attitudinal and normative variables as predictors of specific behavior. *Journal of personality and Social Psychology, 27*(1), 41. doi.org/10.1037/h0034440

Authors (2019). Exploring the Contribution of Individual Factors for Accident Prevention in Offshore Vessels. Retrieved from https://osf.io/zdhxw?view_only=74b30f3cfefb4f659a5466ab8eecd482%3B%20Authors

Authors (2020). Exploring the Contribution of Individual Factors for Accident Prevention in Offshore Vessels. Retrieved from https://osf.io/abejk/?view_only=5803dc4700984a1996336cbb8c6cd1e6

Avey, J. B., Wernsing, T. S., & Luthans, F. (2008). Can positive employees help positive organizational change? Impact of psychological capital and emotions on relevant attitudes and behaviors. *The journal of Applied Behavioral Science, 44*(1), 48-70. doi.org/10.1177/0021886307311470

Ayim Gyekye, S. (2005). Workers' Perceptions of Workplace Safety and Job Satisfaction. *International Journal of Occupational Safety and Ergonomics, 11*(3), 291-302. doi:10.1080/10803548.2005.11076650

Baumann, N., & Kuhl, J. (2005). Positive Affect and Flexibility: Overcoming the Precedence of Global over Local Processing of Visual Information. *Motivation and Emotion, 29,* 123-134. doi:10.1007/s11031-005-7957-1

Bedny, G., & Meister, D. (1999). Theory of Activity and Situation Awareness. *International*

Journal of Cognitive Ergonomics, 3(1), 63-72. doi:10.1207/s15327566ijce0301_5

Bergheim, K., Nielsen, M. B., Mearns, K., & Eid, J. (2015). The relationship between psychological capital, job satisfaction, and safety perceptions in the maritime industry. *Safety Science, 74*(C), 27-36. doi:10.1016/j.ssci.2014.11.024

Blau, P. (1986). *Exchange and Power in Social Life*. Somerset, UNITED KINGDOM: Taylor & Francis Group.

Bolte, A., Goschke, T., & Kuhl, J. (2003). Emotion and intuition: Effects of positive and negative mood on implicit judgments of semantic coherence. *Psychological science, 14*(5), 416-421. doi.org/10.1111/1467-9280.01456

Bonett, D. G., & Wright, T. A. (2015). Cronbach's alpha reliability: Interval estimation, hypothesis testing, and sample size planning. *Journal of Organizational Behavior, 36*(1), 3-15. doi.org/10.1002/job.1960

Brown, S. P., & Leigh, T. W. (1996). A new look at psychological climate and its relationship to job involvement, effort, and performance. *Journal of Applied Psychology, 81*(4), 358. doi:10.1037/0021-9010.81.4.358

Christian, M. S., Bradley, J. C., Wallace, J. C., & Burke, M. J. (2009). Workplace safety: a meta-analysis of the roles of person and situation factors. *Journal of Applied Psychology, 94*(5), 1103. doi.org/10.1037/a0016172

Chung, J., & Monroe, G. S. (2003). Exploring social desirability bias. *Journal of Business Ethics, 44*(4), 291-302. doi:10.1023/A:1023648703356

Dahl, Ø., Fenstad, J., & Kongsvik, T. (2014). Antecedents of safety-compliant behaviour on offshore service vessels: a multi-factorial approach. *Maritime Policy & Management, 41*(1), 20-41. doi:10.1080/03088839.2013.780311

Danner, D. D., Snowdon, D. A., & Friesen, W. V. (2001). Positive emotions in early life and longevity: Findings from the nun study. *Journal of Personality and Social Psychology,*

80(5), 804-813. doi:10.1037/0022-3514.80.5.804

Dekker, S. W. (2001). The re-invention of human error. *Human Factors and Aerospace safety, 1*(3), 247-265. Retrieved from: https://www.ida.liu.se/~729A71/Literature/Human%20Error_T/Dekker_2002.pdf

Duncker, K. (1945). On problem-solving. *Psychological Monographs, 58*(5), i-113. doi:10.1037/h0093599

Eid, J., Mearns, K., Larsson, G., Laberg, J. C., & Johnsen, B. H. (2012). Leadership, psychological capital and safety research: Conceptual issues and future research questions. *Safety Science, 50*(1), 55-61. doi.org/10.1016/j.ssci.2011.07.001

Endsley, M. R. (1995). Toward a Theory of Situation Awareness in Dynamic Systems. *Human Factors, 37*(1), 32-64. doi:10.1518/001872095779049543

Flin, R., Mearns, K., O'Connor, P., & Bryden, R. (2000). Measuring safety climate: identifying the common features. *Safety Science, 34*(1-3), 177-192. doi:10.1016/S0925-7535(00)00012-6

Fredrickson, B. L. (1998). What Good Are Positive Emotions? *Review of General Psychology: Journal of Division 1, of the American Psychological Association, 2*(3), 300-319. doi:10.1037/1089-2680.2.3.300

Fredrickson, B. L., & Levenson, R. W. (1998). Positive Emotions Speed Recovery from the Cardiovascular Sequelae of Negative Emotions. *Cognition & Emotion, 12*(2), 191-220. doi:10.1080/026999398379718

Gasper, K. (2004). Do you see what I see? Affect and visual information processing. *Cognition and Emotion, 18*(3), 405-421. doi:10.1080/02699930341000068

Gasper, K., & Clore, G. (2002). Attending to the Big Picture: Mood and Global Versus Local Processing of Visual Information. *Psychological Science, 13*, 34-40. doi:10.1111/1467-9280.00406

Gloria, C., Faulk, K. E., & Steinhardt, M. (2013). Positive affectivity predicts successful and unsuccessful adaptation to stress. *Motivation and Emotion, 37*. doi:10.1007/s11031-012-9291-8

Gordon, R., Flin, R., & Mearns, K. (2005). Designing and evaluating a human factors investigation tool (HFIT) for accident analysis. *Safety Science, 43*(3), 147-171. doi.org/10.1016/j.ssci.2005.02.002

Griffin, M. A., & Curcuruto, M. (2016). Safety climate in organizations. *Annual Review of Organizational Psychology and Organizational Behavior, 3*, 191-212. doi.org/10.1146/annurev-orgpsych-041015-062414

Grimm, P. (2010). Social desirability bias. *Wiley International Encyclopedia of Marketing*. doi:10.1002/9781444316568.wiem02057

Hart, C. M., Ritchie, T. D., Hepper, E. G., & Gebauer, J. E. (2015). The balanced inventory of desirable responding short form (BIDR-16). *Sage Open, 5*(4). doi:10.1177/2158244015621113

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford publications.

Hjellvik, L. R., Aga, R. E. H., & Sætrevik, B. (in press). Organizational and Individual Safety Factors in Work on Chemical Tanker Vessels. doi:10.31234/osf.io/szr3f

Hobbs, A., & Williamson, A. (2002). Unsafe acts and unsafe outcomes in aircraft maintenance. *Ergonomics, 45*(12), 866-882. doi.org/10.1080/00140130210148528

Hystad, S. W., Bartone, P. T., & Eid, J. (2014). Positive organizational behavior and safety in the offshore oil industry: Exploring the determinants of positive safety climate. *The Journal of Positive Psychology, 9*(1), 42-53. doi: http://dx.doi.org/10.1080/17439760.2013.831467

Høivik, D., Tharaldsen, J. E., Baste, V., & Moen, B. E. (2009). What is most important for

safety climate: The company belonging or the local working environment? A study from the Norwegian offshore industry. *Safety Science, 47*(10), 1324-1331. doi.org/10.1016/j.ssci.2009.04.001

Isen, A. M., Daubman, K. A., & Nowicki, G. P. (1987). Positive affect facilitates creative problem solving. *Journal of Personality and Social Psychology, 52*(6), 1122-1131. doi:10.1037/0022-3514.52.6.1122

Jiang, L., Lavaysse, L. M., & Probst, T. M. (2019). Safety climate and safety outcomes: A meta-analytic comparison of universal vs. industry-specific safety climate predictive validity. *Work & Stress, 33*(1), 41-57. doi:10.1080/02678373.2018.1457737

Johnsen, B., Espevik, R., Saus, E., Sanden, S., & Olsen, O. (2015). Note on a Training Program for Brief Decision Making for Frontline Police Officers. *Journal of Police and Criminal Psychology, 31*. doi:10.1007/s11896-015-9180-7

Kahneman, D., & Klein, G. (2009). Conditions for intuitive expertise: a failure to disagree. *The American Psychologist, 64*(6), 515. doi:10.1037/a0016755

Kalimo, R., Tenkanen, L., Härmä, M., Poppius, E., & Heinsalmi, P. (2000). Job stress and sleep disorders: findings from the Helsinki Heart Study. *Stress Medicine, 16*(2), 65-75. doi:10.1002/(SICI)1099-1700(200003)16:2<65::AID-SMI834>3.0.CO2-8

Karasek Jr, R. A. (1979). Job demands, job decision latitude, and mental strain: Implications for job redesign. *Administrative Science Quarterly*, 285-308. doi: 10.2307/2392498

Klein, G. (2008). Naturalistic decision making. *Human Factors: The Journal of the Human Factors and Ergonomics Society, 50*, 456-460. doi.org/10.1518/001872008X288385

Klein, G., Calderwood, R., & Clinton-Cirocco, A. (2010). Rapid Decision Making on the Fire Ground: The Original Study Plus a Postscript. *Journal of Cognitive Engineering and Decision Making, 4*, 186-209. doi:10.1518/155534310X12844000801203

Kongsvik, T., Fenstad, J., & Wendelborg, C. (2012). Between a rock and a hard place:

Accident and near-miss reporting on offshore service vessels. *Safety Science, 50*(9), 1839-1846. doi.org/10.1016/j.ssci.2012.02.003

Kuhl, J. (2000). *Chapter 5 - A Functional-Design Approach to Motivation and Self-Regulation: The Dynamics of Personality Systems Interactions*: Elsevier Inc. doi.org/10.1016/B978-012109890-2/50034-2

Luthans, F. (2002). The need for and meaning of positive organizational behavior. *Journal of Organizational Behavior, 23*(6), 695-706. doi.org/10.1002/job.165

Luthans, F., Avey, J. B., Avolio, B. J., & Peterson, S. J. (2010). The development and resulting performance impact of positive psychological capital. *Human Resource Development Quarterly, 21*(1), 41-67. doi.org/10.1002/hrdq.20034

Luthans, F., Avolio, B. J., Avey, J. B., & Norman, S. M. (2007). Positive psychological capital: Measurement and relationship with performance and satisfaction. *Personnel Psychology*, *60*(3), 541-572. doi.org/10.1111/j.1744-6570.2007.00083.x

Mearns, K., & Flin, R. (1995). Risk perception and attitudes to safety by personnel in the offshore oil and gas industry: a review. *Journal of Loss Prevention in the Process Iindustries, 8*(5), 299-305. doi.org/10.1016/0950-4230(95)00032-V

Mearns, K., Flin, R., Gordon, R., & Fleming, M. (1998). Measuring safety climate on offshore installations. *Work & Stress, 12*(3), 238-254. doi.org/10.1080/02678379808256864

Mearns, K., Rundmo, T., Flin, R., Gordon, R., & Fleming, M. (2004). Evaluation of psychosocial and organizational factors in offshore safety: a comparative study. *Journal of Risk Research, 7*(5), 545-561. doi.org/10.1080/1366987042000146193

Mearns, K. J., & Flin, R. (1999). Assessing the state of organizational safety—culture or climate? *Current Psychology, 18*(1), 5-17. doi.org/10.1007/s12144-999-1013-3

Mednick, S. A. (1962). The associative basis of the creative process. *Psychological Review,*

69, 220. doi.org/10.1037/h0048850

Morrow, P. C., & Crum, M. R. (1998). The effects of perceived and objective safety risk on employee outcomes. *Journal of Vocational Behavior, 53*(2), 300-313. doi.org/10.1006/jvbe.1997.1620

Neal, A., & Griffin, M. A. (2004). Safety climate and safety at work. *The Psychology of Workplace Safety,* 15-34. doi.org/10.1037/10662-002

Neal, A., Griffin, M. A., & Hart, P. M. (2000). The impact of organizational climate on safety climate and individual behavior. *Safety Science, 34*(1-3), 99-109. doi.org/10.1016/S0925-7535(00)00008-4

Newman, A., Ucbasaran, D., Zhu, F., & Hirst, G. (2014). Psychological capital: A review and synthesis. *Journal of Organizational Behavior, 35*(S1), S120-S138. doi:10.1002/job.1916

Nielsen, M. B., Eid, J., Hystad, S. W., Sætrevik, B., & Saus, E.-R. (2013). A brief safety climate inventory for petro-maritime organizations. *Safety Science, 58,* 81-88. doi.org/10.1016/j.ssci.2013.04.002

Nielsen, M. B., Hystad, S. W., & Eid, J. (2016). The Brief Norwegian Safety Climate Inventory (Brief NORSCI)–Psychometric properties and relationships with shift work, sleep, and health. *Safety Science, 83,* 23-30. doi:10.1016/j.ssci.2015.11.004

Nielsen, M. B., Mearns, K., Matthiesen, S. B., & Eid, J. (2011). Using the Job Demands–Resources model to investigate risk perception, safety climate and job satisfaction in safety critical organizations. *Scandinavian Journal of Psychology, 52*(5), 465-475. doi: 10.1111/j.1467-9450.2011.00885.x

Norwegian Maritime Authority (2017). *Focus on risks 2017.* Retrieved from: https://www.sdir.no/en/shipping/accidents-and-safety/safety-investigations-and-reports/focus-on-risks-2017/

Norwegian Maritime Authority. (2018). *Focus on risks 2018*. Retrieved from https://www.sdir.no/globalassets/sjofartsdirektoratet/fartoy-og-sjofolk---dokumenter/roh---dokumenter/focus-on-risk-2018.pdf?t=1589202223643

Norwegian Maritime Directorate (2011). Marine casualties 2000-2010. Strategic safety department 2011. Retrieved from: https://www.sdir.no/globalassets/global-2/ulykker-og-sikkerhet/ulykkesstatistikk/statistikk-ulykker/marine-casualties-2000---2010.pdf

Norwegian shipowner's association, NSA. (2014). Norwegian Offshore Shipping Companies: Local value creation, Global success. Retrieved from: https://rederi.no/rapporter/

Orasanu, J. and Connolly, T. (1993). 'The Reinvention of Decision Making. In Klein, G.A., Orasanu, J.,Calderwood, R. and Zsambok, C. (Eds.), Decision Making in Action: Models and Methods (p. 3-20), Norwood, CT: Ablex, 1993.

Patrick, J., & Morgan, P. L. (2010). Approaches to understanding, analysing and developing situation awareness. *Theoretical Issues in Ergonomics Science*, *11*(1-2), 41-57. doi.org/10.1080/14639220903009946

Paulhus, D. L. (1991). Measurement and control of response bias. In J. P. Robinson, P. R. Shaver, & L. S. Wrightsman (Eds.), *Measures of social psychological attitudes, Vol. 1. Measures of personality and social psychological attitudes* (p. 17–59). Academic Press. https://doi.org/10.1016/B978-0-12-590241-0.50006-X

Probst, T. M., & Graso, M. (2013). Pressure to produce= pressure to reduce accident reporting? *Accident Analysis & Prevention, 59*, 580-587. doi:10.1016/j.aap.2013.07.020

Psarros, G., Skjong, R., & Eide, M. S. (2010). Under-reporting of maritime accidents. *Accident Analysis & Prevention, 42*(2), 619-625. doi:10.1016/j.aap.2009.10.008

Reason, J. (1990). *Human error*: Cambridge university press.

Reason, J. (2000). Human error: models and management. *Bmj, 320*(7237), 768-770.

doi.org/10.1136/bmj.320.7237.768

Rundmo, T. (1994). Associations between safety and contingency measures and occupational accidents on offshore petroleum platforms. *Scandinavian journal of work, environment & health*, 128-131. Retrieved from www.jstor.org/stable/40966236

Rundmo, T. (1995). Perceived risk, safety status, and job stress among injured and noninjured employees on offshore petroleum installations. *Journal of Safety Research, 26*(2), 87-97. doi:10.1016/0022-4375(95)00008-E

Rundmo, T. (1996a). Associations between risk perception and safety. *Safety Science, 24*(3), 197-209.

Rundmo, T. (1996b). Changes in risk perception among North Sea offshore personnel in the period 1990 to 1994. *Safety Science, 21*(3), 205-221. doi:10.1016/0925-7535(95)00065-8

Rundmo, T. (2018). Is it possible to prevent unforeseen events? In E. T. G. (Ed.), *Interaction: 'Samhandling' under risk. A step ahead of the unforeseen* (pp. 55-74). Oslo: Cappelen Damm Akademisk.

Schaubroeck, J. M., Riolli, L. T., Peng, A. C., & Spain, E. S. (2011). Resilience to Traumatic Exposure Among Soldiers Deployed in Combat. *Journal of Occupational Health Psychology, 16*(1), 18-37. doi:10.1037/a0021006

Sijtsma, K. (2009). On the use, the misuse, and the very limited usefulness of Cronbach's alpha. *Psychometrika, 74*(1), 107. doi:0.1007/s11336-008-9101-0

Simon, H. A. (1992). What is an "Explanation" of Behavior? *Psychological Science, 3*(3), 150-161. doi:10.1111/j.1467-9280.1992.tb00017.x

Smith, K., & Hancock, P. A. (1995). Situation Awareness Is Adaptive, Externally Directed Consciousness. *Human Factors, 37*(1), 137-148. doi:10.1518/001872095779049444

Sneddon, A., Mearns, K., & Flin, R. (2006). Situation awareness and safety in offshore drill

crews. *Cognition, Technology & Work, 8*(4), 255-267. doi:10.1007/s10111-006-0040-1

Sneddon, A., Mearns, K., & Flin, R. (2013). Stress, fatigue, situation awareness and safety in offshore drilling crews. *Safety Science, 56*, 80-88. doi:https://doi.org/10.1016/j.ssci.2012.05.027

Snyder, C., Irving, L. M., & Anderson, J. R. (1991). Hope and health. *Handbook of social and clinical psychology: The Health Perspective, 162*, 285-305.

Stajkovic, A. D., & Luthans, F. (1998). Social cognitive theory and self-efficacy: Going beyond traditional motivational and behavioral approaches. *Organizational Dynamics, 26*(4), 62-75. doi:10.1016/S0090-2616(98)90006-7

Stanton, N. A., Stewart, R., Harris, D., Houghton, R. J., Baber, C., McMaster, R.,…Green, D. (2006). Distributed situation awareness in dynamic systems: theoretical development and application of an ergonomics methodology. *Ergonomics, 49*(12-13), 1288-1311. doi:10.1080/00140130600612762

Subramaniam, K., Kounios, J., Parrish, T. B., & Jung-Beeman, M. (2009). A Brain Mechanism for Facilitation of Insight by Positive Affect. *Journal of Cognitive Neuroscience, 21*(3), 415-432. doi:10.1162/jocn.2009.21057

Sullivan, S. E., & Bhagat, R. S. (1992). Organizational stress, job satisfaction and job performance: where do we go from here? *Journal of Management, 18*(2), 353-374. doi:10.1177/014920639201800207

Sætrevik, B. (2013). Developing a context-general self-report approach to measuring three-level situation awareness. Retrieved from: https://journals.viamedica.pl/international_maritime_health/article/view/34687

Sætrevik, B., & Hystad, S. W. (2017). Situation awareness as a determinant for unsafe actions and subjective risk assessment on offshore attendant vessels. *Safety Science, 93*, 214-

221. doi:https://doi.org/10.1016/j.ssci.2016.12.012

Tharaldsen, J., Olsen, E., & Rundmo, T. (2008). A longitudinal study of safety climate on the Norwegian continental shelf. *Safety Science, 46*(3), 427-439. doi.org/10.1016/j.ssci.2007.05.006

Ulleberg, P., & Rundmo, T. (1997). Job stress, social support, job satisfaction and absenteeism among offshore oil personnel. *Work & Stress, 11*(3), 215-228. doi.org/10.1080/02678379708256836

Valdersnes, K. B., Eid, J., Hystad, S. W., & Nielsen, M. B. (2017). Does psychological capital moderate the relationship between worries about accidents and sleepiness? *International Maritime Health, 68*(4), 245. doi:10.5603/IMH.2017.0043

Woods, D.D. and Hollnagel, E. (2006). Joint cognitive systems: Patterns in cognitive systems engineering. Boca Raton, FL: Taylor & Francis.

Woods, D. D., & Sarter, N. B. (2010). Capturing the dynamics of attention control from individual to distributed systems: the shape of models to come. *Theoretical Issues in Ergonomics Science, 11*(1-2), 7-28. doi:10.1080/14639220903009896

Yagil, D., & Luria, G. (2010). Friends in Need: The Protective Effect of Social Relationships Under Low-Safety Climate. *Group & Organization Management, 35*(6), 727-750. doi:10.1177/1059601110390936

Zohar, D. (2000). A group-level model of safety climate: testing the effect of group climate on microaccidents in manufacturing jobs. *Journal of Applied Psychology, 85*(4), 587. doi:doi.org/10.1037/0021-9010.85.4.587

Zohar, D. (2010). Thirty years of safety climate research: Reflections and future directions. *Accident Analysis & Prevention, 42*(5), 1517-1522. doi.org/10.1016/j.aap.2009.12.019

Appendix A

Safety Climate Questionnaire

Below are some statements of importance to health, working environment and safety. Some statements only apply to the working environment or safety. Based on your current work situation, indicate to what degree you agree with the various statements. (The sum of the items constitute a second-order factor measuring the general feeling of safety). Mark each statement on a scale from 1 = strongly disagree to 5 = strongly agree. (* reversed).

Individual intention and motivation

1. I report dangerous situations when I see them
2. Safety has top priority when I do my job
3. I ask my colleagues to stop work when I think the task in question is being carried out in a risky manner
4. I stop working if I think it can be dangerous for me or other to continue

Managements prioritizing

5. In practice concern for production precedes the concern for health, environment and safety *
6. Reports on accidents or dangerous situations are often “smartened up” *
7. There are often parallel work operations proceeding that leads to dangerous situations*
8. Lack of maintenance has resulted in reduced safety*

Safety routines

9. I have the necessary competence to perform my job in a safe manner
10. I have easy access to personal protective equipment
11. The safety deputies’ suggestions are taken seriously by the management

Appendix B

Psychological Capital Questionnaire (PCQ)

Below are statements that describe how you may think about yourself right now. Use the following scales to indicate your level of agreement or disagreement with each statement. Mark each statement on a scale from 1 = strongly disagree, to 6 = strongly agree. (* reversed).

Self -efficacy

1. I feel confident analyzing a long-term problem to find a solution.
2. I feel confident in representing my work area in meetings with management.
3. I feel confident contributing to discussions about the company's strategy.
4. I feel confident helping to set targets/goals in my work area.
5. I feel confident contacting people outside the company (e.g., suppliers, customers) to discuss problems.
6. I feel confident presenting information to a group of colleagues.

Hope

7. If I should find myself in a jam at work, I could think of many ways to get out of it.
8. At the present time, I am energetically pursuing my work goals.
9. There are lots of ways around any problem.
10. Right now I see myself as being pretty successful at work.
11. I can think of many ways to reach my current work goals.
12. At this time, I am meeting the work goals that I have set for myself.

Resilience

13. When I have a setback at work, I have trouble recovering from it, moving on*
14. I usually manage difficulties one way or another at work.

15. I can be “on my own,” so to speak, at work if I have to.
16. I usually take stressful things at work in stride.
17. I can get through difficult times at work because I’ve experienced difficulty before.
18. I feel I can handle many things at a time at this job.

Optimism

19. When things are uncertain for me at work, I usually expect the best.
20. If something can go wrong for me work-wise, it will. *
21. I always look on the bright side of things regarding my job.
22. I’m optimistic about what will happen to me in the future as it pertains to work.
23. In this job, things never work out the way I want them to. *
24. I approach this job as if “every cloud has a silver lining.”

Appendix C

The Job Satisfaction Questionnaire

Based on your current work situation, indicate to what degree you agree with the various statements. Mark each statement on a scale from 1 = strongly disagree, to 5 = strongly agree. (* reversed).

1. I feel fairly satisfied with my present job
2. Most days I am enthusiastic about my work
3. I find real enjoyment in my work
4. I consider my job rather unpleasant *
5. Each day of work seems like it will never end *

Appendix D

Situation Awareness Questionnaire

The following statements are related to the safety situation on board. Mark each statement on a scale from 1 = completely disagree, to 5 = completely agree. (* reversed)

1. I notice when an unsafe situation is about to arise at my workplace (level 3)
2. I sometimes lose track of information relevant for maintaining safety in my work (level 1) *
3. It's hard to know what consequences my actions have for safety (level 2) *
4. I sometimes lose track of safety due to receiving too much information at the same time (level 1) *
5. I plan ahead in order to handle various adverse incidents that may arise (level 3)
6. I know which information is relevant for safety and which information is not relevant for safety (Level 2)
7. It is impossible to predict what will happen during an adverse incident (Level 3) *
8. I know how to act to maintain safety (Level 2)
9. I feel confident that I know how to deal with the various adverse incidents that may arise (Level 2)
10. Some of the information I need to assess safety is presented in a way that makes it difficult to understand (Level 1) *
11. I usually know what's going to happen next with regards to safety (Level 3)
12. The information I need to assess safety is easily available (Level 1)
13. I know which situations in my work involves higher risk than others (Level 2)

Appendix E

Risk Perception Scenario Questionnaire

- How would you rate the likelihood that **you** over the next 12 months will be affected by a work and personal accidents involving..
- How would you rate the likelihood that **someone else** over the next 12 months will be affected by a work and personal accidents involving..

(Mark each statement on a scale from 1 = very unlikely, to 6 = very likely)

a) Struck by objects in motion (e. g. cargo)

b) Trapped, crushed or squeezed

c) Cuts or contact with sharp or pointed elements

d) Contact with hazardous substances

e) Man overboard

f) Slips, trips, falls

g) Electrical hazard, fire, explosion

Appendix F

Risk Behavior Questionnaire

The following statements are related to the safety situation on board. Mark each statement on a scale from 1 = strongly disagree, to 5 = strongly agree. (* reversed).

1. I have exposed myself or others to danger in order to get the job done
2. To get the job done, I have taken shortcuts with regards to safety
3. I sometimes adapt my work to avoid triggering certain safety procedures
4. I'm sometimes pressured to do work tasks that I know may reduce safety
5. Being busy at port makes it difficult for me to maintain safety
6. We are able to maintain safety while running parallel operations *
7. I urge colleagues to stop work that I believe is being carried out in a risky way *
8. I stop work if I think it may be dangerous for me or others to continue *

Appendix G

Desirability Bias Questionnaire

Please answer the following statements on how this relates to you. Mark each statement on a scale from 1 = strongly disagree, to 8 = strongly agree. (* reversed).

Self-deceptive enhancement

1. Not always honest *
2. Know why I like things
3. Hard to shut off a disturbing thought *
4. Never regret decisions
5. Can’t make up my mind *
6. Am completely rational
7. Confident in judgements
8. Doubted my ability as a lover *

Impression management

9. Sometimes tell lies *
10. Never cover up mistakes
11. Taken advantage of someone *
12. Sometimes try to get even *
13. Said something bad about a friend *
14. Avoid listening
15. Never take things (steal)
16. Don’t gossip

Appendix H

Reporting Attitudes

Answer the following statements on how this relates to you and your work.

Mark each statement on a scale from 1 = strongly disagree, to 5 = strongly agree. (* reversed).

1. I report all minor accidents in writing
2. There is no point in reporting unwanted events since it does not lead to improvements*
3. Since it's impossible to prevent all unwanted events, we shouldn't spend too much resources on reporting*
4. Reporting can have negative consequences for me *
5. Incident investigations are used to find out who is to blame for the incident
6. Reporting of near misses does not lead to improvements*
7. I am not motivated to report near-misses *
8. It would take too much time if we were to report all the near misses *
9. Reporting all near-misses will not be helpful to increase safety *
10. I report all incidents that may have evolved into accidents
11. I report situations that may feel unsafe, even when I cannot point to any specific breaches of the safety regulation
12. I am committed to reporting situations where security can be improved, rather than to report all deviations
13. I report trivial matters that have no impact on safety, just because I’m expected to report a given number of incidents
14. Reports from accidents or dangerous situations are often 'embellished' *

Appendix I

Information Letter to participants

Invitation to participate in a study about factors that influence safety among employees in offshore vessels. The present study is a part of a master's thesis project in collaboration with the shipping company, in which we ask all employees working on offshore vessels in the shipping company to participate. Based on an agreement with the Department of Psychosocial Science at the University of Bergen, NSD – The Norwegian Centre for Research Data AS has assessed that the processing of personal data in this project is in accordance with data protection legislation.

All information will be treated confidentially. The technical implementation of the survey is conducted by SurveyXact. The researcher will be given data from SurveyXact, which is not linked to email or IP addresses. All information will be made anonymous when the project is completed, by May 2020. All personal information will be deleted upon the completion of the project, however, the research group may use non-identifiable data for future research. Participation in the survey is **voluntary** and you may withdraw from the study at any point with no justification needed. However, your response would be essential to our project and would be much valued.

Collected data will be stored on a password-protected computer to be safely secured. The information from individual participants will **not** be made available to the shipping company. However, the completed project will be presented to the management of the shipping company, but please note that identifying information will not be included in these documents or presentations.

Your rights: Upon registering for this study, you will be asked to create your own unique identity marker which works as an equivalent to a username. You have the right to gain access, edit, delete, and receive a copy of your responses at any time after the completion

of the study. This will be made possible by contacting one of the project leaders and identifying yourself with your personal marker. This procedure will ensure your anonymity. We kindly ask that you remember the marker as well as keeping it secret for your own privacy's sake. You also have the right to file a complaint to the Norwegian Data Protection Authority regarding the processing of your personal data.

You will be asked to answer an online questionnaire that should take approximately 20-30 minutes to complete. If you choose to participate in the study, you will be asked to determine to which degree you agree to a series of questions regarding safety-related matters at work as well as yourself. Your consent allows us to analyze your personal data.

Thank you for your participation! By giving my consent, I have received the information about the study "safety on offshore vessels" and I understand the implications of participating. I have had opportunity to ask questions about the study. And I am 18 years or older.

I give consent to participate in this online survey and the processing of my data: _____

Date: ___/____/____

Appendix J

Debriefing Page

We thank you for taking the time to participate in our study. Your time and effort mean a great deal to our project.

Title: Exploring the Contribution of Individual Factors for Accident Prevention in Offshore Vessels. The purpose of this study is to identify some cognitive, affective, and personality factors that contribute to safer offshore operations. Our study aims to provide a proactive toolbox to determine which individual factors might predict safety outcomes. For instance, we believe that having a positive outlook on the future, as well as confidence in one's own ability to reach goals would affect the work environment in such a way that offshore operations occur in a safer manner.

It is important to us that our hypothesis do not get revealed to other participants before they respond to the survey. This is because having knowledge about our research question may affect the way in which participants frame their answers. Therefore, we kindly ask that you do not share information about specific content or our hypotheses to your colleagues. We will determine whether our hypotheses are supported or not by connecting your responses to accident data from the shipping company's entire fleet. Your anonymity will be prioritized throughout our data analysis.

You have the right to gain access, edit, delete, and receive a copy of your responses up until the start of data analysis (The end of January 2020). This will be made possible by contacting one of the project leaders and identifying yourself with your personal marker. We will be happy to share our finished master thesis with anyone who participated in the study. You may contact us via email or you can contact the shipping company's management.

Appendix K

Pre-Registration Edits

Status update of the project "Exploring the Contribution of Individual Factors for Accident Prevention in Offshore Vessels". Date of document: February 17th, 2020

Since the completion of the preregistration of the current project, we have encountered several challenges that have changed the trajectory of our study. The rationale behind this document is to lay out these challenges and openly discuss their implications. Importantly, the data has not yet been previewed or analyzed to any extent by the researchers.

Firstly, the number of participants is far lower than what was initially expected. The goal was to reach approximately 400 participants, which would be a response rate of about 40 percent. Going towards the end of the data collection period, our current response rate is approximately 28 percent.

Furthermore, a few days before the survey was ready to be dispatched, the shipping company informed of a survey that was ongoing among the crew. The survey was executed by an external firm, and unfortunately it also incorporated some of the same subjects as covered by our survey. The theme of their survey was trust-based leadership and it focused on positive aspects of the workplace. We postponed the start date of our survey with two weeks and sent out the email a link to our survey at December 2nd, 2019 (and a stop date at February 14th, 2020). We suspect that this may have affected the willingness of the crew to participate in a second survey, and it may unfortunately affect the responses of those who did participate in or survey after the other.

The postponement as well as the low rate of new participants to our survey has resulted in a more rigid time pressure than we first assumed would be realistic. Our plan was

to register key performance indicators (an objective number of accidents and near misses) after the survey was closed so we could infer some causality. However, due to the present time pressure we are unable to do so within the time the project is due to be finished. In other words, we will no longer be able to collect and analyze objective data, and we therefore lose one of our variables. Due to the elimination of this variable, we can no longer test our hypothesis number four.

In the period after the pre-registration was completed, we carried out a more rigorous literature review of our research topic, and quickly realized that hypothesis number one, in which we hypothesized that psychological capital, safety climate, job satisfaction, and hardiness are positively related to situation awareness. We assume that they all do, but we have however realized that there is a possibility of multicollinearity within our variables in our first hypothesis. Psychological capital and hardiness will most likely correlate in their resilience elements, as well as the correlation between job satisfaction and safety climate. To adjust for these deficiencies, we have decided to remove hardiness from our analyses, and to complete the multiple regression as it is, with the possibility that safety climate and job satisfaction correlate.

The next phase in our project will be to start the data analysis.