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The differential impact of organizational restructuring and downsizing on the psychosocial work environment and safety climate in the petroleum industry

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ABSTRACT

This study examines trends in employee perceptions of psychosocial risk and safety climate during organizational change in the Norwegian petroleum industry between 2007 and 2019. Using data from the RNNP survey, which is distributed to personnel on offshore facilities on the Norwegian Continental Shelf and onshore installations biennially, a repeated measures analysis was conducted to identify trends in psychosocial risk and safety climate perceptions. Results indicated that while safety climate was perceived to improve significantly from 2009 to 2019, those participants who had experienced organizational downsizing, organizational restructuring, or both downsizing and restructuring reported a significantly lower safety climate on most waves included in the analysis. While those participants that had experienced downsizing reported a significantly lower quality psychosocial work environment across waves, it was organizational restructuring that was associated with the largest perceived decline in the quality of the psychosocial work environment and not downsizing. The combination of restructuring and downsizing was significantly associated with a lower quality psychosocial work environment across all waves but to a lesser extent than for safety climate. Our study highlights that different types of organizational change – restructuring and downsizing, have a differential impact on the perception of different types of risk – psychosocial risk and safety climate. It further demonstrates the long-term detrimental effect of large-scale resource cuts, particularly those that culminated in 2017 in the Norwegian Petroleum industry, demonstrated as an erosion in the perception of the quality of both safety climate and the psychosocial work environment.

1. Introduction

The petroleum industry has over the last years gone through significant change processes in order to adjust expenditure to income levels. This is due to challenges arising from low oil prices, high cost pressures and rapid technological development. Technological changes and fluctuations in market dynamics have led to higher demands for cost reduction, implementation of new technology, and changes in how work is organized and managed (Fijalkowska et al., 2017; Mathisen et al., 2017).

Thus, organizational change has become a prominent characteristic of the sector, including mergers and acquisitions, downsizings, efficiency initiatives and other types of cost-reductions (Heyerdahl et al., 2018). While downsizing refers to employee headcount reduction and restructuring captures organizational reconfigurations, in practice they have often been treated as one in policy and in practice (Cascio, 2002). Whereas the aim of these changes is to make organizations more robust, they may also have negative side effects.

A number of empirical and theoretical studies that investigated disastrous events conclude that organizational change can adversely affect safety systems in high-risk industries (Gehman, 2003; Heyerdahl et al., 2018; Perrow, 1984; Vaughan, 1996; Weick, 1993). Thus, organizational change conditions have been shown to result in, among other things, changing contractual relationships, increased employee

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uncertainty, higher work intensity, and irregular working conditions. Such changes may increase psychosocial risks to employee health, safety and well-being and organizational performance. The changes can imply major transitions for employees, such as changed tasks, faster pace of work, need for competence development, changed social status, job insecurity, as well as new leaders and colleagues or losing coworkers. Additionally, these changes may have several effects on employees including being distracted from work tasks, taking shortcuts due to fewer employees to perform the same tasks, lack of appropriate knowledge and experience to complete tasks effectively, work overload and reduced well-being (e.g. Datta et al., 2010; de Jong et al., 2016). Consequently, the risk of human error can increase that may result in severe consequences such as accidents which can be catastrophic, especially in high-risk industries such as the petroleum industry (Mathisen and Bergh, 2016; Zwetsloot et al., 2014).

A reduced prioritization of important risks may evolve gradually during times of organizational change. Reason (1990) introduced the term 'latent errors' to describe an erosion of safety processes and referred to the not so apparent elements in the organization that can contribute to the occurrence of actual errors (that in turn may lead to accidents). Latent errors can be weakened organizational defenses, such as organizational climates and cultures, leadership, organizational structures and procedures, and psychosocial work environments. Such erosion of safety processes can result in the possibility of lack of prioritization of important risks and failure to implement appropriate control measures to alleviate negative outcomes. Furthermore, according to Reason (2005, p. 58), the "damaging consequences (of latent errors) may lie dormant for a long time, only becoming evident when they combine with active failures and local triggering factors to breach the system's many defenses". Thus, during times of major organizational change, the awareness of possible safety erosion processes is highly important as a measure to prevent accidents and disasters.

This study focuses on the petroleum industry in Norway. The industry faced significant challenges between September 2014 and January 2016, when oil prices dropped from an average of 100 USD to 30 USD per barrel (The Central Bank of Norway, 2022). By the end of 2014, the industry implemented several cost-cutting measures, including widespread restructuring and downsizing. Changes implemented in the sector included restructuring in terms of merging teams and departments and reduced focus on equipment maintenance (Aalberg et al., 2019), and downsizing in terms of drastically reducing staff. For example, estimates from the Norwegian government indicate that employment rates were reduced by more than 10 percent in the Norwegian hydrocarbon-related industries during this period (Aalberg et al., 2019).

The aim of this study was threefold: a. to examine trends in employee perceptions of the quality of the psychosocial work environment and safety climate between 2007 and 2019; b. to explore differences between those that had experienced organizational change (both restructuring and downsizing) and those that did not; and c. to explore differences between those that experienced only restructuring and those that experienced only downsizing.

1.1. Psychosocial risks and organizational change

Psychosocial factors concern how work is organized, designed and managed. These factors are about interactions among job content, organization, relationships and management, on the one hand, and employees' capabilities and needs on the other, that may have an influence on health and safety through the employeeś perceptions and experience of the situation (ILO, 1986). The Job Demands Resources model (JD-R model, Bakker and Demerouti, 2007) offers a coherent theoretical framework when analyzing positive (Resources) as well as challenging psychosocial factors (Demands) inherent in different types of occupations. Job demands are "those physical, psychological, social, or organizational aspects of the job that require sustained physical and/or psychological (cognitive and emotional) effort or skills" (Bakker and Demerouti, 2007, p. 312). Job resources, on the other hand, refer to "those physical, psychological, social, or organizational aspects of the job that are either/or functional in achieving work goals; reduce job demands and the associated physiological and psychological costs; stimulate personal growth, learning, and development" (p. 312). The present study used the JD-R model as its theoretical framework and assessed psychosocial factors including both demands and resources.

Psychosocial risks refer to the potential of psychosocial factors to create harm to the person or organization (British Standards Institution (BSI), 2011). Typical psychosocial risks are excessive workload, lack of control at work, role conflict, lack of support from leaders and colleagues, and job insecurity. Psychosocial risks have been frequently reported to influence employeeś health and safety, including those working in the petroleum industry (e.g., Chan, 2011; Derdowski and Mathisen, 2023; Parkes, 1992; Sutherland and Flin, 1989). There is also an increasing recognition in the petroleum industry that psychosocial risks are highly relevant with regards to operational risks (e.g., risk of explosion, fire, structural failure, shut-down, reduced productivity) resulting from human error (Bjerkan, 2010; Nahrgang et al., 2011; Sneddon et al., 2013). For example, Bergh et al. (2014) found an association between increased exposure to psychosocial risks and hydrocarbon leaks (which could lead to large scale accidents) in a major oil and gas company in Norway.

While organizational change can also be labeled an organizational psychosocial risk (Leka and Jain, 2010), in our study we examine it as a contextual precursor of psychosocial risk exposure. A study by Flovik et al. (2019) examined the impact of organizational change on a number of psychosocial risks. They found that employees perceived job demands to increase both short- and long-term following the implementation of various types of organizational change. In addition, a short-term effect was observed for job control while reduced role clarity and increased role conflict were found both in the short- and long-term after organizational change was introduced. Both social climate and perceived support from co-workers were found to be lower following various types of change, although long-term effects were only shown for social climate.

Organizational restructuring has been found to be associated with a worse psychosocial work environment in terms of increased workload (Egan et al., 2007; Head et al., 2006; Kivimäki et al., 2001), a loss of control (Paulsen et al., 2005; Proktor and Doukakis, 2003; Tvedt et al., 2009), reduced role clarity (Korunka et al., 2003; Oreg et al., 2011), and a change in the relations between employees when colleagues are let go or when well-established organizational structures disappear (Campbell and Pepper, 2007; Kivimäki et al., 2003). Furthermore, Frone and Blais (2020) examined the association of organizational downsizing with working conditions and employee outcomes. The results indicated that downsizing was associated with higher levels of work demands, role conflict, supervisor aggression, dysfunctional leadership, job insecurity, and employment insecurity. Overall, there is a larger body of literature on the negative impact of restructuring on the psychosocial work environment than downsizing.

All this, in turn, may contribute to different short- and long-term outcomes at the individual and organizational level, such as psychological morbidity (Virtanen et al., 2005), early retirement (Saksvik and Gustafsson, 2004), increased job strain (Korunka et al., 2003), sickness absenteeism (Nguyen and Kleiner, 2003), and injuries (Quinlan et al., 2001; Virtanen et al., 2005). When investigating downsizing effects specifically, mostly negative effects have been found on multiple levels, such as lower job satisfaction (Lee and Teo, 2005; Luthans and Sommer, 1999), increased demotivation, insecurity and less organizational commitment (Carbery and Garavan, 2005; Mishra and Spreitzer, 1998), negative workplace behavior (McElroy et al., 2001), reduced performance (Spreitzer and Mishra, 2002), as well as physical strain and illness (Cascio, 1993; Kalimo et al., 2003; Kivimäki et al., 2000; Mishra and Spreitzer, 1998; Vahtera et al., 1997; Vahtera et al., 2004). These studies

almost unanimously conclude that downsizing has a negative impact on both its victims (i.e. employees that are laid off) and its survivors (i.e. employees that remain in their jobs).

While both downsizing and other types of restructuring have been found to be associated with increased exposure to psychosocial risks, few studies have examined whether there is an additive effect of having experienced both restructuring and downsizing on the perception of the quality of the psychosocial work environment.

H1 There is an erosion of the psychosocial work environment in the petroleum industry in Norway between 2007 and 2019.
H2 Those employees who experienced organizational restructuring report a worse psychosocial work environment in comparison to those that did not experience any organizational change.
H3 Those employees who experienced organizational downsizing report a worse psychosocial work environment in comparison to those that did not experience any organizational change.
H4 Those employees who experienced organizational restructuring report a worse psychosocial work environment in comparison to those that experienced organizational downsizing.
H5 Those employees who experienced both organizational restructuring and downsizing report a worse psychosocial work environment in comparison to those that experienced only restructuring or downsizing.

1.2. Organizational change and safety climate

Safety climate refers to the individuaĺs perception of the organizatioń s procedures, leadership commitment and priorities, policies, and practices that indicate the priority of safety in the organization as compared with other goals (Alruqi et al., 2018; Zohar, 2010). Thus, safety climate is a specific type of organizational climate that concerns perceptions of safety, relevant behaviors and priorities in the organization. The range of perceptions that can constitute safety climate is wide and they are "characterized by being intrinsically descriptive and cognitive in their nature with reference to observable features of organizational safety as they are experienced by employees in their daily interactions" (Griffin and Curcuruto, 2016, p.4).

A number of studies have reported a relationship between a poor safety climate and accidents and injury rates (see Ajslev et al., 2018; Alruqi et al., 2018 for reviews). In times of organizational change, there may be a risk of erosion of safety climate. Management attention might be directed towards the implementation of change processes with the possible risk of reduced focus towards safety. Furthermore, major cost reductions that include a reduced workforce imply the accomplishment of more work in less time with the risk of a reduced focus on safety behavior. Probst and Brubaker (2001) found that workers perceiving higher insecurity, exhibited less safety motivation and compliance and had higher levels of injury in the US manufacturing industry. A more recent study in 122 high-risk companies found a detrimental effect of work intensification on safety climate (Bunner et al., 2018). However, and surprisingly, there is a scarcity of empirical studies investigating the relationship between organizational change and safety climate. An exception is a study by Bergh et al. (2018) that examined the association between restructuring and the risk of occupational injury, and whether this association is mediated by psychosocial working conditions and safety climate in the Norwegian petroleum industry. It was found that employees who had experienced restructuring had a significantly higher risk of occupational injury, and this was mediated by both psychosocial working conditions and safety climate. Furthermore, to the authors' knowledge, there is no study that has investigated whether there is an additive effect of having experienced both restructuring and downsizing on the perception of safety climate.

H6 there is an erosion of safety climate in the petroleum industry in Norway between 2007 and 2019.
H7 Those employees who experienced organizational restructuring report worse safety climate in comparison to those that did not experience any organizational change.
H8 Those employees who experienced organizational downsizing report worse safety climate in comparison to those that did not experience any organizational change.
H9 There is no difference in the perception of safety climate between those employees who experienced organizational restructuring in comparison to those who experienced organizational downsizing.
H10 Those employees who experienced both organizational restructuring and downsizing report worse safety climate in comparison to those that experienced only restructuring or downsizing.

2. Method

2.1. Sample

"The trends in risk level in the petroleum activity questionnaire" (in Norwegian: "RisikoNivå i Norsk Petroleumsvirksomhet" (RNNP, Petroleum Safety Authority Norway)) has been distributed biennially to employees in the Norwegian petroleum industry since 1999/2000. Key stakeholders like trade unions, employers' organizations, researchers, and authorities have been collaborating in developing the RNNP. The questionnaire is generally, based on recognized and tested measuring instruments (including the QPS Nordic, Wannstrom et al., 2009) and has also previously been tested and validated (Hoivik et al., 2009; Tharaldsen et al., 2008). Despite sustained developments, some major themes have been retained for several years, these include topics like personal risk, incidents that may cause major accidents, physical and psychosocial risks. Please see RNNP report 2001, p. 25 for a description of the survey development process (Petroleum Safety Authority Norway, 2001).

This study is based on data from 2007 to 2019, and we only include participants reporting a valid workplace (detailed below). The total number of participants over the seven included time points were 62,535. A total of 4,266 participants (6.8 %) reported up to two years' tenure, 10,568 (16.9 %) reported between two and five years, 10,163 (16.3 %) between six and ten years, 13,949 (22.3 %) between 11 and 19 years, 15,239 (24.4 %) over 20 years and 8,350 (13.4 %) did not report tenure (detailed across timepoints in Table 1).

2.2. Instruments

All single variables and constructed indices were derived from seven timepoints of the RNNP survey. Tenure was measured with two questions, one for onshore workers ("How long have you worked at petroleum facilities on land in total?") and a similar question for offshore workers ("How long have you worked offshore in total?"). These two questions were combined into one, as no respondent answered both questions, and the response options were identical: "0–3 months", "4 months–1 year", "2–5 years", "6–10 years", "11–19 years", and "20 years or more". Due to few responses, the first two categories were combined (see Table 1).

Workplace ID

The workplace ID given by The Petroleum Safety Authority Norway was used to identify workplaces across the different surveys. To enhance confidentiality the authors of this paper did not have access to the names of the facilities. Participants not reporting workplace, reporting multiple workplaces, or reporting a workplace that the Petroleum Safety Authority Norway were not able to identify or code were dropped before the repeated measures analyses (31,079 participants from 2013 through 2019 were dropped due to missing or multiple workplace information).

Downsizing and organizational restructuring

Downsizing was measured with one dichotomous question per wave: "During the last year, has your workplace been subjected to workforce reductions or redundancies?". Organizational restructuring was

Table 1
Sample characteristics across seven timepoints.

			Years of tenure						
Year		Total	< 2	2—5	6—10	11—19	> 20	Missing	Total
2007	n	9,984	1,342	2,359	1,754	2,120	2,312	97	9,984
	%	100 %	13.4 %	23.6 %	17.6 %	21.2 %	23.2 %	1.0 %	100 %
2009	n	9,137	742	2,470	1,351	2,120	2,281	173	9,137
	%	100 %	8.1 %	27.0 %	14.8 %	23.2 %	25.0 %	1.9 %	100 %
2011	n	10,037	685	1,816	1,271	1,946	2,253	2,066	10,037
	%	100 %	6.8 %	18.1 %	12.7 %	19.4 %	22.5 %	20.6 %	100 %
2013	n	9,563	677	1,575	1,613	1,865	2,107	1,726	9,563
	%	100 %	7.1 %	16.5 %	16.9 %	19.5 %	22.0 %	18.1 %	100 %
2015	n	8,570	285	1,183	1,604	1,856	2,055	1,587	8,570
	%	100 %	3.3 %	13.8 %	18.7 %	21.7 %	24.0 %	18.5 %	100 %
2017	n	7,620	154	604	1,332	2,019	2,223	1,288	7,620
	%	100 %	2.0 %	7.9 %	17.5 %	26.5 %	29.2 %	16.9 %	100 %
2019	n	7,624	381	561	1,238	2,023	2,008	1,413	7,624
	%	100 %	5.0 %	7.4 %	16.2 %	26.5 %	26.3 %	18.5 %	100 %
Total	n	62,535	4,266	10,568	10,163	13,949	15,239	8,350	62,535
	%	100 %	6.8 %	16.9 %	16.3 %	22.3 %	24.4 %	13.4 %	100 %

measured with one question: "During the last year, have you experienced reorganizations that affect the way you plan and / or carry out your work on the facility?". The response options included: "I have experienced reorganizations with significant consequences", "I have experienced reorganizations with moderate consequences", "I have experienced reorganization without it leading to significant consequences to my work" and "I have not experienced reorganization". The response option "I have experienced reorganization without it leading to significance consequences to my work" was omitted in 2019. A dichotomous variable on restructuring was created by coding "I have not experienced reorganization" as 0 and all other responses as 1 ("I have experienced reorganizations with significant consequences", "I have experienced reorganizations with moderate consequences", "I have experienced reorganization without it leading to significant consequences to my work"). A variable reflecting both downsizing and the dichotomous variable on restructuring was created by combining the afore mentioned dichotomous downsizing variable and the dichotomous restructuring variable into one variable for each wave. The combined variable had four possible values: 1 "neither downsizing nor restructuring (none)", 2 "only downsizing", 3 "only restructuring " and 4 "both downsizing and restructuring".

Psychosocial work environment index

The internally consistent (Cronbach alpha = 0.83) psychosocial work environment index was based on 13 items and constructed with the Stata "alpha" command. All 13 items used a five-point Likert scale. Four items were reversed, so that 1 was "most negative" and 5 was "most positive" for all items measuring the psychosocial work environment. Hence the final index also has a theoretical range from 1 (most negative) to 5 (most positive). The 13 items were: "Does your work require so much attention that you find it a strain?", "Do you have so many tasks that it becomes hard to concentrate on each one?", "Is it necessary to work very fast at a high pace?", "Can you set your own work speed?", "Can you influence decisions which are important to your work?", "Can you influence the way you perform your work?", "Do you work so much overtime that it is a strain?", "Do you get sufficient rest / relaxation between workdays?", "Does your immediate supervisor value your work results?", "Does your immediate supervisor help and support you in your work if you need it?", "Does your immediate supervisor give you feedback on your work performance?", "Do your colleagues help and support you in your work if you need it?" and "Do you feel that the cooperation climate in your work unit is encouraging and supportive?".

Safety climate index

The safety climate index includes items that over the years has been considered by the PSA and the industry as particularly relevant for the petroleum industry (Risikonivå (RNNP) (ptil.no). The internally consistent (Cronbach alpha = 0.78) safety climate index based on nine items was constructed with the Stata "alpha" command. All nine items used a five-point Likert scale. Five items were reversed, so that 1 was "most negative" and 5 was "most positive" for the safety climate index. Hence the final index also has a theoretical range from 1 (most negative) to 5 (most positive). The nine items were: "In practice, production takes priority over HSE", "Deficient maintenance has caused poorer safety", "There are often simultaneous work operations which lead to dangerous situations", "Reports about accidents or dangerous situations are often "embellished", "I ask my colleagues to stop work which I believe is performed in an unsafe manner", "I report any dangerous situations I see", "Safety is number one priority when I work", "The management takes input from the safety delegates seriously", "The equipment I need to carry out my work safely is easily available".

2.3. Analysis

Stata/IC 15.1 for Windows was used for all statistical analyses. First, we used one-way analysis of variance (ANOVA) to check if there were significant differences between the means of participants' experience of safety climate across the combined downsizing and reorganization variable. This ANOVA was repeated for each wave (Table 2). Second, we checked if there were significant differences between means of the psychosocial work environment across the combined downsizing and reorganization variable. This ANOVA was also repeated for each wave (Table 3). Third, we used the Stata "collapse" command to calculate the means of both safety climate and psychosocial work environment by year, facility ID and the combined downsizing and reorganization variable. Before we ran the collapse command, we dropped participants without valid facility (detailed above). We used the unique participant's ID as frequency weight, hence weighing the facilities according to numbers of participants associated with each facility. Fourth, to visualise development over time, we used a margins plot with psychosocial work environment as outcome and time and the combined downsizing and reorganization variable as predictors (Fig. 1). Finally, we did a similar margins plot with safety climate as outcome and time and the combined downsizing and reorganization variable as predictors (Fig. 2).

3. Results

3.1. Psychosocial work environment

The repeated measures analysis of the psychosocial work environment at facility level did not indicate an overall significant change from 2007 to 2019 (p = 0.407, Fig. 1), hence H1 was rejected.

On the cross-sectional, individual level, restructuring was significantly associated with lower mean scores on the psychosocial work

Table 2
ANOVA - Psychosocial work environment index from 2007 to 2019.

	None (ref)				Downsizing				Restructuring				Both			
	Mean	sd	n	diff	mean	sd	n	diff	mean	sd	N	Diff	mean	Sd	n	diff
2007	3.82	0.48	3,862	REF	3.83	0.56	472	−0.01	3.69	0.50	4,048	−0.13*	3.67	0.56	1,232	−0.16*
2009	3.83	0.48	2,490	REF	3.79	0.50	529	−0.04	3.73	0.51	3,404	−0.10*	3.63	0.54	2,288	−0.20*
2011	3.84	0.50	3,497	REF	3.79	0.52	414	−0.05	3.74	0.50	4,240	−0.10*	3.66	0.56	1,524	−0.18*
2013	3.87	0.50	3,671	REF	3.81	0.52	538	−0.06	3.73	0.52	3,393	−0.15*	3.65	0.54	1,588	−0.22*
2015	3.88	0.50	997	REF	3.84	0.52	1,135	−0.04	3.75	0.53	1,191	−0.13*	3.70	0.53	4,942	−0.18*
2017	3.89	0.56	1,013	REF	3.79	0.53	746	−0.11*	3.77	0.53	1,503	−0.13*	3.57	0.57	4,006	−0.33*
2019	3.92	0.54	2,533	REF	3.84	0.55	491	−0.08*	3.72	0.57	2,572	−0.20*	3.56	0.63	1,710	−0.36*

Note: * = significant difference from none (ref) the same year ($p < 0.05$).

Table 3
ANOVA – Safety climate index from 2007 to 2019.

	None (ref)				Downsizing				Reorganization				Both			
	mean	sd	n	diff	mean	sd	n	diff	mean	sd	n	Diff	mean	Sd	n	diff
2007	4.03	0.58	3,881	REF	4.01	0.58	476	−0.03	3.95	0.61	4,076	−0.08*	3.88	0.64	1,245	−0.16*
2009	4.14	0.58	2,503	REF	4.01	0.60	532	−0.13*	4.05	0.60	3,428	−0.09*	3.86	0.663	2,302	−0.28*
2011	4.15	0.59	3,525	REF	3.97	0.61	420	−0.18*	4.05	0.61	4,261	−0.10*	3.89	0.62	1,537	−0.26*
2013	4.18	0.57	3,692	REF	4.00	0.61	547	−0.18*	4.04	0.60	3,410	−0.14*	3.92	0.63	1,593	−0.27*
2015	4.21	0.59	1,018	REF	4.10	0.59	1,140	−0.11*	4.07	0.61	1,202	−0.14*	3.96	0.63	4,996	−0.26*
2017	4.18	0.61	1,025	REF	4.00	0.62	752	−0.18*	4.00	0.64	1,525	−0.18*	3.73	0.68	4,036	−0.45*
2019	4.18	0.59	2,566	REF	4.04	0.63	496	−0.14*	4.01	0.63	2,598	−0.16*	3.76	0.69	1,727	−0.41*

* = significant difference (Bonferroni) from none (ref) the same year ($p < 0.05$).

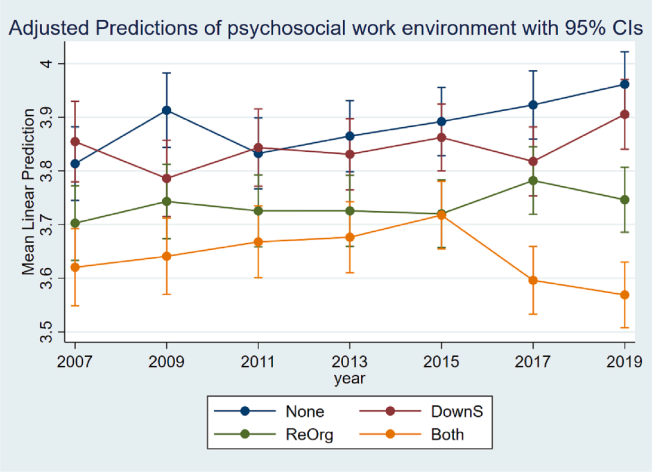

Fig. 1. Relationship between organizational change and psychosocial work environment over time: 2007–2019. Note: None = no organizational restructuring or downsizing, ReOrg = Organizational restructuring, DownS = Downsizing, Both = Both organizational restructuring and downsizing.

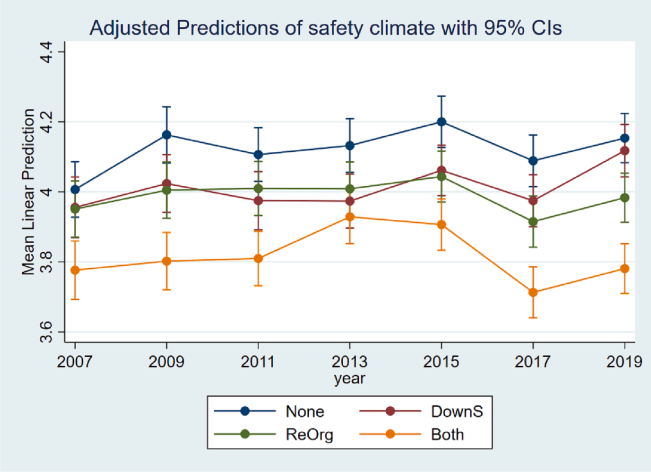

Fig. 2. Relationship between organizational change and safety climate over time: 2007–2019. Note: None = no organizational restructuring or downsizing, ReOrg = Organizational restructuring, DownS = Downsizing, Both = Both organizational restructuring and downsizing.

environment index across all waves (Table 2), supporting H2. Those participants that reported experiencing downsizing also reported a significantly worse psychosocial work environment in the two last waves (Table 2), hence H3 was just moderately supported. Restructuring was associated with larger declines in psychosocial work environment quality than downsizing (H4 supported). Those that reported experiencing both restructuring and downsizing also reported a worse psychosocial work environment across all waves (Table 2), confirming H5. The largest difference was found in 2017 and 2019. The repeated measures analysis also highlighted a significant worsening of the psychosocial work environment in 2017. The drop was especially large in participants reporting both downsizing and restructuring (Fig. 1).

3.2. Safety climate

The repeated measures analysis at the facility level showed that the overall score on the safety climate index increased significantly from 2007 to 2019 ($p < 0.001$, Fig. 2) indicating an improvement in safety climate during this 12-year period with the exception of those who experienced both restructuring and downsizing. Hence H6 is rejected.

On the cross-sectional, individual level, those who had experienced restructuring also reported significantly lower safety climate (H7 supported). Participants who reported experiencing downsizing on their facilities reported significantly lower safety climate in all waves, except the first (Table 3), confirming H8. Downsizing was associated with larger declines in safety climate quality than restructuring (H9 not supported). Finally, those that experienced both downsizing and restructuring reported the worst safety climate across all waves

(Table 3), confirming *H*10.

The largest difference was found in 2017 and 2019 where the difference was more than half a standard deviation (2017: difference = −0.45, SD = 0.68, difference = 66.2 % of SD, 2019: difference = −0.41, SD = 0.69, difference = 60.3 % of SD) (Table 2). The repeated measures analysis also highlighted the significance of 2017. Despite an overall increase in safety climate index, driven by the increase in the majority of participants reporting neither downsizing nor restructuring, there was a significant drop in safety climate in 2017. The drop was especially large in participants reporting only restructuring or both downsizing and restructuring. As these drops in 2017 and 2019 were larger than the sum of downsizing and restructuring separately, this indicates an interaction between downsizing and reorganization (Table 3).

4. Discussion

This study aimed to examine trends in employee perceptions of the quality of the psychosocial work environment and safety climate in the Norwegian petroleum industry between 2007 and 2019. It also aimed to explore differences in these perceptions depending on whether they had experienced any form of organizational change (only restructuring, only downsizing or both restructuring and downsizing) or not. Findings highlight that both downsizing and restructuring impact safety climate and the psychosocial work environment. However, different types of organizational change, restructuring and downsizing, have a differential impact on the perception of different types of risk – psychosocial risk and safety climate.

More specifically, our analysis of the psychosocial work environment at facility level did not indicate an overall significant change from 2007 to 2019. In fact, those employees who did not experience any organizational change showed an improvement in their perception of the quality of the psychosocial work environment. The perception of the psychosocial work environment was worst for those employees who had experienced both restructuring and downsizing across all waves, supporting the additive effect hypothesis in our study which has not been explored sufficiently in previous studies.

Our findings were in line with the extant literature showcasing the negative impact of restructuring on the psychosocial work environment (e.g., Campbell & Pepper, 2007; Egan et al., 2007; Head et al., 2006; Kivimäki et al., 2001, 2003; Korunka et al., 2003; Oreg et al., 2011; Paulsen et al., 2005; Proktor and Doukakis, 2003; Tvedt et al., 2009). However, restructuring was associated with larger declines in psychosocial work environment quality than downsizing across all waves. On the other hand, those participants that reported experiencing downsizing, reported a significantly worse psychosocial work environment only in the last two waves (2017 and 2019). These two waves showcase the impact of the most drastic downsizing measures taken in the Norwegian petroleum industry. Although the negative impact of downsizing on the psychosocial work environment has been reported in previous studies (e.g., Frone and Blais (2020), this finding might indicate that the negative impact of downsizing on the psychosocial work environment is more profound when downsizing is more extreme while restructuring may lead to a more constant erosion of the psychosocial work environment if not managed well.

In relation to the perception of safety climate, our analysis at the facility level showed that this increased from 2007 to 2019. Similarly to the perception of the psychosocial work environment, those who experienced both downsizing and restructuring reported the worst safety climate across all waves, again confirming the additive effect hypothesis.

Both those who had experienced restructuring and those who had experienced downsizing reported lower safety climate across waves in comparison to those who did not. A previous study by Bunner et al. (2018) also found a negative impact of work intensification and safety climate. Contrary to the perception of the psychosocial work environment, downsizing was associated with larger declines in safety climate quality than restructuring. Therefore, this indicates a differential effect for restructuring and downsizing on the perception of safety climate. One explanation of this finding could be related to reduced competency and knowledge (including tacit knowledge) relating to, among others, safety issues which could probably affect safety climate negatively.

Finally, in 2017, there was a significant drop in psychosocial work environment for those who experienced downsizing or both downsizing and restructuring. For safety climate, there was a similar drop, but this concerned both those employees who experienced any form of organizational change and those who did not. This drop was greater for those employees who experienced both restructuring and downsizing. Indeed, by the end of 2014, several drastic cost-cutting measures were implemented in the Norwegian petroleum industry, including widespread restructuring and downsizing. Estimates from the Norwegian government indicate that nearly 1 in 4 employees in the Norwegian hydrocarbon-related industries lost their job during this period (Norwegian Ministry of Finance, 2017). This is manifested in the findings in a significant erosion of both the psychosocial work environment and safety climate for those who experienced downsizing or both downsizing and restructuring. Safety climate was also reported to be worse in 2017 by those who did not experience any organizational change, contrary to the quality of the psychosocial work environment.

Safety climate refers to the individuaĺs perception of the organizationś procedures, leadership commitment and priorities, policies, and practices that indicate the priority of safety in the organization as compared with other goals (Alruqi et al., 2018; Zohar, 2010). It is clear from our findings that in 2017, employees did not feel that the industry prioritized safety in comparison to cost cutting goals. This trend showed some improvement in 2019 although overall safety climate perception did not improve to pre-2017 levels. On the other hand, the perception of the psychosocial work environment continued to decline between 2017 and 2019 for those employees who had experienced both downsizing and restructuring. Our findings demonstrate the long-term detrimental effect of large-scale resource cuts, particularly those that culminated in 2017 in the Norwegian petroleum industry. Such resource depletion can result in a lack of prioritization of important risks and failure to implement appropriate control measures to alleviate potential negative outcomes.

Reason (1990) introduced the term ‘latent errors’ to describe an erosion of safety processes and referred to the not so apparent elements in the organization that can contribute to the occurrence of actual errors (that in turn may lead to accidents). Erosion of psychosocial work environments and safety climate can be considered as a latent error which can have devastating detrimental effects through a failure to implement appropriate control measures to alleviate negative outcomes. It is of utmost importance that organizations regularly monitor the impact of different organizational change processes on both the psychosocial work environment and safety climate and ensure that in times of organizational change, appropriate support systems are implemented at different levels to strengthen their defenses against potential negative outcomes.

4.1. Theoretical contributions

This study has made several novel contributions to the literature. First, it added to the limited evidence base of empirical studies investigating the relationship between organizational change and safety climate. Second, it demonstrated a differential effect for restructuring and downsizing on the perception of safety climate which deserves further attention in future studies. Third, it supported the notion that the negative impact of downsizing on the psychosocial work environment is more profound when downsizing is more extreme while restructuring may lead to a more constant erosion of the psychosocial work environment if not managed well. Fourth, it added support for an additive negative effect of having experienced both restructuring and downsizing on the perception of both the quality of the psychosocial work environment and safety climate. To the authors’ knowledge this is the first

study to investigate this additive effect on the perception of safety climate. Finally, it demonstrated the long-term detrimental effect of large-scale resource cuts which can result in a lack of prioritization of important risks and may act as latent errors with devastating detrimental effects in a high-risk sector such as the petroleum industry.

4.2. Practical implications

Our findings indicate that there may be an ongoing erosion process where the negative effects of changes become stronger over time during long-lasting reorganization processes such as in the petroleum sector. As described in the introduction of this article, both safety climate and psychosocial risks have been linked to operational risks. Thus, the current study indicates that the change processes in the petroleum industry are associated with an erosion of safety behavior. Additionally, changes may result in different outcomes depending on their scale and focus. This underlines the importance of incorporating a strong safety climate focus and proactive psychosocial risk management in business strategy in the sector. In a high-risk industry like the petroleum industry, it is essential to follow-up the psychosocial work environment both as a health risk factor, as well as a risk factor associated with accidents. Although there has been focus on safety climate, reports and studies argue that that there are significant weaknesses in the companies' follow-up of psychosocial and organizational factors. Furthermore, reports indicate that established knowledge about which psychosocial and organizational factors are hazardous and can lead to health damage and adversely affect work performance and safety in the operation, are not well known (Bergh et al., 2018; EU-OSHA, 2009). The most important factors making psychosocial risks particularly difficult to deal with are the lack of available information and suitable tools to help companies manage these risks effectively (EU-OSHA, 2013). Therefore, more practical focus is needed in this area and more systematic follow-up of different types of organizational change and their impact.

4.3. Strengths, limitations and future research

A strength of the study is its large sample size across the Norwegian petroleum industry and the long follow-up period of 12 years. Furthermore, by aggregating data at the facility level, the study used a semi-longitudinal design in the time series analysis. In terms of limitations, missing facility data results in over 30,000 participants being excluded from the study. Furthermore, the study is based on self-report data. Random and systematic measurement error could occur due to cognitive processes, social desirability, survey conditions and related factors (Bound et al., 2001). Choi (2020) noted that the most common weaknesses of using self-report data for assessing work organization hazards were: having only two axes (hazard and occupation), using psychometrically weak items and scales, including scales having little inter-occupational variability, unresolved optimal minimum numbers of subjects per occupation, and low accessibility. Although the RNNP and our study do not contain most of these weaknesses, future studies could enhance validity by further improvement of self-report data as well as using observation data. Furthermore, the study did not distinguish between the content (e.g. downsizing or restructuring) and the process (how it is changing) of the reorganization. Findings from other studies indicate that *how* change processes are implemented is highly relevant to how the change is associated with psychosocial risks (Mathisen et al., 2017; Tvedt et al., 2009). Future studies should address more specifically the effects of different processes of change in reorganizations and downsizings, respectively.

4.4. Conclusion

The findings from our study clarify the need to monitor and follow up psychosocial risk as well as safety climate during restructuring and downsizing. Even though psychosocial and organizational risks associated with restructuring have been the subject of research for the last twenty years, they have not always been considered crucial in the industry's safety work. Experience from the Norwegian Petroleum Safety Authority (PSA) audits has shown that there are still significant weaknesses in the companies' follow-up of psychosocial risks (PSA, 2022). Thus, there is need for leadership development programs in this high-risk sector that clearly address the operational risks related to psychosocial risks and safety climate, the risk of erosion of these safety-related factors during change, how to monitor these issues as well as how to maintain a healthy psychosocial work environment and a strong safety climate during organizational change.

CRediT authorship contribution statement

G.E. Mathisen: Conceptualization, Writing – original draft, Writing – review & editing, Methodology. **T. Tjora:** Data curation, Methodology, Analysis, Writing – orignal draft, Writing – review & editing. **L.I.V. Bergh:** Conceptualization, Data curation, Writing – original draft. **A. Jain:** Conceptualization, Writing – orignal draft, Methodology, Analysis. **S. Leka:** Conceptualization, Writing – original draft, Writing – review & editing, Methodology, Analysis.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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