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Safety Climate Transformation in Oil and Gas Company Ownership Transition (Study Case from Multinational to National Company)

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ABSTRACT

Background: The aim of this research is to analyze the transformation of workers perceptions of the safety climate in an oil and gas company in Indonesia when they experience a change in ownership from a multinational to a national company.

Methods: This cross-sectional study used questionnaires distributed offline and online in three periods of ownership of Company X. Data analysis was carried out descriptively by comparing workers perception scores regarding the safety climate at Company X when managed by the multinational holder, transition period, and national holder.

Results: Workers perceptions of the safety climate in Company X when it experienced a change in ownership from a multinational company to a national company has a trend of decreasing scores (from 8.07 to 7.48). Overall, a decreasing trend in scores occurred in several sub-variables of safety climate, namely management commitment (8.33 to 7.56), communication (8.10 to 7.64), safety priority (8.55 to 7.68), personal appreciation of risk (8.25 to 5.48), involvement (7.50 to 7.36), and personal priority and need for safety (8.25 to 5.48).

Conclusions: Ownership changes cause a trend of decrease in employee perceptions of the safety climate at Company X. Company's priority on safety related to production target factors is decreasing due to the change of ownership. On the other hand, the national period had a higher score in supportive environments and work environments, compared to the multinational period.

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1. Introduction

The oil and gas industry are categorized as a high-risk job. It involves complex industrial processes, including exploration, drilling, production, processing, and distribution [1]. Workers in the oil and gas industry face a high risk chance of fire and explosion due to the ignition of flammable vapors and gases [2]. Therefore, accident prevention has been focused on the oil and gas industry [3,4]. In Indonesia, over the past three years, the accident rate in the oil and gas sector has increased by more than 10,000 cases each year. As an example, in March 2021, a fire broke out at the Pertamina Balongan Refinery in West Java, Indonesia, killing at least five people and

injuring dozens more. The cause of the fire was attributed to a leak in a pipe that carried gasoline to a storage tank, leading to a conclusion that the causal factors were coming from an unsafe work environment and organizational failure to assess the safety standards used [8]. Other cases found were the Piper Alpha disaster in 1998 caused 167 fatalities and the destruction of offshore platforms [5]. The next one was the BP Texas Refinery Fire in 2005 caused 15 fatalities and 180 injuries [6]. The BP Deepwater Horizon explosion in 2010 caused 11 fatalities and a crude oil spill of >4.5 million barrels in the Gulf of Mexico [7]. After investigation, the causal factors for each incident varied from unsafe environment, human error, operational weaknesses, and organizational

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failure [8]. Previous studies also identified a poor safety climate as one of the main drivers of accidents in the oil and gas industry [9,10].

Assessing, describing, and improving the safety climate is considered a proactive approach to safety management [11,12]. Safety climate has been defined as the general perception among members regarding the social unit of the organization, rules, procedures, and practices related to safety [13]. The results of the safety climate description are used to identify latent conditions of accidents to prevent organizational failure as the root cause of future accidents [12,14]. The safety climate also reflects safety policies implemented by a company and has a direct impact toward workers safety behavior [15]. A positive safety climate motivates workers to comply with safety procedures, declaring an effective effort in reducing the number of accidents/injuries and improving safety performance in a company [16,17].

Apart from the high risks of work activities in the oil and gas industry, changes in the organization can certainly affect working conditions. Several studies investigating accidents in high-risk industries have concluded that changes in organizations may have an adverse impact on safety systems [18]. Ownership changes of a company indicate management changes, which is likely to cause different approach on safety practices in a company. This can happen because management has the highest power in determining policies, allocating resources, and organizational activity processes, which means that they have an important role in determining the direction of the safety management systems [19]. Many studies on the dimensions of safety climate have shown that the strongest predictor of safety performance in an organization is management's commitment to safety [20–22].

Changes in organizations means there are major transitions for workers, such as changes in tasks, a faster work pace, the need for competency development, changes in social status, job insecurity, loss of colleagues, and the emergence of new leaders and colleagues. These changes have an impact on increasing the risk of human error, which has the potential to cause accidents and major accidents [18,23,24]. Reprioritization of safety may also develop gradually during times of organizational change [18]. Although this issue is important, there are limited studies that have discussed how workers perceive the safety climate in an organization undergoing a change in ownership. Therefore, this research is being conducted to fill this gap.

This research focuses on Company X, which is one of the largest oil and gas companies in Indonesia. This company is the main operator of the work process of the upstream oil and gas sector in Indonesia. Currently, Company X is experiencing a stakeholder transition from a multinational company to a national one. The aim of this research is to analyze the transformation of workers perceptions of the safety climate in an oil and gas company in Indonesia when they experience an ownership change from a multinational to a national company.

2. Methods

2.1. Sample population and procedure

This study used a cross-sectional study design to collect information regarding workers perceptions of Company X at 3 specific points in time, namely during the multinational company period (from early 2015 up until 2017), the two-year transition period (2018–2019), and the national company period (data from 2020 up to 2023). The data collected between the transition period and the national company were approximately 5 years. Data collection was carried out using questionnaires that were distributed offline and

online. The minimum number of respondents is determined using the Slovin formula as follows:

$$n = \frac{N}{1 + N(e)^2}$$

The Slovin formula is used because the number of populations is known, n is the number of samples required, N is the population, and e is the margin of error (5%). Based on this formula, the following is the minimum sample size for this research.

The calculation results show that the minimum sample required for this research is 357 workers for the multinational period, or 359 workers for the transition period, and 378 workers for the national period. However, this research succeeded in obtaining respondents more than the minimum sample. In the multinational owner period, 1,001 respondents (30.46% of the population) participated in this research. In the transition period, 2,658 respondents participated (77.92% of the population). During the national owner period, this research collected 961 respondents (14.56% of the population). Before participating in the study, informed consent was obtained from all respondents.

2.2. Measures

The socio-demographic information was collected by a self-assessment questionnaire consisting of work location, years of service, employment status, gender, age, and educational background. The questionnaire used to measure the safety climate was adapted from the Loughborough Safety Climate Assessment (LSCAT) Toolkit [25]. This toolkit has been well known and used for assessing safety climate in oil and gas companies [26]. The questionnaire has gone through the translation and back translation processes, as well as the validity and reliability tests on 39 workers. The test results show that all statements have a composite reliability index value of 0.8 (>0.6), which shows that all questions in the questionnaire can be understood by respondents and can be used as a data collection instrument. The 43-item safety climate questionnaire consists of 3 variables and 9 sub-variables.

- a. Organizational safety values: workers perceptions as members of the organization regarding safety.
 - *Management commitment* (7 items): workers perceptions regarding management's commitment to safety issues.
 - *Communication* (5 items): characteristics and effectiveness of safety communication in organizations.
 - *Priority of safety* (4 items): how safety is considered an important priority within the organization.
 - *Safety rules and procedures* (3 items): workers views on the efficacy and necessity of rules and procedures in safety implementation.
- b. Group safety values: workers perceptions as working unit members regarding safety.
 - *Supportive environment* (6 items): characteristics of the social environment at work and the support obtained from it.
 - *Work environment* (6 items): workers perceptions of the characteristics of the physical environment of the workplace.
 - *Involvement* (3 items): the extent to which safety is a focus for everyone and how involved workers are in implementing work safety.
- c. Individual safety values: workers perceptions as individuals regarding safety.
 - *Personal priority and need for safety* (5 items): an individual's view of their own safety and the need to feel safe when working.

- *Personal appreciation of risk* (4 items): how individuals perceive risks related to their work.

The Loughborough Safety Climate Assessment Toolkit was originally answered using a 5-point Likert scale of *strongly disagree* (1), *disagree* (2), *neither agree nor disagree* (3), *agree* (4), *strongly agree* (5). However, this study did not use the *neither agree nor disagree* option (3) on the questionnaire to prevent central tendency bias, namely the tendency of respondents to give answers that tend to be in the middle (neutrality) so that the results are inaccurate [27]. So, the final answer scale of this study are *strongly disagree* (1), *disagree* (2), *agree* (4), and *strongly agree* (5). Scores will be averaged for each item, across the whole participant. These average item scores are used to calculate the sub-variable scores. Before plotting and comparing, the scores need to be standardized because each sub-variable has different number of items. Converting the scale from 1 to 5 to a 1 to 10 scale can be achieved by dividing the actual score by the total possible score and then multiplying by 10 [25].

The score for each variable is determined by calculating the average of the sub-variables. After that, the overall safety climate score is determined by calculating the average of all variables. The worker's perceptions of the safety climate at Company X will be interpreted into 5 categories adapted from Hudson's safety maturity model [28–30]. Each category is determined to have the same scale range value as follows:

1. Basic (A score of 1.00–2.80): safety is a problem caused by workers. The main drivers are the business and a desire not to get caught by the regulator.
2. Reactive (A score of 2.81–4.60): organizations start to take safety seriously, but there is only action after incidents.
3. Compliant (A score 4.61–6.40): safety is driven by management systems, with much collection of data. Safety is still primarily driven by management and imposed rather than looked for by the workforce.
4. Proactive (A score 6.41–8.20): with improved performance, the unexpected is a challenge. Workforce involvement starts to move the initiative away from a purely top-down approach.
5. Resilient (A score of 8.21–10.00): there is active participation at all levels. Safety is perceived to be an inherent part of the business. Organizations are characterized by chronic unease as a counter to complacency.

At the end of the questionnaire, there is an open-ended question section that aims to collect workers opinions and suggestions regarding safety at Company X. After calculating the scores from each period, a comparison was made based on the workers perception scores regarding the safety climate at Company X when managed by the multinational holder, transition period, and national holder. This was done to understand whether there was an increasing or decreasing trend in workers perceptions of the safety climate at Company X in these 3 periods (Table 1).

3. Results

Table 2 shows that from the 3 periods, respondents were dominated by workers who came from the project location. This is because the number of offices participating in this research is only at two locations, while the number of project locations is 4 – 11 locations. The percentage of respondents who are contractor workers is higher than that of permanent workers and contractor service workers. Contractor workers are workers from third parties (outsourcing) who collaborate with Company X to manage production activities. Respondents were dominated by contractor

Table 1
Population, minimum sample, and actual sample of study

Periods	Population	Minimum sample	Actual sample
Multinational	3,286	357	1,001
Transition	3,411	359	2,658
National	6,598	378	961

workers because most of the production process was carried out by contractors. Permanent workers are workers from Company X who were hired without third parties. Service contractor workers are workers from third parties who only provide services. The difference between contractor workers and service contractors is that contractors provide services, tools, and materials, while service contractors only provide services (e.g., inspection services, supervisory services, RBI analysis consultants). Most respondents were male, aged 31–48 years, and had a senior high school educational background. This study shows a length of service percentage that varies between three periods. During the multinational holding period, respondents were dominated by workers with <5 years of service. During the transition period, respondents were dominated by workers with 5 - 10 years of service. During the national holder period, respondents were dominated by workers with >10 years of service. This is caused by the increase in years and the respondent's working period also increases.

In general, workers perceptions of the safety climate at Company X during the multinational, transition, and national ownership periods are on the same level, namely proactive (Fig. 1). However, if we look at the details (Table 3), the change in ownership from a multinational to a national company has a trend of decrease in the safety climate score. When managed by multinational holders, workers perceptions of the safety climate at Company X were at a score of 8.07. However, when entering the ownership transition period, the score decreased to 7.77. Worker's perceptions of safety as members of the organization and as individuals decreased during the transition period, while workers perceptions as members of the work unit increased. After being

Table 2
Workers' socio-demographic characteristics at company X

Variables	Multinational		Transition		National	
	n	%	n	%	n	%
Locations						
Office	214	21%	746	28.1%	63	7%
Project	787	79%	1,912	71.9%	898	93%
Length of services						
<5 years	649	65%	622	23%	298	31%
5 – 10 years	202	20%	1,117	42%	203	21%
>10 years	150	15%	919	35%	460	48%
Employment status						
Permanent	225	22%	875	33%	156	16%
Contractor	547	55%	953	36%	580	60%
Service contractor	229	23%	830	31%	225	23%
Gender						
Male	924	92%	2,443	92%	943	98%
Female	77	8%	215	8%	18	2%
Age						
≤30 years	269	27%	630	24%	238	25%
31 – 40 years	378	38%	1,185	45%	353	37%
41 – 50 years	288	29%	665	25%	301	31%
>50 years	66	7%	178	7%	69	7%
Educational background						
Senior high school	566	57%	1,181	44%	620	65%
Diploma	104	10%	268	10%	104	11%
Bachelor	244	24%	937	35%	170	18%
Postgraduate	18	2%	184	7%	8	1%
Other (elementary, junior high)	69	7%	88	3%	54	6%
TOTAL	1,001	100%	2,658	100%	961	100%



Fig. 1. The level of workers' perception toward safety climate in company X during the multinational, transition, and national ownership periods.

Table 3

Comparison of workers' perception towards safety climate variables in company X during the multinational, transition, and national ownership periods

Variable	Multinational	Transition	National
Organizational safety values	8.10	8.06*	7.83*
Group safety values	7.50	7.55	7.50*
Individual safety values	8.42	7.70*	6.74*
Average	8.07	7.77*	7.48*
Category	Proactive	Proactive	Proactive

* Decreased.

managed with compliance according to minimal local standards, employee perceptions of the safety climate at Company X continued to decrease until they reached a score of 7.48. In the national company period, workers perceptions of safety as members of the organization, work unit, and as individuals experienced another decline.

Table 4 shows several sub-variables that experienced a decrease during the transition period were management commitment, communication, priority of safety, supportive environment, involvement, and personal appreciation of risk. After being managed in compliance according to national holder standards, the sub-variables that experienced a decrease were management commitment, communication, priority of safety, supportive environment, work environment, personal priority, and need for safety, as well as personal appreciation of risk.

Overall, workers perceptions of safety as members of the organization and as individuals continued to decline when Company X experienced a change of ownership. Worker's perceptions of safety as members of the work unit tend to be consistent, although they have experienced an increase during the transition period. The sub-variables that continued to decline when Company X experienced a change of ownership were management commitment, communication, priority of safety, and personal appreciation of risk. The variable with the most reduction points is personal appreciation of risk, with a reduction number of 2.77, taking this variable down to the "compliance" level. In addition to that, the variable of priority of safety was turning downside with a reduction number of 0.87. On the contrary, safety rules and procedures continue to increase. The supportive environment and work environment experienced an increase during the initial transition to ownership change but experienced a decrease when it was managed in compliance according to national holder standards. In contrast, involvement decreased during the transition period and rose again when managed with national holder standards, although the score was not as high as when managed by multinational holders. The personal priority and need for safety scores remained consistent during the ownership transition period, but decreased when managed with national holder standards.

4. Discussion

The main objective of this research is to analyze the transformation of employee perceptions of safety climate in company X when it experienced a change of ownership from multinational to national owner. Even though it is still on the same level (proactive), there is a trend of decrease in workers perception scores regarding the safety climate at Company X. This is in line with other studies, which say that changes in organizations may have a negative impact on safety systems [18]. A change in ownership indicates a change in management. This can certainly influence safety practices in organizations because management is the holder of the highest power in determining policies, resource allocation, and organizational activity processes. During times of change in an organization, a reprioritization of safety may also develop gradually [18].

Overall, workers perceptions of safety as members of the organization and as individuals continued to decline when Company X experienced a change of ownership. Worker's perceptions of safety as members of the work unit tend to be consistent. Continuous decline occurred in the sub-variables of management commitment, communication, priority of safety, and personal appreciation of risk. Management has an important role in determining the direction of the safety climate in an organization because they have the highest power in establishing policies, resource allocation, and organizational activity processes [19]. This research also collected several comments from participants regarding their perceptions of changes in management commitment at Company X:

"After the transition period to national holders, many safety policies at Company X were eliminated without replacement policies."

"When Company X is managed by the international holder, management also feels responsible if an accident occurs and does not completely blame the workers. However, after being managed by the national owner, workers who are deemed to have caused the accident are blacklisted."

"In Company X there was a decrease in the quantity and quality of PPE. The change procedures of PPE have also become more complicated in bureaucracy and longer in new PPE provision." (This could increase the safety risks)

"Current management is more difficult to ask for funds (for safety, such as PPE and others), they tend to reduce costs."

The comments above indicate that workers felt a derivation in management's commitment to safety when Company X changed ownership from multinational to national owners. Workers perceive that, when managed by the national holder, many safety policies are removed, management changes to human blaming when accidents occur, there is a decrease in the quantity and quality of PPE, and management tends to find it difficult to provide funds for safety needs. Many studies on the dimensions of safety and climate have shown that the strongest predictor of safety performance in an organization is management's commitment to safety [20–22]. Managers at all levels in the organization must show real commitment and support for safety. As an example: educating people about safety, allocating resources to create a safe work environment, fixing safety problems, and most importantly, managers need to be consistent between their words and actions regarding safety [22,31].

Communication is a vital component of any system involving humans. Without effective communication, human activities cannot be carried out successfully [32]. Safety-related communication is

Table 4

Comparison of workers' perception towards safety climate sub-variables in company X during the multinational, transition, and national ownership periods

Variable	Sub-variable	Multinational	Transition	National
Organizational safety values	Management commitment	8.33	8.05*	7.56*
	Communication	8.10	7.89*	7.64*
	Priority of Safety	8.55	8.24*	7.68*
	Safety rule and procedure	7.32	8.06	8.42
Group safety values	Supportive environment	7.55	7.85	7.60*
	Work environment	7.45	7.68	7.56*
	Involvement	7.50	7.11*	7.36
Individual safety values	Personal priority and need for safety	8.58	8.58	8.02*
	Personal appreciation of risk	8.25	6.81*	5.48*

* Decreased.

divided in two ways: formal and informal communication. Formal communication related to safety is the exchange of information through channels determined by the organization. This can be implemented by toolbox meetings, safety signs, safety training, work orders, etc [32,33]. In contrast, informal communication related to safety does not occur in official channels and is only formed between members of certain work groups, for example, informal discussions or exchanges of information between colleagues via social media [32,33]. This research also collected several comments from participants regarding safety communication at Company X:

“Safety information conveyed to frontline workers through posters/magazines/presentations is often unattractive because there is too much writing and is not communicative. This causes frontline workers to fail to understand information regarding safety.”

“Please provide education about safety not only to permanent workers but also to contractor and service contractor workers. Many service contractor workers do not receive full information about safety.”

Based on the comments above, workers feel that safety information is conveyed in less attractive media and ways. Apart from that, workers also feel that there are differences in educational services regarding safety between employment statuses, safety education is less felt by contractor workers and service contractors. It is highly recommended to provide visual safety education to provide a deeper understanding of occupational risks [32,34]. Education about safety should also be given not only to permanent workers but also maximally given to contractor workers and service contractors.

Safety priority in the safety climate talks about how the organization prioritizes safety over other goals [17,18,35]. The participant comments that we managed to collect regarding their perceptions of changes in safety priorities at Company X are as follows:

“Reduce the imposition of operational targets because they often put safety aside. Central management now often gives difficult orders without knowing the conditions of the project areas.”

“Safety first, not production first. Management is now too stingy in terms of procuring work safety equipment. The risks borne are not in line with employee wages.”

This variable was the second variable with the highest rate of decrease. Participants' comments show that they feel that current management (national holders) prioritizes production targets over worker safety. This condition needs to be corrected immediately because if there is a conflict between production and safety, workers will definitely consult with supervisors or management regarding their own safety behavior [22]. Even though management declared that the company's priority is safety, management's

actions show the opposite, workers will align their behavior, namely prioritizing production targets over safety [35]. It is highly recommended that Company X carry out a review regarding what priorities the company has. By determining safety as the main priority, all group members will have a clear common goal regarding safety [36,37].

Personal appreciation of risk is the sub-variable that has the lowest value compared to the others. The personal appreciation of risk variable points is decreasing from a total point of 7.92 to a number of 7.73, indicating that this variable is now on the “compliance” level. During the national period, employees with more than 10 years of work experience accounted for 48% of the total workforce. In contrast, during the multinational period, only 15% of the employees had more than 10 years of work experience. Additionally, the majority of the respondents were from the project location. This aspect relates to the individual employee's perception of the risks associated with his work [38,39]. The participant comments that we managed to collect regarding their perceptions of risk in the workplace are as follows:

“When I work, sometimes my harness breaks, especially when I work at height, scaffolding locks start to come loose, and gloves also get damaged.”

“Regarding hot work, there are incomplete work tools. For example, fire blankets, hot air pencils, and other work tools that are damaged. This would put our safety at risk.”

“As a mechanic, the work clothes we use are very limited (2pcs/year) even though we are often exposed to chemicals. We hope that the number of coveralls will be increased for employees who are exposed to chemicals.”

“Please provide proper training to workers according to their responsibilities. As a scaffolding operator, I am responsible for scaffolding as a validator, but I only get standard knowledge about scaffolding.”

Based on these comments, workers at Company X perceive that there are risks in their work because some work tools are damaged, inadequate PPE, and a lack of proper training, according to the employee's job description. In this case, it is strongly recommended to repair work equipment and complete PPE needs. Company X also needs to provide proper training according to employee job descriptions to ensure that workers have sufficient knowledge to carry out their duties properly and correctly.

This research shows that there was an increase in the safety rules and procedures sub-variable at Company X when it experienced a change of ownership. Safety rules and procedures in the Loughborough questionnaire relate to how workers perceive safety rules and procedures in the workplace. The participant comments that we managed to collect regarding their perceptions of workplace rules and procedures are as follows:

“Company X currently meets the applicable minimum standards. The existing standards have been created based on accidents that have occurred.”

“There are many procedures, but sometimes they change when working in the field.”

“Work practices do not comply with work plans. Many work plans change once in the field. Work plans are made to achieve fast and cheap production targets.”

Respondents' comments indicate that the workers perception of the company's workplace rules and procedures is not in accordance with work practices. Sometimes existing work plans or procedures are changed depending on field conditions to achieve faster production targets. This needs to be corrected immediately because it can affect safety compliance, namely the level or extent to which individuals comply with safety standards and rules in the workplace [40]. A balance between safety and production is the most effective technique for improving safety compliance [4]. Encouraging workers to comply with safety rules can reduce accidents in the industry [4].

Supportive environment and work environment increased during the initial transition to ownership change but decreased when Company X was managed in compliance with national holder standards. The supportive environment is defined as the nature of the social environment in place and the support it provides for safety [38,39]. The participant comments that we managed to collect regarding their perceptions of the decline in the supportive environment at Company X are as follows:

“After the transition period, the worker who caused the accident received a penalty up to the point of being blacklisted, even though he had already paid the fine. Workers are required to work as perfectly as possible. So, some workers feel afraid and burdened by the existing system. When managed by the international holder, if something goes wrong, it is corrected. Now, if you make a mistake, you're immediately fired.”

“When it was managed by a multinational owner, there was a reward system. Now there are no rewards, there are instead punishments.”

The comments above show that after being managed in compliance according to national holder standards by the national holder, Company X no longer has a reward system. Workers who make mistakes are also immediately given fines or fired from their jobs, so many workers feel stressed and afraid of the current system. In fact, a supportive environment has a strong influence on safety climate [41]. When management shows support and takes action to improve safety, workers believe that they are valued, and the organization is committed to their safety [19,42]. So, employees will be motivated to implement safety behavior and try to be involved in safety activities in the organization [19,20,43,44]. Therefore, Company X is strongly advised to create a social environment that can support employees to voluntarily implement safety behavior without pressure.

The work environment in the Loughborough Safety Climate Assessment Toolkit refers to the physical environment, including the availability of tools, working conditions, safety systems, operating targets, an adequate number of workers, and the adequacy of time given to complete the work. The participant comments that we managed to collect regarding their perceptions of the decline in physical working environment conditions at Company X are as follows:

“When I work, sometimes my harness breaks, especially when I work at height, scaffolding locks start to come loose, and gloves also get damaged.”

“Regarding hot work, there are incomplete work tools. For example, fire blankets, hot air pencils, and other work tools that are damaged. This would put our safety at risk.”

“There is a need to rejuvenate work support tools that are starting to not function as they should (for example hand tools, lifting, etc.)”

“Please make it easier to change PPE procedures at work sites. Complex bureaucracy can make workers have no desire to replace their worn-out PPE and can result in a reduction in the quality of protective equipment.”

“The current number of workers needed is insufficient, not suitable for the field. Apart from that, it does not meet the competency criteria.”

Based on the comments above, workers perceive that the physical environment related to work tools, the provision of PPE, and the number of workers still needs to be improved. A good work environment can motivate workers to work safely, whereas a bad work environment can reduce motivation to work safely [45]. In this case, Company X is strongly recommended to improve the physical environment of the workplace by providing a complete set of working tools, improve the availability and ease of PPE replacement procedures, and ensure that the number of workers is adequate and has the required competencies.

The involvement score decreased during the initial transition period and rose again when managed with national holder standards, although the score was not as high as when managed by multinational holders. It can be concluded that there was still a decline in the level of employee involvement when Company X changed ownership to become a national company. The participant comments that we managed to collect regarding their perceptions of worker involvement regarding safety at Company X are as follows:

“Service contractor workers also need access to provide advice about safety equipment at Company X.”

“When an accident occurs, frontline workers are only interviewed without being involved in improvement efforts.”

“Management now often gives orders rather than involving employees in setting standards.”

“Please listen and implement the feedback about work safety from workers.”

“Please also carry out frequent campaigns to barges regarding safety issues because sometimes barge workers who work in wells do not have enough safety information.”

Based on the comments above, workers perceive that management does not involve workers regarding safety at Company X. Involving workers in every decision regarding safety will help increase safety awareness so that workers will independently try to behave safely while working. Several studies show that worker involvement in safety meetings and participation in the matter can improve safety compliance within an organization [4,46]. Company X needs to ensure that all employees are involved in safety activities, such as safety meetings, accident analysis, carrying out monitoring of safety targets, etc. There needs to be a generalized perception that work safety is not the responsibility of the safety

department alone, but is a shared responsibility. Empowerment and involvement of workers are very important in organizational performance and makes the organization more resilient to errors [47].

Personal priority and need for safety scores remained consistent during the initial transition to ownership change but decreased when managed with national holder standards. Personal priority and need for safety are an individual's views of their own safety management and the need to feel safe when working. The participant comments that we managed to collect regarding their perceptions of the decline in personal priority and need for safety at Company X are as follows:

"Work carefully, be alert, focused, check equipment and the work environment. Don't forget if conditions are unsafe, report the stop card and work permit, and remind all coworkers to comply with safety regulations."

"Safety is an important thing in the company. In terms of knowledge, it already exists, but not everyone has adequate safety competency, especially production workers."

"Reduce the force of operations that pursue targets because they often ignore safety. Central management now often gives difficult orders without knowing the conditions in the field."

"Safety and operational aspects should support each other in the field, not limit each other."

Participants' comments indicate that workers understand the importance of safety at work. The intrinsic motivation to act proactively related to work safety comes from the worker's personal need for security [48]. However, workers perceive those operational targets often limit them from working safely. Company X needs to improve this condition because balancing safety and production targets is the most effective technique for increasing compliance to create safe work practices [4]. Apart from that, workers perceive that they also need adequate safety competency training, not just knowledge about safety. In creating awareness to carry out safety practices, workers need to have the knowledge and skills to identify hazards and carry out controls if necessary [49]. This capacity among employees depends on whether they have received the necessary work safety education and training from the company [50]. Good safety knowledge and skill can significantly increase the level of safety compliance within an organization [51,52].

For future research, it would be better to reduce the gap of work rules and procedures from multinational to national company that affect safety climate by integrating positive rules and procedures from multinational company to rules and procedures in national company. This will reduce the negative effect of the work rules and procedures in safety climate practice. This research can also only interpret the differentiation of the safety climate in Indonesia, considering the fact that other countries' results may be different due to the work culture available.

5. Conclusion

This study aims to analyze the transformation of workers perceptions of safety climate in one of the oil and gas company (Company X) when it experienced a change of ownership from multinational to national owner. This study needs to be done because the upstream oil and gas industry has a very big role in supporting economic growth programs, making it not only a source of revenue but also a locomotive for economic development in Indonesia. Even though workers perceptions of the safety climate at Company X throughout the period were at a proactive level, there is

a trend of decrease in variable scores. In detail, the change in the company's ownership (from a multinational to a national company) made a trend of decrease on several sub-variables of safety climate scores, namely management commitment, communication, priority of safety, personal appreciation of risk, and involvement. However, safety rules and procedures have a trend of increase. Even though the score decreased from the transition period to the national period, the supportive environment and work environment in the national period had a higher score compared to the multinational period.

Participants made many comments regarding declining numbers on working conditions and environment during the change of ownership of Company X. In summary, changes in ownership at Company X resulted in a decreased company's priority on safety related to production target factors. This decreasing number in safety priority can be seen from the slow process of providing PPE, which can impact on increasing safety risks. It would be better if benchmarking was carried out with studies in other countries so that a more comprehensive comparison of contributing factors related to changes in the company's ownership can be obtained which have an impact on the safety climate or safety performance. Regardless, this study needs further development to be implemented in other countries, considering that at present, the study results can differ due to different safety cultures and can only be implemented in Indonesia.

Ethical approval

This study was approved by the Ethical Committee of Research and Community Development, Faculty of Public Health, University of Indonesia (Ket- 603/UN2.F10.D11/PPM.00.02/2023).

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Data accessibility statement

The data used is confidential and not publicly available.

CRedit authorship contribution statement

Zulkifli Djunaidi: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing – review & editing. **Mufti Wirawan:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Supervision. **Indri H. Susilowati:** Conceptualization, Formal analysis, Supervision, Validation, Writing – review & editing. **Agra M. Khaliwa:** Project administration, Writing – original draft, Writing – review & editing. **Shellena A. Kanigara:** Project administration, Writing – original draft, Writing – review & editing.

Conflicts of interest

All authors have no conflicts of interest to declare.

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References

- [1] Wanasinghe T, Wroblewski L, Petersen B, Gosine R, James L, Silva O, Mann GK, Warriar PJ. Digital twin for the oil and gas industry: overview, research trends, opportunities, and challenges. *Digit Object Identifier* 2020;8. <https://doi.org/10.1109/ACCESS.2020.2998723>.
- [2] OSHA. Oil and Gas Extraction. *Saf Heal Top* 2022. <https://www.osha.gov/oil-and-gas-extraction>. [Accessed 10 August 2023].
- [3] Benson C, Argyropoulos CD, Dimopoulos C, Mikellidou CV, Boustras G. Safety and risk analysis in digitalized process operations warning of possible deviating conditions in the process environment. *Process Saf Environ Prot* 2021;149:750–7. <https://doi.org/10.1016/j.psep.2021.02.039>.
- [4] Benson C, Argyropoulos C, Dimopoulos C, Mikellidou C, Boustras G. Analysis of safety climate factors and safety compliance relationships in the oil and gas industry. *Saf Sci* 2022;151. <https://doi.org/10.1016/j.ssci.2022.105744>.
- [5] Singh B, Jukes P, Poblete B, Wittkower B. 20 Years on lessons learned from Piper Alpha. The evolution of concurrent and inherently safe design. *J Loss Prev Process Ind* 2010;23:936–53. <https://doi.org/10.1016/j.jlp.2010.07.011>.
- [6] Saleh JH, Haga RA, Favarò FM, Bakolas E. Texas City refinery accident: case study in breakdown of defense-in-depth and violation of the safety-diagnosability principle in design. *Eng Fail Anal* 2014;36:121–33. <https://doi.org/10.1016/j.engfailanal.2013.09.014>.
- [7] Ismail Z, Kong KK, Othman SZ, Law KH, Khoo SY, Ong ZC, Shirazi SM. Evaluating accidents in the offshore drilling of petroleum: regional picture and reducing impact. *Meas J Int Meas Confed* 2014;51:18–33. <https://doi.org/10.1016/j.measurement.2014.01.027>.
- [8] Nwankwo CD, Arewa AO, Theophilus SC, Esenowo VN. Analysis of accidents caused by human factors in the oil and gas industry using the HFACS-OGI framework. *Int J Occup Saf Ergon* 2022;28:1642–54. <https://doi.org/10.1080/10803548.2021.1916238>.
- [9] Fuller CW, Vassie LH. Benchmarking the safety climates of employees and contractors working within a partnership arrangement: a case study in the offshore oil industry. *Benchmarking Int J* 2001;8:413–30. <https://doi.org/10.1108/EUM000000000006386>.
- [10] Horbah F, Pathirage C, Kulatunga U. Assessing the safety climate in Ghana's upstream oil and gas sector. *13th Int Postgrad Res Conf* 2017:529–41.
- [11] Payne SC, Bergman ME, Beus JM, Rodríguez JM, Henning JB. Safety climate: leading or lagging indicator of safety outcomes? *J Loss Prev Process Ind* 2009;22:735–9. <https://doi.org/10.1016/j.jlp.2009.07.017>.
- [12] Kvalheim SA, Antonsen S, Haugen S. Safety climate as an indicator for major accident risk: can we use safety climate as an indicator on the plant level? *Int J Disaster Risk Reduct* 2016;18:23–31. <https://doi.org/10.1016/j.jidrr.2016.05.011>.
- [13] Schwatka N, Rosecrance J. Safety climate and safety behaviors in the construction industry: the importance of co-workers commitment to safety. *Work* 2016;54:401–13. <https://doi.org/10.3233/WOR-162341>.
- [14] O'Connor P, O'Dea A, Kennedy Q, Buttrey SE. Measuring safety climate in aviation: a review and recommendations for the future. *Saf Sci* 2011;49:128–38. <https://doi.org/10.1016/j.ssci.2010.10.001>.
- [15] Zulfirman D, Djunaidi Z. Analisis Iklim Keselamatan Kerja di Pt. XYZ Balikpapan. *PREPOTIF J Kesehatan Masy* 2021;5.
- [16] Kalteh H, Mortazavi S, Mohammadi E, Salehi M. The relationship between safety culture and safety climate and safety performance: a systematic review. *Int J Occup Saf Ergon* 2018. <https://doi.org/10.1080/10803548.2018.1556976>.
- [17] Alruqi WM, Hallowell MR, Techera U. Safety climate dimensions and their relationship to construction safety performance: a meta-analytic review. *Saf Sci* 2018;109:165–73. <https://doi.org/10.1016/j.ssci.2018.05.019>.
- [18] Mathisen GE, Tjora T, Bergh LIV, Jain A, Leka S. The differential impact of organizational restructuring and downsizing on the psychosocial work environment and safety climate in the petroleum industry. *Saf Sci* 2023;166:106255. <https://doi.org/10.1016/j.ssci.2023.106255>.
- [19] Xu Y, Wang M, Feng Y, Xu Y, Li Y. Does managers' walking around benefit workplace safety? A safety climate intervention field study. *Saf Sci* 2023;161:106062. <https://doi.org/10.1016/j.ssci.2023.106062>.
- [20] Christian MS, Bradley JC, Wallace JC, Burke MJ. Workplace safety: a meta-analysis of the roles of person and situation factors. *J Appl Psychol* 2009;94:1103–27. <https://doi.org/10.1037/a0016172>.
- [21] Beus JM, Payne SC, Bergman ME, Arthur W. Safety climate and injuries: an examination of theoretical and empirical relationships. *J Appl Psychol* 2010;95:713–27. <https://doi.org/10.1037/a0019164>.
- [22] Bosak J, Coetsee WJ, Cullinane SJ. Safety climate dimensions as predictors for risk behavior. *Accid Anal Prev* 2013;55:256–64. <https://doi.org/10.1016/j.aap.2013.02.022>.
- [23] Zwetsloot GJMM, Drupsteen L, de Vroome EMM. Safety, reliability and worker satisfaction during organizational change. *J Loss Prev Process Ind* 2014;27:1–7. <https://doi.org/10.1016/j.jlp.2013.10.008>.
- [24] Mathisen GE, Bergh LIV. Action errors and rule violations at offshore oil rigs: the role of engagement, emotional exhaustion and health complaints. *Saf Sci* 2016;85:130–8. <https://doi.org/10.1016/j.ssci.2016.01.008>.
- [25] Loughborough University. *Safety climate measurement: user guide and toolkit*. Loughbrgh Univ Publ; 2010. p. 1–60.
- [26] McSweeney K, Curry J, Curtis R, Wari E, Zhu W, Craig B, Hussain MM, Haces-Garcia A, Idahosa OP, Zeni E, Seshasakrishna G. Development of a comprehensive multi-component toolkit for offshore safety culture assessment. *Process Saf Environ Prot* 2023;175:78–87. <https://doi.org/10.1016/j.psep.2023.05.030>.
- [27] Douven I. A Bayesian perspective on Likert scales and central tendency. *Psychon Bull Rev* 2018;25:1203–11. <https://doi.org/10.3758/s13423-017-1344-2>.
- [28] Hudson P. Applying the lessons of high risk industries to health care. *Qual Saf Heal Care* 2003;12:7–12. https://doi.org/10.1136/qhc.12.suppl_1.17.
- [29] Hudson P. Implementing a safety culture in a major multi-national. *Saf Sci* 2007;45:697–722. <https://doi.org/10.1016/j.ssci.2007.04.005>.
- [30] Foster P, Hoult S. The safety journey: using a safety maturity model for safety planning and assurance in the UK coal mining industry. *Minerals* 2013;3:59–72. <https://doi.org/10.3390/min3010059>.
- [31] Clarke S, Ward K. The role of leader influence tactics and safety climate in engaging employees' safety participation. *Risk Anal* 2006;26:1175–85. <https://doi.org/10.1111/j.1539-6924.2006.00824.x>.
- [32] Zamani V, Banihashemi SY, Abbasi A. How can communication networks among excavator crew members in construction projects affect the relationship between safety climate and safety outcomes? *Saf Sci* 2020;128:104737. <https://doi.org/10.1016/j.ssci.2020.104737>.
- [33] Alsamadani R, Hallowell M, Javernick-Will AN. Measuring and modelling safety communication in small work crews in the US using social network analysis. *Constr Manag Econ* 2013;31:568–79. <https://doi.org/10.1080/01446193.2012.685486>.
- [34] Lingard H, Pink S, Harley J, Edirisinghe R. Looking and learning: using participatory video to improve health and safety in the construction industry. *Constr Manag Econ* 2015;33:740–51. <https://doi.org/10.1080/01446193.2015.1102301>.
- [35] Zohar D. Thirty years of safety climate research: reflections and future directions. *Accid Anal Prev* 2010;42:1517–22. <https://doi.org/10.1016/j.aap.2009.12.019>.
- [36] Chen G, Kanfer R. Toward a systems theory of motivated behavior in work teams. *Res Organ Behav* 2006;27:223–67. [https://doi.org/10.1016/S0191-3085\(06\)27006-0](https://doi.org/10.1016/S0191-3085(06)27006-0).
- [37] Wang D, Mao W, Zhao C, Wang F, Hu Y. The cross-level effect of team safety-specific transformational leadership on workplace safety behavior: the serial mediating role of team safety climate and team safety motivation. *J Saf Res* 2023. <https://doi.org/10.1016/j.jsr.2023.05.001>.
- [38] Cheyne AJ, Cox S. Assessing safety culture in offshore environments. *Saf Sci* 2000;34:1–19.
- [39] Haslam C, O'Hara J, Kazi A, Twumasi R, Haslam R. Proactive occupational safety and health management: promoting good health and good business. *Saf Sci* 2016;81:99–108. <https://doi.org/10.1016/j.ssci.2015.06.010>.
- [40] Masia U, Pienaar J. Unravelling safety compliance in the mining industry: examining the role of work stress, job insecurity, satisfaction and commitment as antecedents. *SA J Ind Psychol* 2011;37:1–10. <https://doi.org/10.4102/sajip.v37i1.937>.
- [41] Kasim H, Hassan CRC, Hamid MD, Emami SD, Danaee M. The relationship of safety climate factors, decision making attitude, risk control, and risk estimate in Malaysian radiation facilities. *Saf Sci* 2019;113:180–91. <https://doi.org/10.1016/j.ssci.2018.11.025>.
- [42] Schaufeli WB, Bakker AB. Job demands, job resources, and their relationship with burnout and engagement: a multi-sample study. *J Organ Behav* 2004;25:293–315. <https://doi.org/10.1002/job.248>.
- [43] Neal A, Griffin MA. A study of the lagged relationships among safety climate, safety motivation, safety behavior, and accidents at the individual and group levels. *J Appl Psychol* 2006;91:946–53. <https://doi.org/10.1037/0021-9010.91.4.946>.
- [44] Beus JM, McCord MA, Zohar D. Workplace safety: a review and research synthesis. *Organ Psychol Rev* 2016;6:352–81. <https://doi.org/10.1177/2041386615626243>.
- [45] Ningtias ID, Ihsan T, Lestari RA. Analisis Manajemen dan Iklim Keselamatan di Lingkungan Kerja pada Industri Semen Indonesia: Sebuah Review. *J Dunia Kesmas* 2020;9:161–74.
- [46] Lu C-S, Yang C-S. Safety leadership and safety behavior in container terminal operations. *Saf Sci* 2010;48:123–34. <https://doi.org/10.1016/j.ssci.2009.05.003>.
- [47] Mullins-Jaime C, Smith TD. Interconnected pathways: the role of integrated programs, safety climate, and safety professional engagement in safety and other organizational outcomes. *J Saf Res* 2023;86:286–97. <https://doi.org/10.1016/j.jsr.2023.07.007>.
- [48] Mohd RH, Selamat MN, Aziz SFA, Omar NH. Ethnomethodological research on proactive safety behavior of the young workers. *Int J Acad Res Account Financ Manag Sci* 2021;7:129–44. <https://doi.org/10.6007/IJARAFMS/v11-i3/10811>.
- [49] Skjerve AB. The use of mindful safety practices at Norwegian petroleum installations. *Saf Sci* 2008;46:1002–15. <https://doi.org/10.1016/j.ssci.2007.11.005>.
- [50] Dahl Ø, Kongsvik T. Safety climate and mindful safety practices in the oil and gas industry. *J Saf Res* 2018;64. <https://doi.org/10.1016/j.jsr.2017.12.009>.
- [51] Kwon O-J, Kim Y-S. An analysis of safeness of work environment in Korean manufacturing: the "safety climate" perspective. *Saf Sci* 2013;53:233–9. <https://doi.org/10.1016/j.ssci.2012.10.009>.
- [52] Kvalheim SA, Dahl Ø. Safety compliance and safety climate: a repeated cross-sectional study in the oil and gas industry. *J Saf Res* 2016;59:33–41. <https://doi.org/10.1016/j.jsr.2016.10.006>.