

AN EXAMINATION OF MINING COMPANIES' ONLINE HEALTH AND SAFETY POLICIES: IMPLICATIONS FOR IMPROVING ORGANIZATIONAL PERFORMANCE

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ABSTRACT

This study analyzed the publicly available health and safety policies of 26 mining companies to determine the quantity of health and safety (H&S) practices that mining companies encourage in relation to the Plan-Do-Check-Act cycle. A thematic content analysis of the policies identified elements and practices within the text. On average, companies communicated information on about 7 elements (range 1–14, standard deviation = 3.49) and discussed 15 practices (range 2–34, standard deviation = 9.13). The elements in which companies highlighted the most practices were risk management, emergency management, leadership development, and occupational health. A discussion of the policy trends shows areas that mine sites can improve upon within their Plan-Do-Check-Act cycle, in addition to encouraging the use of both leading and lagging indicators to manage health and safety performance.

INTRODUCTION

Mining companies and their employees are expected to identify and manage risks at their worksites to ensure the health and safety (H&S) of everyone at the site. The primary mechanism in place to control these risks is a company's health and safety management system (HSMS) (Boyle, 2012). Broadly, an HSMS is a set of standard, interrelated, and interacting elements used to promote and achieve occupational H&S goals (ANSI/AIHA Z-10, 2012; BS OHSAS 18001, 2007). The practices conveyed within an HSMS are expected to minimize incidents, injuries, illnesses, and even save worker lives (Alsop and LeCouteur, 1999; Arocena and Núñez, 2010). In the United States, both the Occupational Safety and Health Administration (OSHA) and Mine Safety and Health Administration (MSHA) regulate and encourage aspects of an HSMS (US Federal Register, 2011, 2010).

Many HSMS documents (i.e., Chemical Industries Association, 1995; Health and Safety Executive [HSE], 1995; International Labour Office [ILO], 2001) attribute the source of their basic management system to Deming's Plan-Do-Check-Act (PDCA) model of continuous quality improvement and organize their practices within this cycle (Johnson, 2002). The PDCA cycle is a well-adopted approach in health and safety management and promotes continuous learning and adaptability (Robson et al., 2007).

Recent research has made some headway in trying to understand the roles of external factors in the work environment and how management practices conveyed within an HSMS can support aspects of risk mitigation and management (Barling, et al., 2003; Nordlöf et al., 2017; Parker, et al., 2001). However, research also needs to understand what practices are commonly included in writing and how these inclusions may influence the standardization and execution of an

HSMS to enhance the response to site wide risks. To that end, this study attempted to characterize the scope and depth of HSMS practices as described in company H&S policies, and any misalignment with the common PDCA cycle.

Barriers to Effective HSMSs

Health and safety practices consist of meaningful actions, such as observations, decisions, or rules that can enhance workplace perceptions and performance and, thus, help prevent incidents (Brassell-Cicchini, 2003; BS OHSAS 18001, 2007). Despite the various resources available about H&S management, companies differ in their ability to effectively execute such practices within a systematic HSMS (Duijm et al., 2008; Nordlöf, et al., 2015a). Research cites various contributors to struggling HSMSs, including a lack of knowledge (Salminen, 1998), finances (Larsson et al., 2006), and productivity priorities (Nordlöf et al., 2015b). Additional research argues that a lack of commitment to formalizing a system—including developing and executing a routine set of practices—can also impact the interpretation and execution of an HSMS (Arocena and Núñez, 2010; Biggs et al., 2013).

In tandem with a lack of commitment, another problem is that an HSMS requires sustained efforts and actions throughout the continuous PDCA cycle. Although it may seem like *doing* would be more desirable than other aspects of the cycle, regular execution of practices aligned with one phase of the cycle at the expense of another can impede the system's success (Haas and Yorio, 2016). Along these same lines, little theoretical work has been postulated to help understand the process by which health, safety, and risk practices are behaviorally executed throughout the PDCA cycle (Kirsch et al., 2015; Robson et al., 2007). This lack of communication and coordination within a company can negatively impact how an HSMS is interpreted on the job (Guidotti, 2013). Therefore, it is important to recognize how messages and processes can impact outcomes in the workplace and what may help improve system coordination. A potential way to enhance communication of expectations is to improve the breadth and depth of company H&S policies.

H&S Policies as Standardized Communication

One way that companies operationalize tasks and communicate expectations to their employees is through their H&S policies. Policies solidify how companies prioritize respective H&S responsibilities, and their commitment to providing knowledge, training, and advice to employees (Lin and Mills, 2001). Additionally, adequate policies provide clear direction which enhances the H&S investment and benefits for companies (Bianchini et al., 2017). As a result, policies should be visible and clearly promote desired practices.

HSMS document reviews show occupational H&S policies as a primary system element (Robson et al., 2007). Meta-analyses of companies' HSMS practices also confirm strong H&S policies as a common denominator that can function as a leading performance indicator (Lin and Mills, 2001; Mearns, et al., 2003; Robson et al., 2007). To date, limited research exists on the quantity and scope of H&S practices within company policies. However, the off-shore industry prescribes a health, safety, and environmental (HSE) policy as a primary benchmark document, arguing that a strong public policy that

is monitored demonstrates commitment to safety and headway toward zero H&S incidents (Sykes et al., 1997).

Most companies are expected to establish H&S policies to communicate their expectations. For example, the International Organization for Standardization [ISO] 9000 (2003) argues that H&S policies do not merely become another document, but serve as an integral part of the company culture, values, and performance expectations that function as a mechanism to avoid incidents. Assurance of policy compliance in terms of annual self-assessments is also a critical aspect in showing commitment and progress (Mearns et al., 2003). Additional guidelines encourage the adoption of "a comprehensive and integrated H&S policy and the governance structures to support it via active leadership" (State of Queensland, 2013, p. 3).

As highlighted previously, policies as a form of communication messaging should help workers attend to and organize risk-based information, and then execute desired activities. Therefore, a clear policy must foster well-understood values and associated practices among workers (Bowen and Ostroff, 2004; Davis and Tomasin, 1999). In contrast, vague policy practices could influence what hazards workers choose to pay attention to and how they interpret and respond to risks. To date, little research has collected information about company H&S policies to determine general HSMS performance in regards to the PDCA cycle. Understanding where policy language is more focused could provide insight into organizational performance and potential areas in need of more emphasis to help prevent lagging indicators.

Study Objectives

Organizational performance is associated with H&S practices as they are interpreted and then executed in the workplace (Larsson et al., 2006). This study sought to initially understand the former by assessing the frequency and descriptive nature of H&S practices within company policies. Additionally, we wanted to know what H&S practices are emphasized the most and in what stage of the common PDCA cycle they are discussed. To that end, we used publicly available H&S policies for 26 companies to answer the following questions:

Research Question 1: Which HSMS elements and complementary practices are most discussed across mine company H&S policies?

Research Question 2: Where do companies focus their H&S practices within the PDCA cycle, as described in H&S policies?

METHODS

The National Mining Association (NMA) stresses that every mine should conduct, employ, and evaluate a risk-analysis process to prevent incidents (Grayson, 2006). To support these efforts, the NMA worked with industry partners to develop an HSMS program called CORESafety (CORESafety, nd). CORESafety boasts a 20-element HSMS framework specific to mining. Believing that more companies affiliated with NMA would have H&S policies, researchers used the publicly available NMA member list (N=243) as the initial sample pool.

Online H&S Policy Retrieval

For each of the 243 NMA-member companies, online searches to find and include each company's H&S policy occurred in several steps:

- The organization's name was entered into Google search to locate the company's website.
- Organizations that did not have an official website were eliminated ($n=10$).
- A search for each company's health and safety policy was completed on the home page or sub-tab, using the internal search bar to type: 'health and safety.' If the site did not have an internal search bar, then an external search for the organization's H&S policy was conducted via google. If this search also turned up with no results, the organization was eliminated from the sample ($n=195$).

In general, the policies found were retrieved from a health/safety subtab on the company website. It was found that 38 of the 243 NMA

companies had a health and safety policy that could be publicly accessed on their website.

Sample

Of these 38 companies, 26 of them could also be retrieved using MSHA's online retrieval database (2017). The other 12 were members of NMA but not active mining companies that could be located in MSHA's online retrieval system. For example, there are member companies that specialize in consulting to help provide assistance in health and safety performance and assessment. Other companies specialize in developing and selling engineering, hazard protection, or firefighting products to the mining industry. For the purposes of this study, we limited the sample to those that are affiliated with MSHA, assuming they all have similar compliance issues that a policy would help address. So, the 26 remaining mining companies made up the sample for the current study.

Of these 26 companies, 12 (46%) mined coal; 11 (43%) mined some type of metal; and 3 (11%) mined some type of non-metal aggregate. In addition, 8 (31%) of the companies primarily ran underground operations; 7 (27%) surface; and 11 (42%) had both surface and underground operations. The 26 companies were responsible for several mine sites throughout the domestic U.S. and some internationally as well. The range of active mine sites for the sample was 1 – 16 ($M = 5.65$, $SD = 4.549$).

Content and Thematic Analysis of H&S Policies

Researchers copied each available policy into a Word document for analysis. Policies ranged from 1 – 12 pages. Thematic coding (Saldaña, 2015) was used to identify HSMS elements and complementary practices within the text. In order to consistently assign and code each identified H&S practice to a corresponding element, researchers developed a guidance document using definitions of HSMS elements and example practices as outlined in the CORESafety handbook. Detailed information about the 20 elements allowed strict and clear guidelines to help researchers determine inclusion and code assignment. Although many HSMS programs exist, the current study only used CORESafety because the mining-specific terminology and practices helped minimize the chances of coding error.

Two researchers discussed each policy line by line and collectively coded each identified practice, referring back to the guidance document of the elements, practices, and definitions. This method reduced the chances of excluding or miscoding a practice (Armstrong et al., 1997). When assigning identified practices to elements and transferring the codes for subsequent reporting, researchers used a "1" to show "yes" and a "0" to show "no." For example, if researchers identified a practice that they deemed to be part of an HSMS element such as *Leadership Development*, they put "1" under that element for the company. If researchers identified no practices that corresponded to *Leadership Development* within a company policy, they entered "0" for that element. This assignment allowed for the quantification of company practices within each element.

After assigning each H&S practice to a corresponding HSMS element, all practices were grouped under their respective elements, creating a 20-tab coding document used to identify themes, or patterns in the data. The primary researcher initially worked independently, adhering to theoretical coding guidelines in the sense that the PDCA cycle was used to identify similar types of practices for each element (Boyatzis, 1998). The plan, do, check, and act phases functioned as umbrella areas that accounted for codes that emerged within each policy, with practices eventually informing the research questions (Corbin and Strauss, 2008; Saldaña, 2015). This framework was particularly helpful in identifying where policies were weak (e.g., evaluating) and strong (e.g., planning, training). After the primary researcher initially developed themes, definitions, and examples to create a codebook, three researchers provided inter-rater reliability coding of the data to confirm the validity of the results (Landis and Koch, 1977).

RESULTS

Research Question 1

On average, company policies shared information for about 7 HSMS elements (Range 1 – 14, SD = 3.49) and discussed 15 practices (Range 2 – 34, SD = 9.13). The elements that companies highlighted the most, including practices around leading and lagging indicators and interventions, included: *Risk Management* (51 unique practices); *Emergency Management* (38); *Occupational Health* (30); *Culture Enhancement* (27); *Leadership Development* (24); *HSMS Assurance* (20); and *Management Systems Coordination* (18). Alternatively, some elements were not mentioned at all (i.e., *Change Management*) and others rarely, including *Resources and Planning* (2 unique practices); *Reinforcement and Recognition* (7); *Contractor Management and Purchasing* (10); and *Communication and Collaboration* (11).

It is worth mentioning that some of the practices listed were requirements of the company, especially when referring to MSHA or OSHA rules. However, many practices were not listed in response to any regulatory requirement. For the purposes of this study, we were interested in the frequency of practices listed and how they aligned with the PDCA cycle – not necessarily their adherence to existing rules or requirements.

Table 1 shows the top six elements mentioned throughout the policies, including the number of companies that specifically mentioned the element and how many practices in total were identified throughout the policies. Finally, [paraphrased] example practices are shown in the table to demonstrate what type of language was used to communicate support and action for health and safety.

Table 1. Example HSMS Elements and Practices Identified within NMA Company Policies.

| HSMS Element, Number of Companies, Number of Practices, and Examples of Practices |
|--|
| Risk Management: 16 companies, 51 practices <ul style="list-style-type: none"> • Use proactive risk program to improve competency of workers to identify, understand, and manage risks. • Conduct fatality prevention audits regularly. • Perform systematic evaluation for common hazard identification inputs, including near misses. |
| Emergency Management: 11 companies, 38 practices <ul style="list-style-type: none"> • Maintain emergency response teams and training. • Perform emergency preparedness audits every 2 years. • Ensure that internal and external communications plans are in place. |
| Occupational Health: 11 companies, 30 practices <ul style="list-style-type: none"> • Systematic approach for estimating exposures to chemical and physical agents for all materials, processes, and employees. • Compliant with the BS OHSAS 18001:2007 standard. • Qualitative assessments define air and noise monitoring and validation plans for each facility and are analyzed to determine if exposure management programs are required. |
| Culture Enhancement: 16 companies, 27 practices <ul style="list-style-type: none"> • Safety is a core value and is the foundation for how we manage every aspect of our business. • Provide a working environment that is conducive to personal health, mental alertness, and awareness. |
| Leadership Development: 11 companies, 24 practices <ul style="list-style-type: none"> • Leadership program emphasizes improving frontline supervisors' ability to engage constructively with their teams. • Leaders on site help design the methods to effectively measure safety performance. |
| HSMS Assurance: 11 companies, 21 practices <ul style="list-style-type: none"> • Policies, strategies, and performance indicators to manage risks and improve performance are approved by corporate HSE. • Compliance with regulations are managed in part through joining the NMA CORESafety mining program. • Follow OSHA recordkeeping rules to measure and record incidents. |

Research Question 2

Themes were identified within each phase of the PDCA cycle to help pinpoint potential strengths and weaknesses of company H&S systems. The results focused on within this paper highlight practices for elements that are consistently cited as critical to a well-balanced and functional HSMS including risk management, leadership development, assurance, and occupational health (OSHA, 2012; Yorio and Willmer, 2015).

Writing the Plan: The results showed that all of the companies spend a lot of time communicating interventions developed for health, safety, and risk management (e.g., an inventory of hazards, behavior-based decisions, and exposures to hazards). Such practices, synonymous with the *planning* phase of an HSMS, were among the most prevalent for the companies. These results show that companies establish fairly routine, standard workplace rules and processes.

Examples of these identified planning practices were grouped into themes for each element, including the following examples:

- **Leadership Development:** *Formal training or resources to develop current manager skills.*
- **Risk Management:** *Tools, rules, and procedures developed to promote adequate execution of risk management and assessment.*
- **Occupational Health:** *Anticipation of occupational health hazards through periodic exposure assessments.*

As depicted, the practices within these themes contained intervention activities that focused on identifying leading indicators through assessment programs, tools, or software (Haas and Yorio, 2016). Example practices that fell into *planning* included activities such as: fatality management programs to identify and review critical incident scenarios; life-saving rules to be used in relation to key risks; safety leadership coaching programs that emphasize frontline supervisors' ability to engage constructively with teams; and industrial hygienists conducting risk assessments of potential health issues.

Executing the Plan: Fewer companies highlighted the implementation of practices that were discussed in the *planning* phase. Those companies that did describe their *doing* practices often detailed how they executed risk-based activities, specifically. Policies most often discussed practices within risk management that help workers to perceive risk; identify high-hazard situations that have the potential to result in injury; perform active assessments on noise, air, and other exposure monitoring; and use various behavioral programs to identify and share risky scenarios, what behaviors could prevent incidents, and ways to discourage risky behavior. Several of these practices fell into themes that focused on executing specific programs to prevent future incidents.

Nonetheless, a consistent trend across policies was a lack of reference about what happens after hazards are identified—including some type of process that should be utilized by employees. Rather, companies more often highlighted activities in place at operational levels higher up in the organization about how and what strategies and tools are reviewed. However, policies did not go into strategic detail about how employees should respond on the ground to use the programs and tools identified to mitigate risks. This gap should be addressed because H&S policies exist as a communication mechanism for employees throughout the entire company and can be a good daily reference point for the hourly workforce.

Lack of Checking and Acting Practices in Policies: In comparison to the first half of the PDCA cycle, companies discussed fewer practices, and in less detail, about how employees are expected to check and respond to site-wide risks. This finding correlates with previous research asserting that traditional HSMS programs often have less activity corresponding to the *check* and *act* domains of the Deming Model (Robson et al., 2007). For example, there was no category of practices identified within the *Leadership Development* element about how companies evaluate their leaders on site and how they respond if certain competencies need to be improved. Obviously, this does not mean that companies do not have a mechanism to evaluate their managers on site. However, without a formal practice

documented for employees to reference, it is difficult for the workforce to know steps in place for improving identified problems. For example, one company simply stated, "We use NMA's CoreSafety initiative that focuses on preventing accidents before they happen using leadership and assurance."

The same gap emerged regarding H&S practices associated with *acting*. As an example, under risk management, where several companies outlined risk assessment processes, the practice that could be associated with *acting* was "use risk assessments to respond to incidents." Although both of these practices include key buzzwords, employees cannot take anything tangible from this policy practice and execute appropriate proactive decisions.

DISCUSSION

The qualitative analysis of available policies showed the range of companies in terms of having more or less in-depth H&S practices and whether or not practices were distributed over the entire PDCA cycle. These results provide implications for future research and practical considerations for mine practitioners.

Carrying H&S Practices through the PDCA Cycle

Recent research shows that many mine company policies continue to be vague and have poorly established rules and procedures (Bourrier, 2017). Likewise, the current study showed that company policies did not document the quantity and scope of H&S practices that might be expected throughout the PDCA cycle. Specifically, the *check* and *act* practices almost exclusively responded to lagging indicators rather than proactively following through on the leading indicators outlined in the policy *planning* phase. Absence of documented procedures can be problematic in terms of workers executing desired behaviors. Specifically, lack of policy characteristics found to inhibit worker H&S performance include: (1) vague work tasks; (2) limited information on performance; (3) lack of guidance on activity measurement and success; (4) no assigned job roles; and (5) little consideration for range of task performance and compliance (McLeod et al., 2016). We argue that, in order to enhance effective decision-making, all practices within H&S policies should serve as a specific function to clarify, manage, or prevent risks rather than be placeholders for subsequent reference if an incident occurs on site.

Balance Leading/Lagging Indicators and Interventions within Policy Practices: As previously mentioned, there was a lack of policy practices synonymous with *checking* and *acting* in response to leading indicators identified within company policies. Because practices and programs to identify leading indicators were given ample attention in the *planning* and *doing* phases, the absence of their evaluation was surprising. Additionally, whenever responses to leading indicators were mentioned within policies, the text was vague, so employees may be left wondering what their decisive role in risk prevention is on the job. For example, one policy practice within a highly discussed element, *HSMS Assurance*, was "We have been monitoring, measuring and working toward improving leading indicators of performance while simultaneously increasing the growth of the company. As a result of our efforts, lagging indicators such as worldwide recordable and lost time rates have continued to decrease." Again, this practice provides buzzwords and offers efforts that are occurring at the operational level, but provides little guidance to the hourly workforce on their roles in HSMS implementation.

Further, when policy practices proceeded to state that evaluation activities were in place, it was not to *check* how any activity was functioning. Rather, evaluation practices were more often in response to incidents. Similarly, research shows that *acting* and *checking* tend to be in response to workplace accidents, legislation, or enforcement, rather than acting as proactive measures (Robson et al., 2007). Therefore, it is possible that workers' decisions and actions are, in part, due to the priority that company policies place on responding to incidents rather than focusing on their prevention. For example, a common company practice within the *Risk Management* element was, "Recording, reporting, and investigation protocols are in place for all accidents, incidents, losses, and near misses."

Despite the above gaps, the results also showed that some companies do publicly document more practices within their policies that complete the PDCA cycle, with a focus on both leading and lagging indicators. An example of one company that took these practices through the cycle is reflected in this statement: "We have implemented Safety Violation Reduction Plans at each mine site. These plans focus on the top five most frequently cited categories at each location, and form corrective action plans. These plans are reviewed quarterly and appropriate adjustments are made." In this example, the lagging indicator is not an incident or illness, but a near miss, with an opportunity to correct before something more serious occurs on site. An example of policy H&S practices that proceeded throughout the PDCA cycle in detail from both an individual worker and organizational level is provided in Figure 1 in order to provide greater clarity on the subtle differences among the phases of the PDCA.

These examples help illustrate how some companies showed policy depth and breadth. Additionally, the figure shows how some companies strategize and communicate the expectations of their hourly-level workforce and corporate-level employees.

Thorough practices including the examples in Figure 1 were seldomly found to be in place throughout the sample of companies. Research supports the importance of managing risks by engaging in consistent dialogue between employees and managers and engaging employees in ongoing risk response and monitoring (Coombs, 2014; McComas, 2006). Through the process of documenting *checking* and *acting* practices within policies, companies can improve the context and opportunity to build the knowledge, skills, abilities, awareness, and motivation of workers.

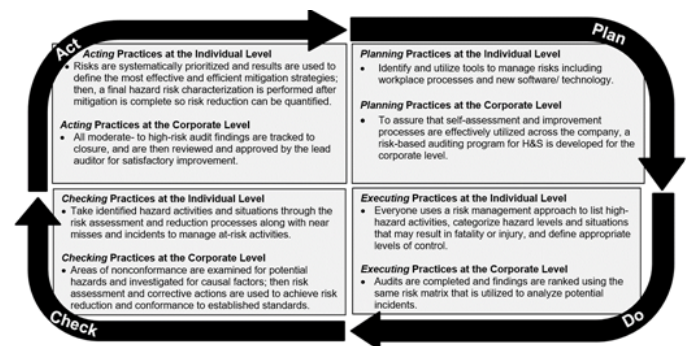


Figure 1. Example Policy that Displayed H&S Practices throughout the PDCA.

Communicate and Coordinate the System: Finally, results show that companies have an opportunity to foster stability in their workforce through not only having clear, consistent practices within their policies, but also posting their policies on company websites for everyone to easily access. Research suggests that system practices must exhibit consistency between what they intend to do and what they actually do in order to continually improve safety (Bowen and Ostroff, 2004; Delery and Doty, 1996). However, these mandated and recommended H&S behaviors must be explicitly visible by the workforce so that workers can identify relevant risks presented throughout the day and execute the necessary responses. If workers are not able to read policy practices and make a cognitive connection between a given H&S practice they are expected to perform and the outcomes promised by the organization, then the message to workers is potentially left unnoticed or inconsistent with the purpose of the practice. Involving everyone in conversations around policy practices and subsequently making these practices available to everyone may help workers take more ownership of their workplace risks and enact safer choices (Battles et al., 2006).

CONCLUSION

Possessing a strong policy that loops the PDCA cycle has been linked to an effective, low-cost approach to prevent incidents (Walker and Tait, 2004). This study provides initial insights into these aspects of mining policies. Specifically, the analysis showed how 26 companies prioritize and communicate their H&S objectives, through the quantity

and scope of their policy practices. The qualitative analysis showed that practices can be enhanced to have more depth and clarity about what is expected of employees to prevent incidents.

Limitations

This study, although providing implications for communicating and coordinating H&S management practices within mining, is not without limitations. First, the sample is small and the results cannot be generalized to all NMA companies and other high-risk industries. Along these lines, it is quite possible that a majority of these NMA companies do indeed have H&S policies but they are not publicly available and rather, posted on an internal website that can only be accessed via their company intranet. A similar limitation exists within each company, since individual mine sites could have their own organizational-level policy that covers practices in more detail. However, it can also be assumed that site-level policies would derive specific HSMS elements and practices from the values communicated in their parent company policy.

Also, the researchers who coded the policy practices did so through their own interpretation of the CORESafety elements and practices. Although a guidance document with definitions and examples was used throughout the coding process, it is possible that other researchers would have identified and selected slightly different quantities and assignment of practices. Although the qualitative analysis revealed instances where the execution of safety behaviors might be enhanced, there is still much speculation about how the implementation of an HSMS looks at these sites, not to mention the plethora of other factors, including company longevity, worker experience, and other information, that was not available to the researchers but should be considered with the results.

Future Directions

Despite these limitations, this information can be used to encourage mining companies to consult their website and check: first, the accessibility and visibility of their policies and second, the quantity and scope of their policies. It is hoped that companies make improvements to their policies to equip the workforce in risk identification and response. Moving forward, companies have the opportunity to reassess their policy visibility and content to ensure their H&S goals and messages are being communicated adequately to the workforce. Additionally, it may behoove upper management to determine if there is a distinct absence of specific HSMS elements and practices as well as an absence of checking and evaluating practices that can be added to improve the consistency of what managers promote and expect in day-to-day operations. Finally, assurance of responsibility and communication is continually promoted in HSMS research (Bianchini et al., 2017) but little guidance about where and how to start making progress in these areas is provided on the company level. This study shows that responsibility, by way of policy practices, should be further studied in order to understand potential impacts on workers' effective implementation and evaluation of decisions, behaviors, and ultimately incidents that occur on site. Future research should work to more explicitly document these links in terms of workplace incidents.

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