|  |  |
| --- | --- |
| cetlogo ***CHEMICAL ENGINEERING TRANSACTIONS***  ***VOL. xxx, 2025*** | A publication of  aidiclogo_grande |
| The Italian Association  of Chemical Engineering  Online at www.cetjournal.it |
| Guest Editors: Bruno Fabiano, Valerio Cozzani  Copyright © 2025, AIDIC Servizi S.r.l. **ISBN** 979-12-81206-xx-y; **ISSN** 2283-9216 | |

Understanding Safety Commitment at the Managerial Level

David Levovnika,\*, Darija Aleksićb, Marko Gerbeca

aJozef Stefan Institut, Jamova 39, 1000 Ljubljana, Slovenia

bSchool of Economics and Business, University of Ljubljana, Kardeljeva ploščad 17, 1000 Ljubljana, Slovenia

david.levovnik@ijs.si

The safety commitment of managers is known to play a central role in preventing major industrial accidents (O’Dea and Flin, 2001). The concept is positively related to employees’ process safety attitudes and safety behavior (Bieder and Bourrier, 2013) and can also facilitate the implementation of safety management systems (e.g., Levovnik et al., 2019; Nwankwo et al., 2020). However, while most studies focus on how managers’ commitment to safety can lead to better safety performance, fewer studies focus on how managers' commitment is shaped (Tappura et al., 2017). Although researchers have recently started to explore how environmental and individual factors can influence managers’ contribution to safety (Bieder and Callari, 2020) or how safety professionals can influence managers’ commitment to safety (Madigan et al., 2022), such studies are still few and far between. A better understanding of factors that can influence managers' commitment to safety is essential to effectively develop and promote managers’ commitment to safety in both theory and practice. Therefore, this paper outlines the various factors that can influence managers’ commitment to safety. The aim is to identify external, organizational, and individual factors that can promote or hinder managers’ commitment to safety from the extant literature and provide a holistic overview of identified factors. Thus, this paper adds to a better understanding of managers’ commitment to safety. In addition, outlining the factors that can influence managers’ commitment to safety facilitates further research.

* 1. Introduction

The safety commitment of managers is known to play a central role in preventing major industrial accidents (O’Dea and Flin, 2001). Their position in the organization enables them to make important safety decisions and engage in safety-related behavior that can significantly affect safety (Fruhen et al., 2019). Managers can control different aspects of the work and working environment that others cannot and can considerably improve working conditions. Managers’ commitment to safety is related to managers’ leadership style (Levovnik et al., 2025) and other managers’ behaviors that can show their commitment (Fruhen et al., 2014b). If managers show employees that safety is important for the organization (e.g., Ye et al., 2020), this can positively affect employees’ process safety attitudes and behavior (Bieder and Bourrier, 2013). In addition to promoting safety compliance and participation (Lim et al., 2018), managers' commitment to safety can also reduce risk-taking behavior (Bosak et al., 2013). Further, managers’ commitment is crucial in implementing safety management systems (e.g., Levovnik et al., 2019; Nwankwo et al., 2020). Studies (e.g., Samuelsson et al., 2023; Markowski et al., 2021) show that managers' commitment to safety positively relates to both occupational safety (i.e., hazards like cuts, slips, and falls, which generally involve one individual employee) and process safety (i.e., releases of hazardous substances, explosions, and fires, which can have negative consequences for various stakeholders), even though these are two distinct safety aspects (Center for Chemical Process Safety, 2008). Thus, this indicates that managers' commitment has a multifaced influence on safety outcomes. However, while most studies focus on how managers’ commitment to safety can lead to better safety performance, fewer studies focus on factors shaping managers’ commitment to safety (Tappura et al., 2017). Although researchers have recently started to explore how environmental and individual factors can influence managers’ contribution to safety (Bieder and Callari, 2020) or how safety professionals can influence managers’ commitment to safety (Madigan et al., 2022), such studies are still scarce.

A better understanding of factors that can influence managers' commitment to safety is essential to effectively develop and promote managers’ commitment to safety in both theory and practice. Therefore, this paper outlines the various factors that can influence managers’ commitment to safety. The aim is to identify external, organizational, and individual factors that can promote or hinder managers’ commitment to safety and provide a holistic overview of identified factors. Thus, this paper adds to a better understanding of managers’ commitment to safety and sheds light on how it can be promoted. In addition, providing a holistic overview of factors that can foster or impede managers’ commitment to safety facilitates further research.

* 1. Method

To outline factors that can influence managers’ commitment to safety, a scoping review of the literature is employed to identify the current body of knowledge and determine its scope. This approach facilitates mapping existing research and identifying potential knowledge gaps in the literature (Munn et al., 2018). The literature search was performed through the Web of Science database, one of the most acknowledged databases for scientific literature. The literature obtained through the database was then closely reviewed and analyzed. The analysis results were synthesized to provide a holistic overview of identified factors that can promote or hinder managers' commitment to safety.

* 1. Factors that can positively or negatively influence managers' commitment to safety

Although, in recent years, scholars have started to explore different aspects of managers' commitment, little is known about factors that can influence managers' commitment to safety. Therefore, gaining a deeper knowledge of what factors can promote or hinder managers' commitment to safety is essential, as it can help organizations foster managers' commitment in practice and, in turn, ensure better safety performance. The scoping review revealed only a few studies that would explore which factors can influence managers' commitment to safety. The studies can be generally divided into two broad groups: those that directly focus on the manager's commitment to safety and those that address this topic only indirectly as they explore other important aspects of managers' safety behavior.

* + 1. Studies that directly explore managers' commitment to safety

One such study was conducted by Tappura et al. (2017). The authors explored factors that can influence the commitment to safety-related management roles and leadership of middle managers and direct supervisors in various organizations. The study focused specifically on organizational factors and provided recommendations for promoting managers' commitment to safety in the organization. The study used a qualitative research approach (interviews) to explore managers' perceptions of the factors that can influence their safety commitment. It included both middle-level managers and direct supervisors from organizations in different sectors. The study identified various categories of different factors. Factors with negative influence include safety goals (external), safety procedures (complicated procedures), role overload (several managerial activities), production pressure (production has a priority over safety), employee safety attitudes (negative attitudes at meetings), and managers' safety attitudes (safety is not seen as important). On the other side, factors that were perceived as positive include safety awareness (emphasizing managers' safety responsibilities), recognizing managers' commitment (rewards for safety results), influencing managers' attitudes (through safety knowledge), support from superiors (encouragement from the superiors), safety procedures (mandatory procedures), safety improvement (progress and results), and safety benchmarking (between units and organizations). The identified factors indicate a considerable range of factors that can positively or negatively influence managers' commitment to safety (Tappura et al., 2017).

In contrast to a previous study that explored organizational factors that can promote or hinder managers’ safety commitment, Fruhen et al. (2014b) focused specifically on the individual characteristics of managers that enable them to engage in safety-related behaviors that display their commitment to safety. The authors explored how managers' social competence (social perception and persuasion), problem-solving abilities (gaining a better understanding of the safety issue and developing problem-solving ideas), and safety knowledge (e.g., safety-related facts and information, managers' backgrounds, education, and experiences) can influence behaviors that demonstrate their commitment to safety. Such behaviors can generally include developing new policies and organizational practices, making safety-related decisions, communicating, and being actively involved with employees. The study used qualitative research methods to collect data by conducting interviews with senior managers from air traffic management organizations. The interviews were designed to capture managers' behavior exhibiting their commitment to safety and personal characteristics (answers were quantified for correlation analysis). The results showed that both problem-solving ability and social competence were related to the demonstration of managers' commitment to safety. However, the safety knowledge of managers was not related to such safety-related behaviors (Fruhen et al., 2014b).

Another study that recently explored how managers' commitment can be influenced was a study by Madigan et al. (2022). Compared to the previous research, the authors focused on one particular factor. The study explored how safety professionals can influence managers who make important safety decisions. Although the study focused only on one factor, the ability of safety professionals to influence managers' commitment was explored in depth. In contrast to Tappura et al. (2017), this study employed a combination of qualitative and quantitative approaches to perform a survey and gather their data. Various strategies that can be used to promote managers' safety commitment were explored together with factors that can hinder or promote their effect on desired outcomes. The results showed that both managers and safety professionals perceived rational persuasion as the most effective influence approach to influence managers' commitment (Madigan et al., 2022).

* + 1. Studies that indirectly explore managers' commitment to safety

In addition to the studies that directly focused on managers' safety commitment and explored factors that can influence their commitment, some studies addressed this only indirectly, as they explored other important safety topics. For example, Bieder and Callari (2020) explored environmental (external, organizational, work) and individual factors that can influence managers in relation to safety. However, in contrast to the previous studies, the authors focused on factors that can positively and negatively impact managers' contribution to safety during their day-to-day activities in general. More specifically, the focus was on the daily managerial activities of middle-level managers who worked in civil aviation. A qualitative research approach was employed to conduct in-depth interviews with participants. The authors explored how environmental and internal factors interrelate with managers’ safety-related actions and how those interrelations enhance or hinder managers' contribution to safety. The results indicate that individual mindset (managers' safety beliefs derived from their approach to safety, their experiences, and their educational background), working environment (unit or department in which managers work), organizational environment (elements beyond the single unit/department), and external environment (beyond a single organization) can influence managers' safety practices (Bieder and Callari, 2020).

Similarly, Cheung et al. (2021) explored safety leadership factors to better understand how to promote safety leadership among managers. Researchers focused on how job characteristics and managers' personal resources can influence their engagement in a specific type of leadership behavior. The study incorporated managers' commitment to a safe working environment as a specific behavior that indicates their safety leadership. Thus, the demonstration of safety commitment was considered an integral part of managers' safety leadership behavior. In contrast to previously mentioned studies, which employed qualitative methods or a combination of qualitative and quantitative methods, this study used a solely quantitative research method to explore the proposed relationship between concepts. The results indicate that personal resources and job characteristics can positively affect work engagement related to safety leadership behavior. Based on these findings, we can infer that managers' personal resources, represented by psychological capital, and job characteristics, which include job resources and job demands, could also have been related to managers' safety commitment, which was demonstrated through safety leadership behavior (Cheung et al., 2021).

Fruhen et al. (2014a) also indirectly explored managers' commitment to safety. In their study, the authors examined how managers' personal attributes affect safety-related work activities and, in turn, organizational safety. More specifically, they develop a concept of managers' safety intelligence, consisting of managers' personality, motivation, safety knowledge, problem-solving, social competencies, and leadership. It was proposed that managers' approaches to solving safety problems in organizations demonstrate their commitment to safety. Therefore, demonstrating managers' commitment was considered a specific part of safety behavior. The premise is that managers have to understand the safety problems in their organization, address and prioritize different aspects of safety issues, and make decisions that demonstrate their commitment to safety. The study, conducted in two separate stages, used a qualitative approach to collect data through a survey (open-ended questions) and semi-structured interviews with senior managers. Results confirmed that the proposed individual characteristics of managers are related to their safety intelligence, including problem-solving, which ensures that managers' decisions reflect their safety commitment (Fruhen et al., 2014a).

We can see that if some studies focused only on specific factors, such as individual characteristics (e.g., Fruhen et al., 2014) or organizational factors (e.g., Tappura et al., 2017), others strived to address various factors at the same time, from external, organizational, to the individual (e.g., Bieder and Callari, 2020). The studies and the identified factors are summarized in Table 1.

Table 1: Most important authors and identified factors that can promote and/or hinder safety commitment

|  |  |
| --- | --- |
| Study | Identified factors |
| Fruhen et al. (2014b) | Managers' personal characteristics (social competence and problem-solving abilities) that enable managers to demonstrate their commitment to safety. |
| Tappura et al. (2017) | Safety goals, safety procedures, role overload, production pressure, employee safety attitudes, managers' safety attitudes, safety awareness, recognition of commitment, support from superiors, safety improvement, and safety benchmarking. |
| Madigan et al. (2022) | Upward influence approach of safety professionals (safety professionals influence managers' commitment to safety interventions and improvements). |
| Bieder and Callari (2020) | Individual mindset (managers' safety beliefs derived from their approach to safety, their experiences, and educational background), working environment (unit or department in which managers work), organizational environment (elements beyond the single unit/department), and external environment (beyond a single organization). |
| Fruhen et al. (2014a) | Problem-solving was recognized as one of the important personal attributes that can support managers' safety behavior and demonstrate their commitment to safety. |
| Cheung et al. (2021) | Job characteristics (job resources/demands) and managers' personal resources. |

* 1. Overview of the identified factors and aspects that remain to be addressed

The aforementioned studies form an important knowledge base, representing the first attempts to explore various factors that can influence managers' commitment to safety. However, these studies often address the concept of managers’ commitment to safety only partially, as they focus on a specific factor or group of factors that can promote or hinder managers’ commitment to safety. Although the study of Tappura et al. (2017) represents an important cornerstone in the literature, some aspects are not addressed in this study. For example, the authors focused only on organizational factors, leaving out potential external factors (e.g., regulation, industrial standards) or individual factors (e.g., risk perception, knowledge) that could also influence the managers' commitment to safety. Further, Madigan et al., 2022 focused on a single factor that can influence managers' commitment to safety from a specific, upward direction, leaving other factors and directions of influence (downward and lateral) out of the scope. Although the potential influence of this factor was meticulously explored, the study's narrow scope represents an important limitation in this respect. Similarly, Fruhen et al. (2014b) focused specifically on the individual characteristics of managers that enable them to engage in safety-related behaviors that display their commitment to safety.

If some studies directly explored the relationship between the proposed factors and managers commitment to safety (e.g., Tappura et al., 2017), others addressed the concept of managers’ commitment only indirectly, through managers’ contribution to safety during their daily operational activities (Bieder and Callari, 2020). Similarly, Cheung et al. (2021) and Fruhen et al. (2014a) also indirectly explored the effect of factors on managers' commitment to safety. The manager's commitment to safety was considered one of several aspects of managers' safety behavior.

From the methodological perspective, we can see that although some studies opted for quantitative (Cheung et al., 2021) or a combination of qualitative and quantitative methods (Madigan et al., 2022), the majority of studies used qualitative methods to explore factors that can influence managers' commitment to safety (e.g., Fruhen et al., 2014a; Bieder and Callari, 2020). This is expected as qualitative methods are generally used in exploratory research, as they allow researchers to gather and analyze data on new research topics (Bryman, 2016). Even though qualitative methods enable researchers to gain in-depth insight into new and under-explored concepts, there is a need for quantitative research that would further add to the understanding of the topic and enable researchers to examine the effect of specific factors.

Further, studies generally focus on managers from specific organizational levels, which does not allow the comparison of results between different levels. Various external, organizational, or individual factors may influence managers' safety behavior at specific organizational levels. For example, Fruhen et al. 2014b; and Madigan et al. (2022) focused only on senior managers. Thus, the results cannot be compared to those of managers at lower organizational levels. In contrast, Bieder and Callari (2020) focused on managers from the middle organizational level, leaving managers on higher and lower organizational levels out of scope. On the other hand, Cheung et al. (2021) included managers from all three organizational levels; however, there was no differentiation between levels. If the studies do not differentiate between different levels of management (senior managers vs. middle managers vs. direct supervisors), this limits their ability to reveal differences in the influence or strength of various factors on managers' commitment to safety.

In addition, the characteristics of organizations included in the study are also important as they affect the generalizability of the findings. For example, all managers who participated in Fruhen et al.'s 2014b study came from the same sector (air control management); therefore, the generalizability of findings on other high-reliability or risk industries is limited. Similarly, Cheung et al.'s (2021) study focused solely on the construction sector. This limits the generalizability of the results to other organizations with different organizational characteristics and other industries, as organizational structure and other contextual elements could vary considerably between different sectors. Further, including various organizations with specific safety-critical characteristics (e.g., "Seveso organizations") would add to the understanding of how specific contexts can affect managers' safety commitment. Ensuring safety in such organizations is essential, as these organizations have to manage various hazards that could lead to a major industrial accident with grave consequences (Oedewald and Reiman, 2007).

Based on the literature, the identified factors that can influence managers’ commitment to safety were examined and categorized to provide a holistic overview. Table 2 provides a detailed summary of various external, organizational, and individual factors that can promote or hinder managers’ commitment to safety.

Table 2: Detailed overview of various factors that can influence managers' commitment to safety.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Study | Focusa | Factor levelb | | | Managerial levelc | | | Sector/Industry | Methodsd |
|  | D/I | Ext. | Org. | Ind. | High | Middle | Sup. |  |  |
| Fruhen et al. (2014a) | I |  |  | X | X |  |  | Air traffic management | Qual. |
| Fruhen et al. (2014b) | D |  |  | X | X |  |  | Air traffic management | Qual./Quan. |
| Tappura et al. (2017) | D |  | X |  |  | X | X | Energy, Industrial Services, Chemical processing | Qual. |
| Madigan et al. (2022) | D |  | X |  | X |  |  | Unknowne | Qual./Quan. |
| Bieder and Callari (2020) | I | X | X | X |  | X |  | Manufacturing and Air traffic control | Qual. |
| Cheung et al. (2021) | I |  | X | X | X | X | X | Construction industry | Quan. |

*Note.* a Safety commitment can be addressed directly (D) or indirectly (I). b Factors can be classified as external (Ext.), organizational/internal (Org.), or individual (Ind.). c Managerial level addressed in the study (High-level, Middle-level, Supervisors). d Methods used in the study can be classified as qualitative (Qual.) or quantitative (Quan.) e The sample was gathered by an external agency specializing in survey recruiting.

* 1. Directions for future research

The aforementioned examples indicate that various aspects of factors that can influence managers' safety commitment remain unaddressed. Future research should strive to more holistically address factors that can influence managers' commitment to safety. More specifically, scholars should explore and identify both external (e.g., government politics, regulators' requirements) and organizational (e.g., safety policy, strategy, procedures) as well as individual (e.g., risk perception, motivation, knowledge, skills) factors, that can positively or negatively influence managers' commitment to safety. As current studies generally use qualitative methods, further empirical exploration of the relationship between managers' commitment to safety and various factors is needed. Future research should examine the interaction between different groups of factors (e.g., external, organizational, individual) and how this affects managers' commitment to safety. Further, future studies should explore factors at different organizational levels to gain a more detailed understanding of factors that can influence managers’ commitment to safety. To benefit from a better generalizability of findings, factors that can positively or negatively influence managers' commitment to safety should be examined in different settings (industries). Thus, further studies that would address various unexplored factors are needed to add to the understanding of managers' commitment to safety and how it can be promoted.

* 1. Conclusions

The literature explored in this paper forms an important knowledge base, as it represents the first attempts to directly or indirectly explore various factors that can influence managers' commitment to safety. Studies have highlighted several external, organizational, and individual factors that can promote or hinder managers' commitment to safety at different organizational levels in various industries. However, detailed analyses of the content revealed that some aspects remain unaddressed. Studies often addressed the concept of managers’ commitment to safety only partially, as researchers focused on a specific factor that can promote or hinder managers’ commitment to safety, or they addressed the concept of managers’ commitment only indirectly, as they explored other safety activities of managers. Further, studies often focused on managers from specific organizational levels, which limits the ability to compare the results across hierarchical levels. In addition, the characteristics of organizations included in the study are also important as they affect the generalizability of the findings. By examining the extant literature, this paper provides a holistic overview of factors that can influence managers' commitment to safety and, based on the identified literature gaps, sheds some light on avenues for future research on these factors.

References

Bieder C., Bourrier M. (Eds), 2013, Trapping Safety into Rules: How Desirable or Avoidable is Proceduralization, Ashgate.

Bieder C., Callari T.C., 2020, Individual and environmental dimensions influencing the middle managers’ contribution to safety: the emergence of a ‘safety-related universe’, Safety Science, 132, 104946.

Bosak J., Coetsee W.J., Cullinane S.J., 2013, Safety climate dimensions as predictors for risk behaviour, Accident Analysis and Prevention, 55, 256–264.

Bryman A., 2016, Social research methods, 5th Edition, Oxford University Press, New York.

Center for Chemical Process Safety, 2008, What is "Process Safety"?, Process Safety Beacon.

Cheung M.C., Zhang P.R., Cui Q., Hsu S-C., 2021, The antecedents of safety leadership: The job demands-resources model, Safety Science, 133, 104979.

Fruhen L.S., Griffin M.A., Andrei D.M., 2019, What does safety commitment mean to leaders? A multi-method investigation, Journal of Safety Research, 68, 203–214.

Fruhen L.S., Mearns K.J., Flin R., Kirwan B., 2014a, Safety intelligence: An exploration of senior managers’ characteristics, Applied Ergonomics, 45(4), 967-975.

Fruhen L.S., Mearns K.J., Flin R., Kirwan B., 2014b, Skills, knowledge and senior managers’ demonstrations of safety commitment, Safety Science, 69, 29–36.

Levovnik D., Aleksić D., Gerbec M., 2025, Examining the relationship between managers’ commitment to safety, leadership style, and employees’ perception of managers’ commitment, Journal of safety research, 92, 230–244.

Levovnik D., Gerbec M., Dimovski V., 2019, The Role of Leadership in Process Safety Management System “No Process Safety Management System is an Island.”, Chemical Engineering Transactions, 74, 1375–1380.

Lim H.W., Li N., Fang D., Wu C., 2018, Impact of Safety Climate on Types of Safety Motivation and Performance: Multigroup Invariance Analysis, Journal of Management in Engineering. 34(3).

Madigan C., Kïrsten W.A., Johnstone K., Capra M., 2022, Differences between managers’ and safety professionals’ perceptions of upwards influence attempts within safety practice, Journal of Safety Research, 81, 203–215.

Markowski A.S., Krasławski A., Vairo T., Fabiano B., 2021, Process Safety Management Quality in Industrial Corporation for Sustainable Development, Sustainability, 13, 9001.

Munn Z., Peters M.D.J., Stern C., Tufanaru C., McArthur A., Aromataris E., 2018, Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach, BMC Medical Research Methodology, 18, 143.

Nwankwo C.D., Theophilus S.C., Arewa A.O., 2020, A comparative analysis of process safety management (PSM) systems in the process industry, Journal of Loss Prevention in the Process Industries, 66, 104171.

O’Dea A., Flin R., 2001, Site managers and safety leadership in the offshore oil and gas industry, Safety Science, 37(1), 39–57.

Oedewald P., Reiman T, 2007, Special characteristics of safety critical organizations – Work psychological perspective. Helsinki: VTT Publications.

Samuelsson U.A., Larsman P., Grill M., 2023, For the sake of safety: A time-lagged study investigating the relationships between perceived leadership behaviors and employee safety behaviors, Safety Science, 166.

Tappura S., Nenonen N., Kivistö-Rahnasto J., 2017, Managers’ viewpoint on factors influencing their commitment to safety: An empirical investigation in five Finnish industrial organisations, Safety Science, 96, 52–61.

Ye X., Ren S., Li X., Wang Z., 2020, The mediating role of psychological capital between perceived management commitment and safety behavior, Journal of Safety Research, 72, 29–40.