

Time to take corporate innovation initiatives: The consequence of safety accidents in China's manufacturing industry

Abstract

Purpose – A bad safety accident at a manufacturing company usually results in casualties and economic losses. The company affected by such an accident must deal with pressure from multiple stakeholder groups. Employees, in particular, play a key role in pushing the affected company to develop strategies to improve occupational safety and health. The purpose of this paper is to seek answers to two questions: Does a safety accident affect employee behavior in terms of giving up prospects to develop a career at the affected company? If yes, could innovation initiatives adopted by the company help moderate the negative consequences from a safety accident?

Design/methodology/approach – By investigating 120 safety accidents reported by publicly-listed Chinese manufacturing companies between 2009 and 2016, the authors conduct an empirical study using regression-based statistical hypotheses testing to describe the companies' responses and prospects for their employees.

Findings – The results show that the magnitude of the accident and the accident being caused by an employee error positively affect the turnover of employees.

Furthermore, technical innovation initiatives, such as spending on R&D, by the accident-affected companies increase the positive effect of the accident magnitude on employee turnover. On the contrary, management innovation initiatives, such as corporate social responsibility (CSR) activities, weaken the impact of the accident magnitude and employee error on employee turnover.

Originality/value – This study contributes to knowledge development by adding a crisis perspective in human resource management research. It helps to better understand the impact of safety accidents on employee behavior and the response taken by companies through innovation initiatives.

Keywords Occupational safety and health; Career development; Employee turnover; Innovation initiatives; Safety accident

Introduction

With a large labor force and booming industries, China is part of the global manufacturing chain. The country's initial competitive advantages, based on availability of cheap resources, including labor, gradually weakened as people's quality of life and employee wages increased. To maintain competitiveness, many sectors had to undergo economic restructuring and were upgraded; manufacturing was one of them (Chin and Rowley, 2018). The transformation of the manufacturing industry brought about improvements in product quality resulting in economic benefits. However, rapid technological upgrade, if not performed carefully, can also trigger concerns about safety and, indeed, workplace accidents (Khanzode et al., 2012).

In 2007, China ratified the 1981 International Labor Office (ILO)'s Convention on Occupational Safety and Health (Casale and Zhu, 2013). The convention's purpose was to provide safe working environments for employees by offering protection and minimizing the causes of hazards. Nevertheless, industrial accidents and occupational injuries were (and continue to be) a frequent occurrence in China. According to the national workplace safety statistics¹ released by the State Administration of Work Safety (SAWS), there were 53,000 safety accidents and 38,000 deaths only between January and December 2017. In addition to casualties, these safety accidents also cause serious damage to the affected companies. They range from economic losses and costs due to suspension of production, to reduced competitiveness and employee dissatisfaction.

For example, in 2015, a safety accident of poisoning and suffocation occurred in Zhongyuan Special Steel Company, resulting in six casualties². The severe accident was caused by major defects in the project design and poor safety in the production process. Its negative impact on the company included a drop in share price and an increase in the number of employees leaving in search for safer working conditions. In response to the accident and loss of personnel, Zhongyuan Special Steel took some countermeasures, which included updating the company's safety management

¹ http://www.gov.cn/xinwen/2018-01/29/content_5261953.htm

² <http://www.szse.cn/disclosure/listed/bulletinDetail/index.html?b2671d18-7dad-4f94-bd0c-e264f31f58a6>

standards, developing new technologies and introducing protection procedures for the production floor employees. Many of these countermeasures were based on novel approaches and involved new initiatives, such as: protective alarm systems detecting unacceptable levels of contaminants; changes in the production process to avoid direct exposure; and regular interactive employee training based on virtual reality scenarios. This example raises an interesting question for both researchers and managers: can companies redeem their reputation after a serious safety accident by implementing innovation initiatives? More specifically, can a company use technical innovation (e.g., investing in research and development) and management initiatives (e.g., adopting corporate social responsibility activities) as a means to recover from the negative effects of a workplace safety accident?

Serious safety accidents are detrimental to companies in both human and financial terms. The affected company usually faces investigation followed by negative evaluation and punishment from the regulators, which triggers a series of unfavorable chain reactions, including employee dissatisfaction (Andrews et al., 2014). As the occupational safety and health of the employees have been threatened by accident that have occurred or potentially could occur, the balance between career development within the company and family wellbeing can be disrupted (Ito and Brotheridge, 2012). Moreover, the complexity and severity of accidents increase employees' job insecurity, especially for people employed in front-line production, which reduces their job satisfaction (Lee and Jeong, 2017). Consequently, safety accidents may negatively affect the career plans of the employees, including their intention to maintain a career path in the company and overall wellbeing. This can lead to employee resignation, turnover, or even collective turnover (Wu et al., 2017).

To retain employees and continue normal operation, accident-stricken companies have to implement measures which improve occupational safety and health performance along the other aspects of the workplace environment. The existing literature on industrial accidents has focused on aspects related to accident prevention and causation (Katsakiori et al., 2009; Pillay et al., 2015), but little attention has been paid so far to the effectiveness of the safety interventions. Therefore, this study links safety accidents with the management strategies of the companies by examining the impact of occupational safety and health management on employee behavior.

Previous research has also identified that companies have the options to adopt technical and/or management innovations to strategically adjust their performance (Ling and Nasurdin, 2010). While technical innovation is usually related to technology changes, management innovation is associated with the social structure of an organization. For this study, we use spending on research and development (R&D) as a proxy to represent the technical innovation initiatives and use CSR activities as a proxy for the management innovation initiatives. Both, the technical and management innovation initiatives impact the employees and their behavior, in particular, loyalty and commitment to continue or abandon a work environment that has experienced a significant industrial accident. It is thus of interest to understand the nature of such innovation initiatives.

Given the evidence that safety accidents may significantly affect employees, previous research has explored the relationship between work injuries and employee turnover (Lee and Jeong, 2017). However, the existing literature has not yet investigated the impact of different accident attributes, such as magnitude and causation, on employee turnover. Empirical studies about the effectiveness of innovation initiatives undertaken by companies in the aftermath of workplace accidents are also lacking. Based on data for Chinese manufacturing companies, this study analytically examines the relationship between safety accidents and employee turnover. It contributes to the literature by including two key attributes of safety accidents, namely magnitude and employee error, to explain their effects on employee turnover. We also explore how technical and management innovation initiatives should be implemented to help companies regain employee support after such accidents.

Theory and Hypothesis Development

Career development

Careers can be viewed in different ways, including a series of jobs, a cumulative set of work experiences, and a process of personal development (Newman, 2011). How employees' careers develop is of interest from both, a practical and research point of view. Career development involves an organized, formalized and planned effort to achieve a balance between an employee's needs and the organization's workforce

requirements (Lips-Wiersma and Hall, 2007). Modern-day studies argue that career development is at one's control and responsibility, that is, employees can have multiple employment paths of their own choice and less commitment to an organization, whilst developing various commitments towards their profession, professional groups and industry (Foong-ming, 2008). Specifically, an employee's career should be successfully integrated into a satisfactory personal and family life. It should provide a sense of sufficient security to meet the wellbeing and economic needs of the employees, allow flexibility to adapt to one's changing interests, and offer opportunities for rejuvenation (Greenhaus and Kossek, 2014). Thus, the decision for employees to stay or leave the employing organization depends on whether the job is needed and they are suited to perform it, but also whether it is meaningful, they feel supported or are spiritually satisfied at work (Tnay et al., 2013).

Viewed across the life-span of employees, career paths are impacted and changed because of many factors and considerations. For example, many employees, especially women, are facing contradictory requirements between family and careers (Valcour, 2007). In some cases, middle-aged employees need to balance work requirements with care for elderly parents (Gautun and Hagen, 2010). Rapid technology development is also putting high demands on employees' skills and abilities to stay up-to-date with many jobs, which are drastically changing and even disappearing (National Academies of Sciences, Engineering and Medicine, 2017). Moreover, in the complex, competitive and volatile market environment, companies may not remain economically viable, and thus reduce or close their operations, resulting in the lay-off of employees.

This study, however, is particularly interested in crises during the daily production and operation processes, which constitute safety accidents. They may affect the physical and mental health of the employees, and subsequently influence their decision to stay at or leave a particular place of employment. In such situations, the employees make conscious decisions whether their loyalty to a workplace should continue or not. The companies, on the other hand, are looking for the best responses to avoid the occurrence of safety accidents in the future.

Safety accidents and employee turnover

The market environment for manufacturing companies nowadays is very complex. Economic factors (e.g., the cost of accident prevention), technological aspects (e.g., multi-product industries), work conditions (e.g., safety provisions in the work environment) and human characteristics (e.g., work experience and safety training) are all related to the likelihood of safety accidents (Fabiano et al., 2004). Previous research shows that the consequences from safety accidents are also multifactorial, causing serious casualties, economic losses and employee turnover (Gucer et al., 2003).

In fact, occupational safety and health are a major concern for employees. How to handle this issue is of both academic and practical importance. Previous studies have already indicated a relationship between accidents and employee turnover (Bell and Grushecky, 2006; Burt et al., 2009). Safety accidents can cause personal injury to employees, damage the work environment and reduce job satisfaction. Production employees in manufacturing companies are particularly vulnerable to such negative impacts. If concerned about their physical and mental health, employees may decide to leave the work environment where they feel threatened and dissatisfied with the company's safety practices (Amponsah-Tawiah and Mensah, 2016).

The unfolding model of voluntary employee turnover (Lee and Mitchell, 1994) suggests that a negative shock to the organization's system will affect the behavior of the employees. A negative shock is a very distinguishable event that will push employees toward deliberate judgments about their jobs. It can even lead employees to voluntary quitting without considering other job alternatives (Morrell et al., 2008). A safety accident may trigger job dissatisfaction and be considered incompatible with work values and wellbeing standards, making employees to leave the company (Heavey et al., 2013). The idea of quitting is also contagious, particularly after a safety accident – witnessing colleagues leaving may increase others' desire to do the same. Safety accidents may thus lead to collective turnover (Hancock et al., 2017). In line with previous research (Hausknecht and Trevor, 2011), this study defines employee turnover as the aggregate level of employee departures within a group, work unit, or organization.

Safety accidents are usually assessed and investigated by the senior management and relevant departments. According to the regulations governing the reporting,

investigation and risk management of production safety accidents³, the analysis is centered on the magnitude of the accident and the cause behind it. These two aspects are discussed further below.

Accident magnitude. Serious safety accidents result in casualties in the affected companies. In this study, accident magnitude refers to the total number of employee casualties occurred as a result of a safety accident (Odero et al., 2003). Safety accidents damage the company's reputation and change investors' confidence. On the other hand, they harm the interests of the employees and decrease their confidence in personal safety, which results in diminished loyalty and even in them leaving the company (Andrews et al., 2014). According to the expectancy violations theory, conforming behavior remains largely unnoticed, but violations attract attention for their salience and deviance from commonly held expectations (Floyd et al., 1999). A safety accident is an example of a negative violation of employee expectations, and is likely to generate negative emotional responses. That is, manufacturing companies with safety accidents may lose employee approval and commitment because the accident violates the promise for occupational safety and places employees at risk (Gucer et al., 2003). The following hypothesis is tested to empirically study the relationship between accident magnitude and employee turnover:

Hypothesis 1. *Ceteris paribus, accident magnitude positively predicts employee turnover a company encounters.*

Employee error. There are many reasons for safety accidents in a workplace and previous studies have looked at their causes. Raouf (1998) classifies accident causation as immediate causes (e.g., unsafe acts) and contributing causes (e.g., safety management performance). Katsakiori et al. (2009) propose an accident model to identify active and latent causes (e.g., organizational and personal factors). In general, the likelihood for an accident is affected by the type of activities performed, tasks and job levels combined with personal risk factors. A number of studies have investigated worker characteristics associated with severity and likelihood of safety accidents occurring (Niza et al., 2008; Hofmann et al., 2017). Employee error is one possible cause of safety accidents. The accident investigation reports released by the regulators disclose whether a safety accident was caused by an employee error. This study

³ http://www.gov.cn/zwgk/2007-04/19/content_588577.htm

investigates the relationship between employee-error-triggered accidents and employee behavior after an accident.

From the perspective of expectancy violations, safety accidents may create cognitive dissonance by altering the individuals' views of the way things should be. Employees in a high-accident working environment may become more worried about their safety, and thus lower their recognition and commitment to the affiliated company (Heavey et al., 2013). In addition, turnover caused by safety accidents due to employee errors can be contagious because other employees in the same company will also be worried about their occupational safety as they may make the same mistakes. Hence, a safety accident caused by an employee error is likely to subsequently increase the collective employee turnover. We therefore hypothesize the following argument:

***Hypothesis 2.** Ceteris paribus, employee error caused accidents positively predict employee turnover a company encounters.*

Innovation initiatives following accidents

Organizational innovation is usually defined as the adoption of a new idea or behavior by an organization (Daft, 1978). According to Crossan and Apaydin (2010), organizations cope with changes and uncertainties by applying new technology and successfully integrating technical and management improvements in their organizational structures. Conceptually, "technical innovations are those that occur in the operating component and affect the technical system of an organization" (Damanpour et al., 1989). Hence, they affect the used equipment and production methods. Although the employees are in contact with these innovations, they are not specifically aimed at them. By comparison, people are the main focus of the management innovations which involve the generation and implementation of new managing practices, processes or structures, and are intended to further organizational goals (Birkinshaw et al., 2008). In this study, we investigate the effects of the companies' innovation initiatives from the perspective of technical and management innovations represented by R&D spending and CSR activity.

R&D spending. Technical innovations are defined as a means of changing and improving the performance of the technical system and are directly related to the main activities of an organization (Damanpour et al., 1989). Rogers (2010) proposes that

technical innovations can be the implementation of an idea for a new product or the introduction of new elements in an organization's production or services. Technical innovations generate changes in skill requirements, training needs and the occupational mix of employment, which in turn, affect hiring, staffing patterns and employees' career development (Flynn, 1988). Thus, technical innovations have an impact on the human resources management of companies. In line with Latham and Braun (2009), we use R&D spending – that is, investment in research and development, as a proxy for technical innovations in a company.

Moreover, organizational stability is highly correlated with employee turnover, indicating that employees are more likely to stay in a stable work environment in line with their desires for career development (Lee and Jeong, 2017). When employees' occupational safety and health are threatened by accidents, they may perceive job insecurity as an infraction of the implicit or explicit norm of reciprocity within the company (Hofmann et al., 2017). Consequently, they will alter their behavioral attitudes, for example, by reducing their commitment to the company and increasing turnover intentions (Cheng and Chan, 2008). If a company affected by a safety accident invests in R&D and adopts a technical innovation, the employees need to adapt to new technical requirements or face new operating procedures. This further increases their job insecurity. Therefore, technical innovations after a safety accident may act as a catalyst and stimulate employee turnover by further diminishing the stability of the work environment. Two further hypotheses are formulated as follows:

Hypothesis 3a. *Ceteris paribus, R&D spending amplifies the impact of accident magnitude on employee turnover a company encounters.*

Hypothesis 3b. *Ceteris paribus, R&D spending amplifies the impact of employee error caused accidents on employee turnover a company encounters.*

CSR activity. Corporate social responsibility is defined as “categories or levels of economic, legal, ethical and discretionary activities of a business entity as adapted to the values and expectations of society” (Joyner and Payne, 2002). The CSR activities are related to the company's perceived societal or stakeholder obligations (Lee et al., 2013). Employees are highly salient stakeholders to whom the firm owes a perfect duty. This means that they have significant power and legitimacy with which to influence the firm (Greenwood, 2007).

In the aftermath of safety accidents, many accident-stricken companies put new safety improvement initiatives in place which help to monitor their employees' safe and unsafe actions. Management innovation is defined as a difference in the form, quality, or structure over time of the management activities in an organization. It represents a particular form of organizational change and introduces a novelty in an established organization (Birkinshaw et al., 2008). For this study, we consider management innovations as innovative CSR activities targeted at employees after safety accidents, such as new safety training, emotional support and distribution of compensation. Moreover, CSR activities can significantly reduce the negative impacts of crises, and repair the relationship with stakeholders (e.g., employees) by establishing a positive corporate image (Jamali, 2008). Hence, employee-related CSR activities as management innovation initiatives, can improve employees' happiness at work, enhance their job satisfaction, and retain employees (Bode et al., 2015). The following two hypotheses are further formulated:

Hypothesis 4a. *Ceteris paribus, CSR activities attenuate the impact of accident magnitude on employee turnover a company encounters.*

Hypothesis 4b. *Ceteris paribus, CSR activities attenuate the impact of employee error caused accidents on employee turnover a company encounters.*

Method

Sample

The sample for this study was collected from the Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE) – the only two stock exchanges in mainland China approved by government regulators. We analyzed listed manufacturing companies as they are more visible with information publicly available. They are also expected to be closely scrutinized by regulators and the media.

To produce a precise sample, a multistep process was developed to search and gather data about safety accidents. Usually, when an accident occurs, the involved listed company announces details about it to its stakeholders and the public via the stock exchange. Hence, we first searched the headlines of accident announcements on

the websites of SSE⁴ and SZSE⁵, and created the initial set of terms used for a more detailed search. Next, we searched media reports which quoted the accident announcements and identified similar terms. Then we comprehensively analyzed the above results and narrowed the search terms to improve the accuracy of the findings. Finally, we identified the revised keywords to include “safety accident”, “production accident” and “fire accident”, and constructed the sample using them.

Following this procedure, each announcement from the search was individually reviewed to verify that it involved a safety accident which occurred in a manufacturing company. To avoid the risk of confounding effects, we eliminated accidents which had unclear announcements or occurred in companies viewed by the government as being at high risk in terms of quality of products and financial information (Green et al., 2009). We also eliminated accidents which occurred in the same companies after another negative event during the same or following year. The outcome was 120 safety accidents from 110 manufacturing companies identified for the period between 2009 and 2016.

Dependent variable

Employee turnover is the dependent variable for the regression model to test the hypotheses. Employees in manufacturing companies with safety accidents have lower level perceptions about the organizational safety environment, which reduces their job satisfaction. This is especially the case for production employees whose interests are directly affected. Furthermore, employee job dissatisfaction may impact career development prospects in the company and subsequently induce turnover behaviors (Cheng and Chan, 2008).

Thus, we measured employee turnover by dividing the number of production employees who left the affected companies in the year after the accidents, by the average number of production employees in the year and the following year of the accidents (Hausknecht and Trevor, 2011). The data was collected from the companies' annual reports detailing the number of production employees.

Independent variables

⁴ <http://www.sse.com.cn/>

⁵ <http://www.szse.cn/>

The independent variables include accident magnitude, employee error, R&D spending and CSR activity. *Accident magnitude* was a count of employee casualties related to the safety accidents collected from the accident announcements and accident investigation reports. *Employee error* was measured as a dummy variable. If the accident was due to employee errors, it was coded as 1; if the accident was caused by other factors, it was coded as 0. *R&D spending* was measured as log-transformed values of R&D expenditures of the affected company in the year following the accident.

CSR activity was measured as a count of the employee-related activities implemented by the companies following the accident. The *CSR activity* needs to be different from the activities conducted during daily operations and should not have direct effects on the company's economic benefits. Examples include new safety training, counselling and changes to improve the wellbeing of the employees. First, the authors collected all the news posted on the affected companies' websites within a year from the accident. Next, we invited two professional researchers in this field to review all collected news, identify and code CSR activities. The standard they followed was that if the activity in the news was a positive activity for the employees, it was defined as a CSR activity and coded as 1. Alternatively, as 0, if it was not counted. The analysis of the discrepancies produced a relatively high inter-rater reliability score of 0.915. Finally, we summed up the CSR activities and took the total as the measure of CSR activity.

Control variables

We controlled for firm size, leverage, past negative event, past employee turnover, past R&D spending, average wage, accident loss, and the year the accident took place. *Firm size* was measured as the log-transformed value of the total assets of the company reported during the year of the accident. *Leverage* was measured as the debt to equity ratio and obtained from the China Stock Market and Accounting Re-search Database (CSMAR). *Past negative event* was a count of previous negative events in which the company was involved one year prior to the accident. *Past employee turnover* was calculated by dividing the number of production employees who left the affected company in the year of the accident by the average number of production employees in the year of the accident and the previous year. *Past R&D spending* and

average wage were measured respectively as the log-transformed values of R&D expenditures and per capita income of employees in the year of the accident. *Accident loss* was the direct economic loss of the affected company caused by the accident. *Year* was included as a dummy variable, based on the year in which the accident occurred.

Results

This study uses multiple linear regression to test the four hypotheses. Table 1 presents the means, standard deviations, and correlations between all variables studied in the regression analysis. We note that employee turnover, past R&D spending and R&D spending are negatively correlated with CSR activity, and accident magnitude is positively correlated with CSR activity. There is also positive correlation between past R&D spending and R&D spending, and negative correlation between accident magnitude and past negative event. Furthermore, accident magnitude, employee error and average wage are positively correlated with accident loss and firm size, respectively. Finally, accident loss is positively correlated with firm size.

Insert Table 1 here

Table 2 displays the regression models predicting employee turnover in the affected companies. Model 1 contains only the control variables, while Model 2 includes the main effects of accident magnitude, employee error, R&D spending, and CSR activity. The remaining models include the four interaction effects respectively. We examined the variance inflation factors (VIF) to test the presence of multicollinearity and found the highest VIF was 2.964 in the six models, which is well below the accepted threshold of 10 (Neter et al., 1985). Among the control variables in Model 1, the effect of past negative event on employee turnover is positive and significant ($\beta = 0.025, p = 0.035$). The effect of past employee turnover on employee turnover is negative and significant ($\beta = -0.162, p = 0.056$).

Insert Table 2 here

Model 2 tests the main effects of accident magnitude and employee error. Accident magnitude significantly and positively predicts employee turnover ($\beta = 0.004, p = 0.006$), supporting Hypothesis 1 that severe safety accidents will exacerbate employee turnover. Moreover, we find a significant positive effect of

employee error on employee turnover ($\beta = 0.038, p = 0.007$), supporting Hypothesis 2 that accidents that are related to employee errors motivate more employees to leave. Model 3 to 6 examine the moderating effects of R&D spending and CSR activity. As shown in Model 3, there is a marginally significant positive effect of the interaction between R&D spending and accident magnitude on employee turnover ($\beta = 0.001, p = 0.086$) (Noack et al., 2017). This means that the impact of casualties on employee turnover increases for companies which spend more on research and development after the accident. Thus, the result is supportive for Hypothesis 3a. Likewise, Model 4 tests the interaction between R&D spending and employee error. The result is insignificant and indicates that Hypothesis 3b is not supported.

Model 5 shows a significant negative effect of CSR activity on the relationship between accident magnitude and employee turnover ($\beta = -0.001, p = 0.039$). This supports Hypothesis 4a that the positive effect of accident magnitude on employee turnover weakens for companies which conduct more CSR activities. Finally, Model 6 shows that the interaction between CSR activity and employee error is negative and significant ($\beta = -0.005, p = 0.004$), thus supporting Hypothesis H4b.

By graphically examining the effects of the chosen moderators, additional insight is provided about the ability of R&D spending and CSR activity to influence the retaining of employees (Hayes, 2013). Figure 1, 2 and 3 are drawn using the respective coefficients from Model 2, with “Low” indicating the level of the standardized variable is one standard deviation below the mean and “high”, one standard deviation above the mean. Figure 1 shows that higher R&D spending enhances the effect accident magnitude has on employee turnover more than lower R&D spending does. Figure 2 suggests that greater CSR activity more effectively mitigates the effect accident magnitude has on employee turnover than lower CSR activity does. Figure 3 shows a significantly negative moderating effect on the relationship between employee error and employee turnover in the condition of high CSR activity. That is, the positive impact of employee error caused accidents on employee turnover weakens for companies which undertake more CSR activities.

Insert Figure 1 here

Insert Figure 2 here

Insert Figure 3 here

Discussion

This study sheds light on the impacts of companies' innovation initiatives on employee turnover after safety accidents. Using 120 safety accidents which occurred in China's listed manufacturing companies, we explored the relationship between accident magnitude, employee error, R&D spending, CSR activity and employee turnover. The empirical results suggest that the effects of innovation initiatives on employee turnover following the accident are more complex than previously understood.

First, we use accident attributes as the antecedent variables to investigate the effects of safety accidents on employee turnover. The results indicate that accident magnitude and employee error both increase the turnover rate of production employees in the year following the accident. In other words, safety accidents which result in serious casualties or are due to employee errors will trigger the departure of other employees from the company. These findings enhance the current understanding of the relationship between safety accidents and employee turnover (Bell and Grushecky, 2006). They also enrich the study of the causes of collective turnover by adding a safety accident perspective (Hancock et al., 2017).

The examination of the companies' innovation initiatives reveals patterns that are relevant to research on company innovation and the growing literature on human resources management. A new insight provided by this study is that the companies' technical innovations (i.e. R&D spending) would increase the negative impact of the accident magnitude on employee behavior and aggravate employee turnover. When a safety accident occurs in a company, the occupational safety and health of its employees are often seriously threatened. Employees will worry about their personal safety and reduce their trust in the company (O'Toole, 2002). In poor safety circumstances, technical innovation introduced by the affected company not only brings new work challenges to employees, but also makes the production environment more complex and unbalanced. Therefore, companies engaged in technical innovation initiatives after safety accidents will face higher levels of employee turnover. Conversely, companies' management innovation initiatives (i.e. CSR activities) significantly reduce the negative impact of accident magnitude and employee error

and help the affected companies retain production employees. A possible explanation is that CSR activities help manage social evaluations, augment reputation, or can alter stakeholders' negative judgments after a negative event (Lee et al., 2013). The affected companies can use CSR activities to eliminate the expectation gap with employees and to meet societal perceptions.

Additionally, the results show that past negative events of the affected company positively affect employee turnover, while past employee turnover negatively affects employee turnover in the year after the accident. These findings suggest that past negative events may have a negative impact on the company's overall image. Once a safety accident occurs, employees of companies with more negative events in the past are more likely to leave. By comparison, companies with higher levels of employee turnover in the accident year usually take measures to communicate with employees. These employee-related measures can reduce employee turnover in the year following the accident.

Implication and limitation

By studying the safety accidents in Chinese-listed manufacturing companies, this study explores the strategies to manage employee turnover. The findings have both academic and practical implications. Moreover, this study contributes to the literature by linking human resource management with crisis management and by providing insights about strategies for managing employee turnover (Burt et al., 2009). Furthermore, by exploring the impact of the companies' innovation initiatives (i.e., technical innovation and management innovation) on employee behavior after an accident, it enriches the organizational innovation management literature (Ling and Nasurdin, 2010).

In addition, this study extends practical implications for companies to better cope with the aftermath of safety accidents and retain employees. First, since safety accidents have negative effects on many aspects of the company, managers are strongly advised to pay attention to safety management in routine times and avoid the occurrence of major safety accidents. For example, strengthening safety education, conducting safety inspections on a regular basis, and improving the safety management systems are effective ways to reduce the risk of accidents. Second,

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managers should recognize the impact a safety accident has on production employees and implement appropriate innovation initiatives to communicate with them.

According to our research findings, managers should not prioritize technical innovation initiatives after serious safety accidents, but instead create a stable work environment and harmonious internal atmosphere. Moreover, managers could promote employee-related CSR activities after the accident to repair their relationship with the employees, strengthen their organizational commitment, and enhance their job satisfaction, which in turn, improves their loyalty and reduces turnover intentions. Finally, managers should regularly monitor employee issues to ensure occupational safety initiatives remain relevant and up-to-date.

Limitations in the current study, however, should also be acknowledged. First, the sample of this study involves only the listed companies in China, which are more visible and accessible to the public. This may limit the generalizability of the findings. Future studies could consider the representation of non-listed companies. While the findings show that management innovation (i.e., employee-related CSR activities) would be helpful in managing safety accidents and reduce employee turnover, it is not possible to ascertain whether the involved companies should use CSR activities as strategic practices. Future research could add to the findings of the current study by revealing the motivations of managers for implementing CSR activities. Another area of future research is to explore these issues outside China (Chin et al., 2018), which would allow for drawing international comparisons.

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