Facing or Avoiding: How Employees' Error Coping Strategies Influence Learning from Project Failure in High-tech firms?

***ABSTRACT*:** Based on the Chinese context, according to cognition & behavior theory and grief recovery theory, this research empirically tests the effect of employees' error coping strategies on learning from failure by using the data of 752 questionnaires from high-tech enterprises, and further analyzes the mediating roles of negative emotion coping orientations between error coping strategies and learning from failure. Results show that the error management strategy is positively related to learning from failure while the error aversion strategy is not. Loss orientation and restoration orientations play the mediating roles in the relationship between error management strategy and learning from failure, while only restoration orientation plays a mediating role in the relationship between error aversion strategy and learning from failure, which appears to be a suppression effect. The research expands the theory of learning from failure based on behavioral and emotional coping, and provides a realistic basis for the failure management of enterprises.

***KEY WORDS*:** Error Management Strategy, Error Aversion Strategy, Restoration Orientation, Loss Orientation, Learning from Failure, Suppression Effect

***PAPER TYPE*:** Research paper

1. Introduction

Edison once said, “failure is what I need, as well as success”. At present, science and technology are increasingly important for the sustainable development of enterprises. High-tech enterprises inevitably face many problems that may lead to failure in the process of project research and development (Shepherd, Patzelt & Wolfe, 2011). In this process, R&D staff are prone to regret, feel sorry and double themselves, which makes them deeply disturbed. But failure is also a treasure trove of knowledge and information that allows them to learn (Chao-yon, 2014). Learning from failure has a significant positive impact on the innovation performance of scientific researchers (Chao-yon, 2014). Employees can discover tacit knowledge in failure and build a more comprehensive knowledge base for the project to be carried out again later during which they can avoid the same mistakes (Hora & Klassen, 2013). Therefore, how to learn from failure is particularly important for researchers. Learning from failure is concerned by many enterprises and scholars, and how to learn from failure is becoming a key subject with wide attention. The occurrence of failure will not only lead to tangible cost (such as economic loss and resources waste, etc.), but also affect the psychology states of individuals involved in failure events. In particular, the individual’s emotional responses and behavior to failure will be influenced most directly, which will have a significant impact on the subsequent learning behavior of employees. Previous studies on the antecedents of learning from failure mostly focus on personality traits (Zhao, 2011), attribution styles (Yu, Li & Yang, 2013) and cognitive processes (Wang et al., 2018). There are still few studies based on other variables such as emotional reactions and behavioral patterns, and few studies focus on the impact of emotion and behavioral characteristics of individuals after failure on subsequent learning.

In recent years, the concept of “error” has been mentioned by more and more scholars. In fact, failure events are caused by one or more errors, and the core of learning from failure is to discover, identify and solve these errors timely and accurately (Lattacher & Wdowiak, 2020). Then, how should employees deal with errors? And how can different error coping strategies transform failure experience to motivations of learning from failure to the greatest extent? Exploring the important roles of error coping strategies in learning from failure process is meaningful, which can provide sufficient error coping experience for enterprises managers and employees to benefit from failure. In the field of entrepreneurial failure and learning from failure, the theory of error coping was first proposed by van Dyck et al. (van Dyck, Frese, Baer, & Sonnentag, 2005). They believe that organizations will encounter errors inevitably. Errors can have both advantages and disadvantages. Thinking about errors actively and seeking for solutions, which is called “error management strategy”, can minimize the negative results caused by errors and maximize the positive effects. On the contrary, if employees resist facing errors and solve errors negatively, that is, adopting “error aversion strategy”, they may miss opportunities to learn from failure. Based on the study of van Dyck et al. (van Dyck, Frese, Baer, & Sonnentag, 2005), many scholars have introduced perspectives of two error coping strategies into study in recent years, and studied their different effects on individual follow-up behavior (Guchait et al., 2018; Frese, Michael & Keith, 2015). However, there are few studies about the impact of error coping strategies on learning from failure. Only Javed et al. (Javed et al., 2020) conducted a questionnaire survey among service industry practitioners in Pakistan and found that the organization’s error management culture can promote learning from failure. However, whether individuals’ error coping strategies will affect the subsequent learning from failure behavior and this effect mechanism haven’t been paid enough attention. Therefore, it’s necessary to explore the influence mechanism of error coping strategies on an individual’s learning from failure.

According to cognition & behavior theory, the individual’s cognition of events plays an important mediating role in the failure events and behaviors (Ellis, 1991). Therefore, individuals can adopt different coping strategies to balance the subsequent behaviors for psychological barriers caused by failure. For R&D employees, project failures represent not only team loss but also individual loss (e.g., emotional suffering, emotional costs, etc.) (Shepherd & Cardon, 2009). Employees’ participation in R&D firms is not only for personal interests, but also for emotional commitment to the organization, personal growth and individual’s value proof. Therefore, the project failure caused by errors will inevitably lead to negative emotions such as sadness. And these negative emotions will lead to overestimating the negative results of failure and underestimating the positive effects (Nygren, 1996), thereby affecting the ability of employees to learn from failure (Isen & Baron, 1991). In the process of coping with errors and related loss, negative emotions (e.g., sadness) will affect the collection and understanding of loss information. Therefore, when individuals adopt different strategies to deal with errors, they must deal with and recover from negative emotions. The grief recovery theory emphasizes the adverse impact of negative emotions such as grief caused by failure on subsequent information collection and processing, which will reduce the quality of learning from failure. Based on this logic, many scholars explored the different emotion coping orientations of individuals dealing with negative emotions caused by failure events (Shepherd & Cardon, 2009; Shepherd, 2009; Shepherd et al., 2009; Shepherd, 2013). According to Shepherd et al. (Shepherd, Patzelt & Wolfe, 2011), considering the different emphasis on negative emotion coping after individual failure, negative emotion coping orientations can be divided into loss orientation (i.e., an event-coping strategy, focus more on the failure event itself and take positive measures to deal with the loss caused by failure) and restoration orientation (i.e., an emotion-coping strategy, focus more on the inhibition of negative emotions caused by failure by diverting attention). Will the behavior patterns of employees who adopt different error coping strategies lead to different coping orientations to deal with negative emotions caused by errors? And does different negative emotion coping orientation have different effects on individuals’ subsequent learning behaviors? At present, scholars have not reached consistent conclusions on these issues. Therefore, in this study, we include employees’ negative emotion coping orientations to explore its mediating

roles in the relationship between error coping strategies and learning from failure.

In summary, this paper focuses on the relationship between different error coping strategies and learning from failure. By introducing the mediating effects of negative emotion coping orientations, we explored how researchers who adopt different error coping strategies recover from negative emotions (e.g., grief) and how different negative emotion coping orientations affect employees' subsequent learning from failure behaviors. Therefore, considering the situation in China, this paper extends the application context of previous scholars' views. Through the data research of project team employees from several high-tech enterprises in Beijing, and the data test of the questionnaires filled out by them, the application scope of grief recovery theory is further expanded, which makes theoretical supplement to the existing research and provides theoretical support for enterprise failure management in practice.

2. Literature Review and Hypotheses

According to the research of van Dyck et al. (van Dyck, Frese, Baer, & Sonnentag, 2005), error coping strategies mainly includes two types: error management strategy and error aversion strategy, which have different emphases. Employees who adopt error management strategy pay more attention to errors, and take positive measures to solve errors and make up for the negative impact of errors, including error communication, learning from errors, thinking about errors and error competence. And employees with error aversion strategy usually intend to avoid negative effects resulted by failure, with behaviors such as error stain and covering up errors. According to the different manifestations of error coping strategies, previous scholars studied the different impacts of organizational error culture on organizations, teams and individuals, and found that error management culture can usually bring positive effects (e.g., enterprise performance improvement and employee innovation ability enhancement) (van Dyck, Frese, Baer, & Sonnentag, 2005; Zhou, Xia. & Deng, 2017), while error aversion culture often bring negative effects (e.g., decreasing inclusive communication and the processes of team learning in teams) as well as increasing the possibility of making errors (Fruhen & Keith, 2014; Rupert, Homan, Jehn & Blomme, 2019). But few scholars take perspective of the impact of individual employees' error coping strategies on their behaviors. Based on the existing research, we speculate that two error coping strategies at the individual level may have different effects on employees' learning behaviors after failure.

To further explore the relationship between error coping strategies and learning from failure, we added the mediating effect of negative emotion coping orientations. Shepherd (Shepherd, 2003) first proposed the negative emotion coping orientations based on the grief recovery theory. Then, Shepherd et al. (Shepherd, Patzelt & Wolfe, 2011) applied loss orientation and restoration orientation to explore their influence on individuals' learning from failure, and proposed that restoration orientation was not conducive to learning from failure, while loss orientation could promote individuals' learning from failure. However, these hypotheses have not been fully confirmed through empirical test and analysis. Some scholars have also paid attention to the different negative emotion coping orientations, and discussed their important roles in learning from failure. Among them, Yu et al. (Yu, Li, & Yang, 2013) combined restoration orientation and failure attribution to explore the effects of their interaction effect on learning from failure. Shepherd (Shepherd, 2008) investigated the short-term and long-term roles of loss orientation and restoration orientation in promoting learning from failure after family business losses, as well as the role of oscillation orientation in this process. In fact, Shepherd et al. (Shepherd, Patzelt & Wolfe, 2011) proposed that if individuals alternately use restoration orientation and loss orientation when dealing with negative emotions, it's called oscillation orientation. Oscillation orientation can integrate the advantages of restoration orientation and loss orientation, and maximize the positive response of individuals to negative emotions. However, few individuals can adopt this error coping strategy. Most previous scholars discussed restoration orientation and loss orientation respectively to study their effects on emotion and behavior patterns (Yu, Li, & Yang, 2013). Moreover, under what conditions do individuals adopt these coping orientations, and the application value of different coping orientations in learning from failure in the Chinese context has not been confirmed. Therefore, we will test the mediation mechanisms of restoration orientation and loss orientation respectively. In summary, based on cognitive & behavior theory and grief recovery theory, we construct a theoretical framework as shown in Figure 1 to explore the key roles of negative emotion coping orientations in the relationship between error coping strategies and learning from failure

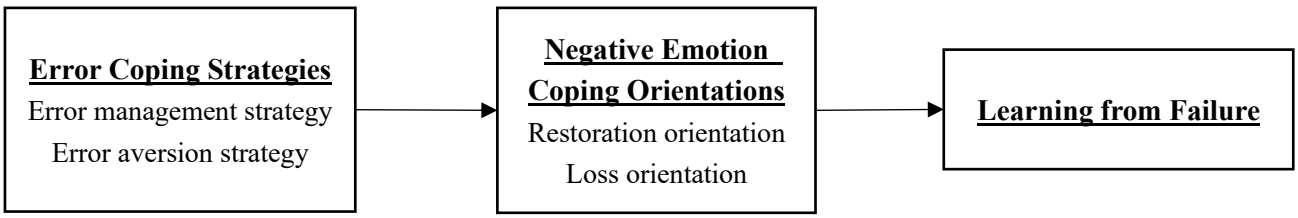

Figure 1 Theoretical Framework

2.1. Error Coping Strategies and Learning from Failure

The error aversion strategy is a way of evading errors. Employees who use this strategy are more concerned and afraid of the negative consequences and negative self-image of themselves caused by the errors and the resulting costs (e.g., demotion, salary reduction, etc.), so they are more likely to engage in withdrawal behaviors such as ignoring and covering up mistakes so as to maintain a positive self-image (Edmondson, 1999; Zhao & Olivera, 2006). These behaviors prevent employees from identifying, analyzing, and thinking about errors after project failure (van Dyck, Frese, Baer, & Sonnentag, 2005), and thus prevent employees from learning from failure.

First of all, employees adopting error aversion strategy will reduce their communication about errors with each other (van Dyck, Frese, Baer, & Sonnentag, 2005). Research shows that open communication about mistakes will lead to information sharing among employees, which helps them come up with creative solutions (van Dyck, Frese, Baer, & Sonnentag, 2005). On the one hand, it may hinder the individual's identification of the content and cause of the error as well as affect the judgment of the properties and effect of the error. As a result, employees are unable to learn effectively from failures. On the other hand, a reluctance to admit mistakes and communicate them to others inhibits sharing of knowledge about mistakes (Edmondson, 1999). In such cases, employees are unable to get help from those around them or receive experience from others' mistakes, which reduces the likelihood of learning.

Secondly, the error aversion strategy creates additional cognitive demands and distracts employees (Hollenbeck, Ilgen, Tuttle & Sego, 1995), which reduces the resources devoted to learning from errors. When a failure occurs, employees who adopt the error aversion strategy not only have to deal with the error, but they also set store by the negative image that the error creates for them, which can lead to additional demands and stress (van Dyck, Frese, Baer, & Sonnentag, 2005). High levels of stress at work, for one thing, can lead to a decrease in an individual's ability and thus increase the likelihood of making bad decisions (Hollenbeck, Ilgen, Tuttle & Sego, 1995). As a result, error aversion strategy makes the process of error handling inefficient, expending more resources such as time and attention, and may lead to new errors. Therefore, it is not conducive to effective learning. In addition, stress from mistakes can lead to negative attitudes and high levels of insecurity, which in turn can reduce self-efficacy (Arenas, Tabernero & Briones, 2006). Thus, the individual's perceived benefits of reporting and learning from failure is affected, and employees with higher self-efficacy are more likely to feel the benefits of learning, they are also more likely to apply what they learn to achieve positive performance results (Zhao and Olivera, 2006). Conversely, employees with lower self-efficacy were less likely to learn from failure due to a lack of confidence in their abilities (Bandura, 1978). For these reasons, we propose:

Hypothesis 1: There is a negative relationship between error aversion strategy and learning from failure.

Unlike the error aversion strategy, the error management strategy is a proactive approach to error (van Dyck, Frese, Baer, & Sonnentag, 2005). There are two kinds of consequences to errors: the positive one is the long-term benefits such as learning and innovation, and the negative ones are the losses caused by errors (van Dyck, Frese, Baer, & Sonnentag, 2005). The goal of error management strategy is to reduce the negative consequences of errors and promote more positive consequences of errors (van Dyck, Frese, Baer, & Sonnentag, 2005). Since adopting error management strategy can lead to a high degree of motivation and willingness to explore (van Dyck, Frese, Baer, & Sonnentag, 2005), error management strategy can facilitate learning from failure.

First, error management strategy helps to promote interpersonal communication and to focus employees' cognitive resources on error handling and learning (van Dyck, Frese, Baer, & Sonnentag, 2005), thus improving the efficiency and quality of learning. For one thing, by adopting an error management strategy, employees can report errors quickly, which can provide information about errors and encourage employees to communicate about them (Frese, 1995), so as to facilitate effective identification of errors (Cannon & Edmondson, 2001). Furthermore, learning is carried out in a more economical and effective way by avoiding the waste of individual cognitive resources to the greatest extent. When employees with diverse knowledge backgrounds and practical experience discuss and share ideas, they develop more creative ideas about errors (Dormann & Frese, 1994). At the same time, this open communication enables individuals to learn not only from their own errors, but also from the failures of others, so it can help employees learn more from each other (van Dyck, Frese, Baer, & Sonnentag, 2005). For another, employees who adopt error management strategy often treat error handling as part of their job (Fischer, Frese, Mertins & Hardt-Gawron, 2018). They don't need to hide their errors or blame others to maintain their self-image, which greatly reduces waste of individual cognitive resources after failure (Hollenbeck, Ilgen, Tuttle & Sego, 1995; Zhao & Olivera, 2006). As a result, employees' valuable resources such as attention and time can be focused more on the failure itself, which can effectively improve the efficiency and quality of learning.

Second, employees who adopt error management strategy tend to take the initiative to explore and think more about errors, and thus discover new knowledge and solutions (Fischer, Frese, Mertins & Hardt-Gawron, 2018; van Dyck, Frese, Baer, & Sonnentag, 2005). For one thing, further processing of errors requires individuals to explore unknown territory (Cannon & Edmondson, 2001). The occurrence of errors will put employees into a new problem context, which will encourage them to seek new ideas to deal with the problem. The error management strategy adopted in this process has a high tolerance for errors, which helps employees to improve their understanding of the environment and events by trial and errors as well as to come up with creative solutions (Fischer, Frese, Mertins & Hardt-Gawron, 2018). In this way, employees can learn new knowledge and

develop new methods from failure (Fischer, Frese, Mertins & Hardt-Gawron, 2018). For another, the exploration of error may also promote counterfactual thinking (van Dyck, Frese, Baer, & Sonnentag, 2005), which means learning from errors that haven't happened yet, or coming up with alternatives for self-improvement (Roese, 1994). These reflections will result in new knowledge, reasonable predictions about possible failures, and corresponding strategies (Baron, 1998), bring about better learning effects. For these reasons, we propose:

Hypothesis 2: There is a positive relationship between error management strategy and learning from failure.

2.2. Negative Emotion Coping Orientations and Learning from Failure

Restoration orientation refers to "an individual's way of coping with the grief caused by failure, emphasizing the suppression of loss feelings and the active facing of secondary sources of stress caused by loss" (Stroebe & Schut, 1999). Restoration orientation focuses on the individual's emotional processing, which is achieved by distraction and suppression of grief. It consists of two dimensions: one of them is the avoidance of the primary stressor, namely distraction, avoidance of failure itself and the events leading to failure; the other is proactive facing secondary stressors, namely, solving problems other than failure events (Shepherd, Patzelt & Wolfe, 2011). Because restoration orientation can restrain grief and reduce the consumption of resources, we think that restoration orientation is beneficial to learning from failure.

First, employees using restoration orientation actively avoid the main stressor (i.e., the event that caused the failure), which helps to suppress their negative emotions and thus reduce the disruption caused by the hurt (Shepherd, 2003). This will make employees have more energy and take a breath from grief. After a failure event, negative emotions impose additional stress and burdens on the individual, which can lead to cognitive resource depletion and interfere with information processing (Shepherd, 2003; Stroebe & Schut, 1999). When employees are distracted by negative emotions, they have difficulty getting feedback from failure events and revising prior knowledge, decisions, or assumptions (Shepherd, Patzelt & Wolfe, 2011; Shepherd, 2003), which leads to a reduction in the individual's ability to learn. By diverting attention, an individual's memory associated with the loss fades, accelerating the employee's recovery from the grieving process (Shepherd, 2003). This releases the psychological resources occupied by grief caused by failure, gives employees more time and energy to deal with failure events, and improves their information processing ability. Therefore, it will promote the rational explanation of failure events and the process of learning from failure.

In addition, adopting restoration orientation means actively responding to secondary stressors (i.e., events other than failure) that can help employees adjust to new life and tasks (Shepherd, 2003) and increase positive emotions, which can lead to continuous learning effect (Stroebe & Schut, 1999). Attention to other aspects of an employee's life, such as dealing with daily life and learning new tasks, not only distracts employees from thinking about the costs of failure, but also allows them to sustain the basic and necessary activities to rebuild all aspects of life or work (Archer, 1999). By taking on new tasks or engaging in new work, employees are able to adapt to changes in the surroundings, adjust their perceptions of the environment and themselves (Stroebe & Schut, 1999), and become more objective and holistic about failure. In addition, dealing with events other than failure can make the negative consequences of failure less pronounced (Shepherd, Patzelt & Wolfe, 2011). At the same time, solving this part of the problem can increase the individual's self-efficacy, bring confidence to the employee so as to increase his positive emotion. Therefore, the motivation to learn is enhanced, and it can promote employees' continuous learning. For these reasons, we propose:

Hypothesis 3: There is a positive relationship between a restoration orientation and learning from failure

Unlike restoration orientation focusing on one's own emotions, loss orientation focuses more on the failure event itself, it refers to "breaking the emotional bond to the loss by dealing with all aspects of the loss" (Shepherd, Patzelt & Wolfe, 2011). It consists of two dimensions: the "Self-dimension" (focusing on the failure process and investigating the cause of failure) and the "Other dimension" (communicating with the outside world to discover the reasons of failure) (Shepherd, Patzelt & Wolfe, 2011). Employees using loss orientation face failure and the events leading to failure, which helps to provide a reasonable explanation for the failure process and increase the understanding of failure events, thus promoting learning from failure. From the "self-dimension" of loss orientation, employees using loss orientation actively explore the causes of failure, which provides an opportunity to learn from failure (Shepherd, Patzelt & Wolfe, 2011). For one thing, in the search for a rational explanation for failure, individuals need to compare the difference between their original plan and their actual performance, and this difference provides important information about failure as a kind of feedback. That's important for employees to revise their beliefs, identify specific reasons for their failures, and figure out what they need to do next (Shepherd, Patzelt & Wolfe, 2011). Meanwhile, this can make employees aware that they should change and update their knowledge and methods (Shepherd, Patzelt & Wolfe, 2011) and promote them to improve their learning ability, thus improving their ability to learn and be more receptive to new knowledge. For another, in the process of facing and exploring the loss, employees can find new meaning from the failure events, thus enhancing the learning motivation. In dealing with failure and its associated events, employees can construct a complete narrative of failure and reconstruct the meaning of failure (Pilkington et al., 1993). As a result, employees using loss orientation not only recognize the costs of failure to themselves, but also see failure as an opportunity to improve their skills and develop themselves (Tjosvold, Yu & Hui, 2004), this positive reappraisal sustained the employees' effort to respond (Stroebe & Schut, 1999). When project work meets an employee's need for autonomy and competence improvement, employees will be more likely to participate in the work (Shepherd, 2003). In other words, when employees realize that failure can have a positive impact on them, their willingness to explore and learn from it will increase.

In addition, from the perspective of the "others-dimension" of loss orientation, employees with loss orientation tend to confide their feelings about project failure to friends and family, and seek advice from others to find the reasons for failure (Shepherd, 2003). This kind of emotional disclosure will alleviate the shame and guilt induced by failure and make employees feel more positive about themselves (Tjosvold, Yu & Hui, 2004), which not only enhances employees' self-confidence and resilience, enables employees to work hard and succeed in the face of difficulties (Rybowiak, Garst, Frese & Batinic, 1999), but also increase the motivation of learning (Luthans et al., 2007), so that employees will have a stronger willingness to learn from failures. At the same time, the sharing of failure events enables employees to reflect on the event, which improves the individual's cognitive capabilities (Finkenauer & Rimé, 1998), and encourages employees to explore and accept the causes of failure and make adjustments to solve them (Rybowiak, Garst, Frese & Batinic, 1999), which in turn encourages them to learn from their failures. For these reasons, we propose:

Hypothesis 4: There is a positive relationship between a loss orientation and learning from failure

2.3. Error Coping Strategies and Negative Emotion Coping Orientations

When employees face errors and failures in the project, it is inevitable that there will be negative emotions such as grief. Therefore, when adopting error coping strategies, individuals will inevitably face the recovery process of negative emotions. So how does this process work? As stated earlier, error management strategy is a proactive process of error handling and exploration that focuses on the failure event itself, with which employees are more likely to take loss orientation. Error management strategy includes analyzing and thinking about the causes of failure and the consequences of the failure, which makes employees take loss orientation and focus on the failure event, allocate more attention to activities that process information about failed events (Finkenauer & Rimé, 1998). At the same time, error management strategy focuses on the long-term benefits of error (van Dyck, Frese, Baer, & Sonnentag, 2005). As a result, employees who adopt error management strategy show a high willingness to explore failure, reflect on the circumstances and events that led to failure (Shepherd, 2003), actively explore the reasons of failure and learn from them. In addition, employees who adopt the error management strategy will cut the emotional bond between the individual and the loss by using loss orientation, so as to deal with the error more effectively and minimize the negative consequences of the error. In addition to loss orientation, employees who adopt error management strategy may also adopt restoration orientation in order to reduce the cognitive interference of negative emotions (Weick, 1990). For one thing, thinking about the error can lead to more negative emotions, and taking a mindful restoration orientation can speed up employees' emotional recovery, improve their information processing skills and focus their attention (Shepherd, 2003). On the other hand, error management strategy focuses on handling the consequences of errors. In order to achieve this goal, some employees may adopt a restoration orientation to adjust their perceptions of themselves and the environment to adapt to the changes in the environment (Stroebe & Schut, 1999), which will help employees to analyze and deal with failures more comprehensively and objectively.

Employees who adopt error aversion strategy can avoid, ignore, and even cover up errors to maintain their self-image for fear of the negative consequences of their mistakes (Edmondson, 1999; Zhao & Olivera, 2006), which makes employees more likely to adopt restoration orientation that focuses on emotional recovery to deal with the negative emotion of failure. Individuals adopting error aversion strategy usually have a negative appraisal of the error that led to the failure, which increases their stress caused by the error and is not conducive to the individual's recovery from the sadness of failure, it may even be harmful to the physical and mental health of individuals (Stroebe & Schut, 1999). Moreover, because employees need to deal with negative self-images by hiding their errors or blaming others, they have additional cognitive burdens that lead to additional negative emotional responses, such as extreme anxiety and insecurity (Stroebe & Schut, 1999). Therefore, restoration orientation can be used to achieve emotional recovery and stress relief through such methods as distraction. Employees who adopt error aversion strategy tend to have a negative attitude toward errors, which lowers their self-confidence and makes them more likely to avoid situations that they perceive as threatening or beyond their ability. As a result, they have a hard time focusing their attention and energy on the error itself and accepting the costs of failure, and they won't take loss orientation to actively noticing and dealing with failures (Shepherd, Patzelt & Wolfe, 2011). For these reasons, we propose:

Hypothesis 5: Employees who adopt error management strategy may adopt both restoration oriented and loss orientation to deal with the negative emotions induced by failure.

Hypothesis 6: Employees who adopt error aversion strategy may adopt restoration orientation rather than loss orientation to deal with negative emotions induced by failure.

2.4. The Mediating Roles of Negative Emotion Coping Orientations

To sum up, we think that the two negative emotion coping orientations play the mediating roles in the relationship between error coping strategies and learning from failure. Employees who adopt different error coping strategies may use different emotional coping orientations to deal with the negative emotions induced by failure. On the one hand, through the loss orientation, the employees who adopt the error management strategy usually invest cognitive resources into the error, thus deepening their understanding of failure and actively exploring failure, providing opportunities for learning from failure. On the other hand, the restoration orientation can restrain the disturbance of negative emotions, and adapt to the change of environment, so as to increase positive emotions and improve the efficiency of learning. On the contrary, adopting error aversion strategy will make employees avoid failure, reduce communication, exploration and learning willingness, which is not

conducive to learning from failure. But if employees can take the initiative to recover from grief and reduce the pressure caused by negative cognitions (i.e., adopt a restoration orientation), they will be more suitable for their own behaviors. By diverting attention and dealing with events other than failures, they can reduce negative emotional interference and increase positive emotions, which can increase their willingness to continue learning and improve the efficiency of learning from failure. This means that restoration orientation plays a special mediating role in the relationship between error aversion strategy and learning from failure, that is, the suppression effect, which sign is opposite to the indirect effect. For these reasons, we propose:

Hypothesis 7: Loss orientation and restoration orientation play the mediating roles in the relationship between error management strategy and learning from failure.

Hypothesis 8: Restoration orientation plays a mediating role in the relationship between error aversion strategy and learning from failure, specifically, it plays a suppression effect, so that individuals who adopt error aversion strategy can promote learning from failure by adopting restoration orientation.

In conclusion, we build a specific research framework as shown in Figure 2.

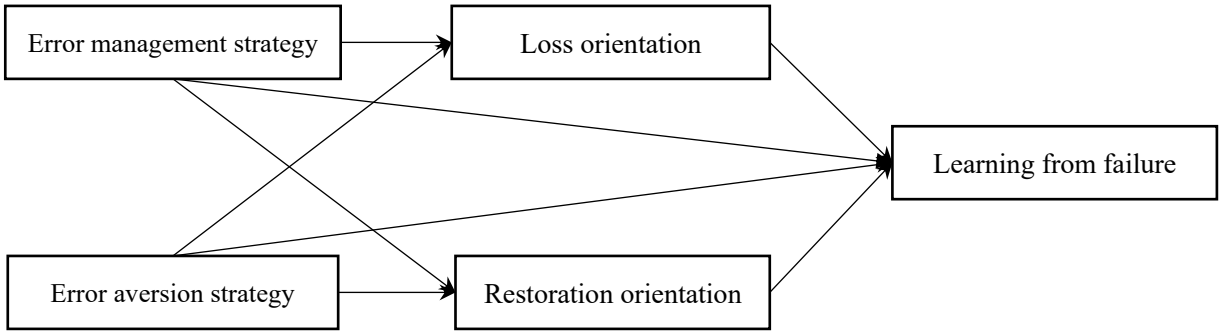

Figure 2 Specific Research Framework

3. Research Design and Variable Selection

3.1. Research Design

R&D teams in high-tech industries are more likely to fail in their work, so it is more representative to use them as our research objects. We randomly selected 400 high-tech companies from Beijing's high-tech companies and invited these companies to participate in our research. Before the study, we described the purpose of the study, emphasized confidentiality, and promised to summarize the results of the study to every leader of the company. The CEO used the support letter template we provided to write a support letter to employees, encouraging them to participate in the survey. After reaching a consensus with the partner company, the company's CEO and our research assistant identified a coordinator (usually a human resources manager), and then determined the list of teams participating in the research. In the end, 774 participants filled out the survey. Due to missing data, 22 reports were excluded. The final sample included 752 participants from 140 teams. About 50.3% of the respondents have a bachelor's degree, and 38.3% of the respondents have a master's degree. The average age of the survey respondents was 31.63 years old, and 23% of them were women.

3.2. Variables' Selection

In the initial measurement, we first measured stable demographic variables, such as gender, age, education level, and measured the company's tenure and the project team's tenure as control variables. Then, we defined project failure as "the termination of a project that does not achieve the goal of creating organizational value" (Shepherd, Patzelt & Wolfe, 2011). Participants were asked to recall their behavior patterns and emotional experiences after the recent project failed. After testing, the internal consistency reliability coefficients of all scales have reached 0.70 or more (see Table 2), indicating that the scales have a good level of reliability.

(1) Error coping strategies. We adopted the error coping scale developed by van Dyck et al. (van Dyck, Frese, Baer, & Sonnentag, 2005), and used Likert-5 point scale for measurement. Among them, the error management strategy contains 17 questions. Representative items include: "After I make a mistake, I will think about how to correct it", "After I make a mistake, I will try to figure out the cause of the error"; the error aversion strategy includes 11 items, representative topics include: "Generally speaking, I will feel very ashamed after making a mistake", "discussing mistakes with other colleagues is meaningless".

(2) Negative emotion coping orientations. We adopted the emotional coping scale developed by Shepherd et al. (Shepherd, Patzelt & Wolfe, 2011), and adopted the Likert-6-point scale for measurement. Among them, the restoration orientation includes 6 questions. Representative items include: “I confided to my friends my feelings about the failure of the project”, “I will find the reasons for the failure with everyone”; the loss orientation includes 6 items, representative items include: “I keep my mind alive so that I don’t just focus on the problems of the project”, “After the project fails, I try to get my life back on track” and other topics.

(3) Learning from failure. We adopted the learning from failure scale developed by Shepherd et al. (Shepherd, Patzelt & Wolfe, 2011), and adopted the Likert-6-point scale for measurement. Including 8 items, representative questions such as: “I can find possible problems in the new project in a timelier manner”, “I can see clearly now that we have made any mistakes that led to the failure of the project”.

3.3. Confirmatory Factor Analysis

This paper conducts a confirmation factor analysis test on five variables: error management strategy, error aversion strategy, loss orientation, restoration orientation, and learning from failure, to test the validity of discrimination between the five core variables. Since the factor loading of the two items in the restoration orientation is too low, the results after we have eliminated them are shown in Table 1. Compared with the index data of other factor models, the fitting degree of each index data of the five-factor model is the most ideal. It shows that the five core variables of this study have good discriminative validity, and the common method bias problem is also well controlled. On the basis of CFA, we further calculated the Construct Reliability (CR) of each scale. At the same time, we used Average Variance Extracted (AVE) to evaluate the convergent validity to ensure that it has good reliability and validity level. The results showed that CR of all measured variables reached above 0.70, and AVE reached the recommended value above 0.50, indicating that the scale has good convergent validity.

Table 1 Confirmatory Factor Analysis

Model	CMIN	DF	CMIN/DF	IFI	TLI	CFI	RMSEA
Five-factor model (LO,RO,EMS, EAS, LFF)	2453.11	990	2.48	0.91	0.90	0.91	0.04
Four-factor model (LO+RO,EMS+EAS, LFF)	3729.18	1022	3.69	0.78	0.74	0.72	0.06
Three-factor model (LO+RO,EMS+EAS,LFF)	4992.18	1191	4.19	0.68	0.66	0.67	0.08
Two-factor model (LO+RO, EMS+EAS+LFF)	6019.30	1262	4.77	0.62	0.59	0.60	0.08
Single-factor model (LO+RO+EMS+EAS+LFF)	7493.27	1302	5.76	0.59	0.54	0.58	0.10

Note：LO means loss orientation; RO means restoration orientation; EMS means error management strategy; EAS means error aversion strategy; LFF means learning from failure.

4. Data Analysis and Hypothesis Testing

In this study, SPSS 20.0 and AMOS 16.0 were used as tools for data analysis and hypothesis testing to analyze the basic distribution of data, correlation, reliability testing of scales, and multiple linear regression analysis. The results of the study are as followings:

4.1. Descriptive Statistic and Correlation Coefficient Matrix

We used SPSS to perform descriptive statistics on each variable, including calculating the means and standard deviation, etc., and then calculate the correlation coefficient matrix. The results are shown in Table 2. From the table, we can see that the error management strategy is positively correlated with learning from failure ($\beta=0.42$, $p<0.01$), the error aversion strategy is negatively correlated with learning from failure ($\beta=-0.18$, $p<0.01$), loss orientation and restoration orientation are both positively correlated with learning from failure ($\beta=0.42$, $p<0.01$; $\beta=0.38$, $p<0.01$), restoration orientation and two error coping strategies are positively correlated ($\beta=0.19$, $p<0.01$; $\beta=0.11$, $p< 0.01$), while the error aversion strategy is only positively correlated with restoration orientation but has insignificant relationship with loss orientation ($\beta=0.11$, $p<0.01$; $\beta=0.00$, $p>0.05$).

Therefore, some of our hypotheses are initially supported.

	M	SD	1	2	3	4	5	6	7	8	9	10
1 Age	31.63	5.47										
2 Education	4.36	0.68	.22**									
3 Sex	1.23	0.42	-0.04	0.00								
4 Tenure in the firm	1.76	0.73	.71**	.20**	-0.01							
5 Turner in the team	1.46	0.69	.53**	.22**	-0.04	.77**						
6 Error management strategy	4.70	0.53	0.02	0.05	0.02	0.01	0.02	**(0.885)**				
7 Error aversion strategy	2.97	0.77	0.02	0.02	0.01	0.05	0.03	-.14**	**(0.852)**			
8 Loss orientation	3.91	0.73	0.00	-.14**	0.06	-0.03	-0.05	.25**	0.00	**(0.702)**		
9 Restoration orientation	3.87	0.67	-0.01	-0.07	0.04	-0.05	-0.05	.19**	.11**	.49**	**(0.715)**	
10 Learning from failure	4.58	0.84	-0.02	-0.04	0.05	-0.03	-0.04	.42**	-.18**	.42**	.38**	**(0.909)**

Note: *p <.05; **p <.01. Sample number is 752. The numbers in brackets on the diagonal are the Cronbach's α coefficients of each variable.

Table 2 Descriptive Statistic and Correlation Coefficient Matrix

4.2. Hypotheses Testing

In order to further test the relationship between the variables, we conducted multiple regression analysis on the relationship between the core variables. The results are shown in Table 3. It can be seen from Model 6 that after adding control variables, the direct effects of two error coping strategies and learning from failure are both significant. Error management strategy positively affect learning from failure and error aversion strategy negatively affect learning from failure (β=0.40, p<0.001; b=-0.14, p<0.001), thus hypothesis 1 and 2 are both supported. It can be seen from Model 2 that both the error management strategy and the error aversion strategy are significantly positively correlated with the restoration orientation (β=0.22, p<0.001; β=0.13, p<0.001); and from model 4, it can be seen that the error management strategy and loss orientation are positively correlated, while error aversion strategy is not significantly related to loss orientation (β=0.25, p<0.001; β=0.01, p>0.05). Therefore, Hypothesis 5 and 6 are supported. Model 7 puts the mediation variables and independent variables into the model at the same time. It can be seen that both restoration orientation and loss orientation are significantly positively correlated with learning from failure (β=0.23, p<0.001; β=0.22, p<0.001), so hypothesis 3 and 4 are both supported. In addition, at this time, the error management strategy and learning from failure are still significantly positively correlated (β=0.29, p<0.001), and the correlation coefficient is reduced, indicating that restoration orientation and loss orientation both play a mediating role in it, and they are partial mediation variables. The mediating effects of restoration orientation and loss orientation respectively accounted for 12.9% and 19.3% of the total effects. Although the error aversion strategy is still significantly related to learning from failure (β=-0.18, p<0.001), the sign of the path coefficient product of the indirect effect and the sign of the direct effect coefficient are not consistent (a×b=-c). Therefore, restoration orientation may play a “suppression effect” in the relationship between error aversion strategy and learning from failure, and the proportion of suppression effect is 21.1% (a×b/|c|) (Wen and Ye, 2014), we will make further confirmation below. So, hypotheses 7 and 8 are also supported.

Table 3 The Result of Regression Analysis

	Restoration orientation		Loss orientation		Learning from failure		
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Age	0.07	0.07	0.07	0.06	0.01	-0.01	-0.04
Education	-0.07	-0.08*	-0.15***	-0.17***	-0.03	-0.05	0.01
Sex	0.045	0.04	0.07	0.03	0.06	0.04	0.02
Tenure in the firm	-0.07	-0.08	-0.05	-0.02	-0.03	0.01	0.04

Tenure in the project team	-0.02	-0.02	-0.01	-0.02	-0.01	-0.04	-0.03
Error management strategy		0.22***		0.25***		0.40***	0.29***
Error aversion strategy		0.13***		0.01		-0.14***	-0.18***
Loss orientation							0.22***
Restoration orientation							0.23***
R^2	0.01	0.07	0.03	0.09	0.00	0.20	0.34
$\triangle R^2$		0.06		0.06		0.20	0.129
F	1.58	7.65	4.29	10.47	0.76	25.95	42.22
P	0.16	0.00	0.00	0.00	0.58	0.00	0.00

Notes: $*p<0.05$; $**p<0.01$; $***p<0.001$, Sample number is 752。

In order to further verify the mediating effect, as shown in Table 4, we used the Bootstrap method to test the direct and indirect effects. From the Table 4, we can see that the direct effect of error management strategy on learning from failure is 0.51 and significant (95% CI does not contain 0), and the indirect effects of restoration orientation and loss orientation in the relationship between error management strategy and learning from failure are respectively 0.07 and 0.09, and both are significant (95% CI does not contain 0), indicating that the mediating effect of restoration orientation and loss orientation is established. The direct effect of error aversion strategy on learning from failure is -0.25 and significant (95% CI does not contain 0), and the indirect effect of loss orientation in the relationship between error aversion strategy and learning from failure is not significant (95% CI contains 0), indicating the mediating effect of loss orientation does not be supported; the indirect effect of restoration orientation in the relationship between error aversion strategy and learning from failure is 0.03 and significant (95% CI contains 0), and the sign is opposite to the direct effect, indicating that there is a suppression effect.

Table 4 The Decomposition of Each Path Effect of Bootstrap Method

Impact path	Standard coefficient value	95%CI
EMC→LFF	0.51	[0.41，0.61]
EAC→LFF	-0.25	[-0.318，-0.17]
EMC→RO→LFF	0.07	[0.03，0.11]
EMC→LO→LFF	0.10	[0.05，0.14]
EAC→RO→LFF	0.03	[0.00，0.06]
EAC→LO→LFF	-0.00	[-0.03，0.02]

Note：LO means loss orientation; RO means restoration orientation; EMS means error management strategy; EAS means error aversion strategy; LFF means learning from failure.

5. Conclusion and Discussion

5.1. Conclusion

As for individuals, reasonable coping with errors is an important prerequisite for employees to learn quickly after failure. This paper constructs a theoretical framework based on previous studies, and conducts an empirical analysis and test on the questionnaire data from the project team of high-tech enterprises, and draws the following conclusions. Error management strategy has a positive impact on learning from failure, while error aversion strategy has a negative impact on learning from failure. Combined with the negative emotion coping orientations, we found that restoration orientation and loss orientation can promote learning from failure, and two negative emotion coping orientations play the mediating roles in the relationship between error management strategy and learning from failure. Surprisingly, restoration orientation plays a suppression effect in the relationship between error aversion strategy and learning from failure. However, the mediating role of loss orientation in the relationship between error aversion strategy and learning from failure has not been confirmed.

5.2. Theoretical Contributions

First of all, this paper makes up for the lack of previous literature that pays little attention to the influence factors of individual behavior response after failure on subsequent learning from failure behavior. In the perspective of individuals, the existing literature pays more attention to individual's stable trait factors (e.g., dark traits) or emotional and cognitive variables (e.g., emotional cost and cognitive bias) (Shepherd, 2003; Shepherd, Patzelt & Wolfe, 2011). However, there is still a lack of research exploring the impact of individuals' behavior on learning from failure. From the perspective of error response, only Javed et al. (Javed et al., 2020) explored the impact of error management culture on learning from failure from the organizational level. We classified and discussed the two perspectives of error coping strategies, and obtained the different influence mechanisms of individuals' error coping strategies on learning from failure, which enriches the theoretical path of "behavior pattern—learning from failure".

Secondly, this paper combined the cognition & behavior theory and the grief recovery theory to correlate error coping strategies with negative emotion coping orientations. We further explored the important role of negative emotion coping orientations in individuals' specific behaviors (i.e., error coping strategies and learning from failure), which also expands the scope of application of grief recovery theory. Previous scholars mostly regard negative emotion coping orientations as the moderators of other individual variables affecting the learning from failure process to study their important boundary roles in this process. Also, some scholars have introduced it into the psychological activities of individuals' learning from failure by constructing a theoretical model, but have not confirmed it from the perspective of data or empirical. We created a model of the influence mechanism of negative emotion coping orientations on individual behavior and verified the hypotheses in the model based on data, thus providing a new perspective for the study of the outcome variables of negative emotion coping orientations. This paper deepened the research on the grief recovery theory, and provides a new perspective for the recovery after individual failure. Previous studies have only mentioned the important role of negative emotion coping orientations in emotional recovery, but few have studied its direct impact on individual behavior. Different from Shepherd et al. 's (Shepherd, Patzelt & Wolfe, 2011) conclusions based on the Western cultural environment, we believe that the two negative emotion coping orientations may both play the positive roles in promoting learning from failure based on Chinese background.

Finally, the conclusion of this paper breaks the original theoretical cognition of error aversion strategy in the academic circle. Some scholars have pointed out that error aversion strategy has adverse effects whether on organizations or individuals. However, we proposed hypotheses and confirmed the mediating variables that may suppress this effect. Although from the perspective of direct effect, individuals' adoption of error aversion strategy is not conducive to learning from failure. However, suppose that the mediating effect of restoration orientation is added to the emotional experience brought about by errors, if negative emotions can be suppressed from the perspective of emotional recovery, error aversion strategy can play a indirect and positive role. This hypothesis is supported by data at the same time, and also provides a new idea for subsequent scholars: whether there may be other suppression variables that can make the error aversion strategy play a positive effect is worth further exploration.

5.3. Practical Contributions

Our research results have important practical significance for managers and organizations. Although learning from failure has attracted much attention from entrepreneurs and scholars, previous studies have also explored the emotional reactions caused by failure, but they have not pointed out how employees can promote learning from failure by dealing with negative emotional reactions. By contrast, we explored and verified the impact of researchers' error coping strategies on learning from failure, and pointed out how to help employees recover their emotions and learn reasonably after setbacks. First of all, adopting error management strategy can promote employees' learning from failure. Therefore, enterprises, especially R&D enterprises or departments can build a cooperate culture to face failure and encourage employees to adopt error management strategy. By breaking the system and culture of rewarding success and punishing failure, employees' perceived security at work is increased and employees are encouraged to communicate and share errors actively.

In addition, employees adopting error aversion strategy can reduce the interference of negative emotions and promote emotional recovery by taking restoration orientation, thereby improving learning willingness and learning efficiency. Building a culture that actively responds to failure is a long-term process. In the early stage of cultural construction, employees may still fear and avoid failure. At this time, managers should assign new tasks, personnel adjustment and other ways to shift the attention of employees, while training employees to enable employees to obtain new skills and develop new capabilities. Through these ways to actively guide employees to adopt restoration orientation to reduce the interference of negative emotions on individual attention and increase positive emotions, so that they are more willing to face failure and gain experience from failure. In the development and completion stage of error management culture construction, managers should guide employees to adopt loss orientation and restoration orientation according to specific circumstances, and further improve the efficiency of dealing with failure events and learning from failure. When employees' emotional response is not strong, they can encourage employees to reflect on and discuss errors, so that they can deepen their understanding of failure events. When employees' emotional response strongly affects their cognition and action, managers can transfer employees' attention through other tasks, carry out new skills training, alleviate the emotional pressure of employees and increase their adaptability.

Finally, different types of employees can be recruited for different positions, or target different individuals to match their error coping strategies and train. R&D personnel and other tasks with high probability of failure can recruit employees who

tend to take error management strategy, so as to improve R&D efficiency and reduce management costs. It can also train R&D personnel in emotional coping strategies, so as to improve the flexibility and ability of employees to adopt different emotion coping strategies in different scenarios.

5.4. Limitations

This paper draws relevant conclusions through empirical research from the questionnaire, but there still exist the following limitations: First, the data source of this paper is cross-sectional data, which may affect the measurement of some variables (for example, restoration orientation has the characteristics of time-varying). Therefore, the follow-up study can take empirical sampling method (ESM) to further verify the conclusions of this paper. Second, this paper only focuses on the mediating roles of negative emotion coping orientations in the relationship between error coping strategies and learning from failure. Whether there are mediating variables of cognition, emotions and other factors is still unknown. Subsequent studies can further explore these problems.

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