Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6, 134-151
2024
Publisher: Learning Gate
DOI: 10.55214/25768484.v8i6.2030

Error management atmosphere, employee career resilience and employee innovation behavior: The mediating role of psychological empowerment

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Abstract: In order to study the specific influence path and mechanism of different dimensions under error management culture on employees' innovation behavior, this paper takes the perception of error management atmosphere and employee career resilience as independent variables, psychological empowerment is taken as intermediary variable, active innovation motivation is taken as the moderating variable of psychological empowerment and employee innovation behavior, and employee innovation behavior is taken as the dependent variable. This paper systematically discusses the multi-dimensional and multi-level relationships among error management culture, employee occupational resilience, psychological empowerment, active innovation motivation and employee innovation behavior. The research finds that by enhancing employees' psychological empowerment, that is, making them feel the meaning, self-efficacy, self-determination and influence of work, enterprises can stimulate employees' intrinsic motivation and encourage them to be more actively involved in innovation activities. This research not only enriches our understanding of how organizational culture shapes the way employees behave, but also reveals the critical role that individual employee traits (such as occupational resilience) and psychological states (such as psychological empowerment) play in the innovation process. This paper provides some suggestions on how to build a culture that encourages innovation and tolerates errors.

Keywords: *Employee career resilience, Employee innovation behavior, Error management atmosphere, Structural equation model.*

1. Introduction

In the current global economic environment, rapid technological developments, ever-changing markets and global challenges require companies to be highly adaptable and innovative. The McKinsey Health Institute (MHI) recently conducted a global survey of nearly 15,000 employees and 1,000 human resource decision makers in 15 countries. The research shows that there is a significant disconnect between job evaluations by employees and employers, with an average gap of 22%. According to the survey on the reasons for leaving employees, the negative atmosphere in the workplace (such as an intolerant culture) is the most important factor, accounting for 60% of the reasons. Faced with a bad work environment, employees are six times more likely to quit than other employees. In a further study, Deng et al. [1] held that tolerating reasonable work errors and promoting employees to discuss errors not only helped employees to learn and make progress, but also promoted the integration of employees from different cultural backgrounds. This open and inclusive environment encourages employees to share their failures and successes, thereby enhancing team cohesion and innovation. In addition, research also shows that effective error management can effectively promote innovation. Avoyan [2] points out that innovation often results from novel solutions to existing problems, and these

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solutions often come from in-depth analysis and understanding of failures. Therefore, a culture that accepts and learns from mistakes not only contributes to employee job satisfaction and teamwork, but is also a key factor in driving organizational innovation and continuous improvement. Career resilience not only helps employees effectively cope with difficulties at work, but also promotes cross-cultural adaptation and teamwork. In an open error management culture, confronting mistakes at work is an important part of personal growth and team progress. Employee occupational resilience enables employees to face up to their work mistakes, rather than avoiding or covering up. This attitude of confronting errors helps to promote open discussion and analysis of errors, thus providing valuable learning opportunities for individuals and teams [3]. Moreover, in a globalized corporate environment, employees' attitudes toward challenges and failures are critical to promoting innovative behavior [4]. Especially in a multicultural context, the way employees perceive and respond to mistakes and challenges at work is strongly influenced by their cultural background. Research points out that employees' innovation motivation, especially the active innovation motivation, is mostly driven by positive psychological factors [5]. Therefore, studying the relationship between the perception of error management culture, employees' career resilience and employees' innovation behavior, as well as exploring the mediating role of psychological empowerment in this process, will not only help enterprises to deeply understand how to create a more open and inclusive working environment, so as to promote employees to actively respond to challenges and mistakes and explore bravely. In addition, it can stimulate the overall innovation ability of enterprises and provide important theoretical support and practical guidance for enterprises to maintain competitive advantages in the rapidly changing market environment.

This paper mainly studies and constructs a comprehensive and systematic theoretical model, which integrates five core variables: error management culture perception, employee career resilience, psychological empowerment, active innovation motivation and employee innovation behavior, aiming to deeply analyze and verify the intricate and interdependent relationships among them, and how these relationships synergistically affect and drive employee innovation behavior. Therefore, by optimizing organizational culture and creating a good atmosphere to encourage innovation and fault-tolerant improvement, employees' willingness and motivation to innovate can be stimulated. By improving employees' ability, enhancing their career resilience and psychological empowerment, they can be more confident in facing challenges and dare to try new methods and ideas; By stimulating the vitality of innovation, it can continuously promote the innovation activities within the organization and promote the birth of new products, new services or new processes, so as to bring sustainable competitive advantages and sustainable development to the organization.

Although existing studies have explored the role of single factors such as error management culture, employee career resilience, psychological empowerment and employee innovation behavior, relatively few systematic studies have integrated these factors [6]. This paper systematically discusses the multi-dimensional and multi-level relationship among error management culture, employee career resilience, psychological empowerment as the independent variable, psychological empowerment as the mediating variable, active innovation motivation as the moderating variable of psychological empowerment and employee innovation behavior, and employee innovation behavior as the dependent variable. This research not only enriches our understanding of how organizational culture shapes the way employees behave, but also reveals the critical role that individual employee traits (such as occupational resilience) and psychological states (such as psychological empowerment) play in the innovation process. More importantly, it clarifies how active innovation motivation, as a moderating variable, affects the dynamic relationship between psychological empowerment and employee innovation behavior, providing a new perspective for understanding the internal mechanism of innovation behavior.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6: 134-151, 2024
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2 Literature Review and Hypotheses Development

2.1. The Perception of Error Management Culture Atmosphere

Positive error management culture perception encourages employees to report errors when they are found, rather than hiding or ignoring them. This culture of openness and transparency reduces the psychological barrier to error reporting, thus facilitating the timely identification and correction of errors [7]. In addition, the perception of error management also significantly affects the innovation behavior of employees. In a culture that sees mistakes as opportunities to learn and grow, employees are more inclined to try new approaches and ideas, even if those attempts may not work out [8]. Al-Bsheish et al. [9] found that employees' perception of the organization's tolerance for errors is positively correlated with their level of psychological empowerment. When employees feel that the organization tolerates and understands mistakes, they are more likely to feel that they are respected and trusted, which enhances psychological empowerment. To sum up, there is a close relationship between error management perception, psychological empowerment and employee innovation behavior. Therefore, the following research hypothesis is proposed in this study:

H_1: The perception of error management atmosphere has a significant positive impact on psychological empowerment.

H_2: The perception of error management culture atmosphere has a significant positive impact on employee innovation behavior.

2.2. Employee Career Resilience

Individuals with higher occupational resilience can cope with work pressure and challenges more effectively and reduce the risk of job burnout and psychological stress [10]. Career resilience can improve individual job satisfaction. When employees are able to actively cope with and recover from difficulties at work, they are more likely to be satisfied and engaged with their work [11]. There is a mutually reinforcing relationship between occupational resilience and psychological empowerment. Employees with higher levels of employee resilience are more likely to feel in control and autonomy at work, thus enhancing psychological empowerment. In the face of challenges and adversities, they are more confident in coping, more willing to take responsibility and seek solutions to problems, and this positive attitude helps to improve their work performance and anti-pressure ability [3]. People with a high sense of occupational resilience have a stronger ability to resist setbacks. Employees may face failures and setbacks at any time during the innovation process, but professional resilience can help them quickly recover from failures, readjust strategies, and move on. This indomitable spirit is an important guarantee for the success of innovation [12]. Therefore, the following research hypotheses are proposed in this study:

H_3: Employee career resilience has a significant positive impact on psychological empowerment.

H_4:Employee career resilience has a significant positive impact on employee innovation behavior.

2.3. Psychological Empowerment

Psychological empowerment can improve the motivation and enthusiasm of employees. When employees feel that they are trusted and supported by the organization, they are more engaged in their work and passionately pursue excellence and innovation [13]. This increase in motivation and motivation makes employees work harder to explore and try new ideas and approaches. When employees feel that the organization tolerates and understands mistakes (error management perception) and have good psychological authorization, employees are more likely to exhibit positive innovative behaviors [14]. Employees with strong career resilience can obtain more innovation opportunities and successful experiences through psychological empowerment, and these successful experiences will further enhance their occupational resilience and psychological empowerment, thus forming a virtuous cycle and constantly promoting the occurrence and development of employees' innovative behaviors. Therefore, the following research hypotheses are proposed in this study:

H_5: Psychological empowerment has a significant positive impact on employee innovation behavior.

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H_6. Psychological empowerment plays a mediating role between the perception of error management atmosphere and employee innovation behavior.

H_7. Psychological empowerment plays an intermediary role between employee career resilience and employee innovation behavior.

2.4. Active Innovation Motivation

When employees have a high sense of psychological empowerment, their motivation to take the initiative to innovate will be enhanced accordingly. This enhanced motivation for active innovation will further stimulate the innovation potential and enthusiasm of employees, making them more willing to invest time and energy in innovative activities [15]. Therefore, under the effect of psychological empowerment, employees' active innovation motivation is strengthened and amplified, which has a more significant promotion effect on employees' innovation behavior. Therefore, the following research hypotheses are proposed in this study:

H_8. Active innovation motivation plays an enhanced moderating role between psychological empowerment and employee innovation behavior.

Based on the above assumptions, the following model is obtained in Figure 1.

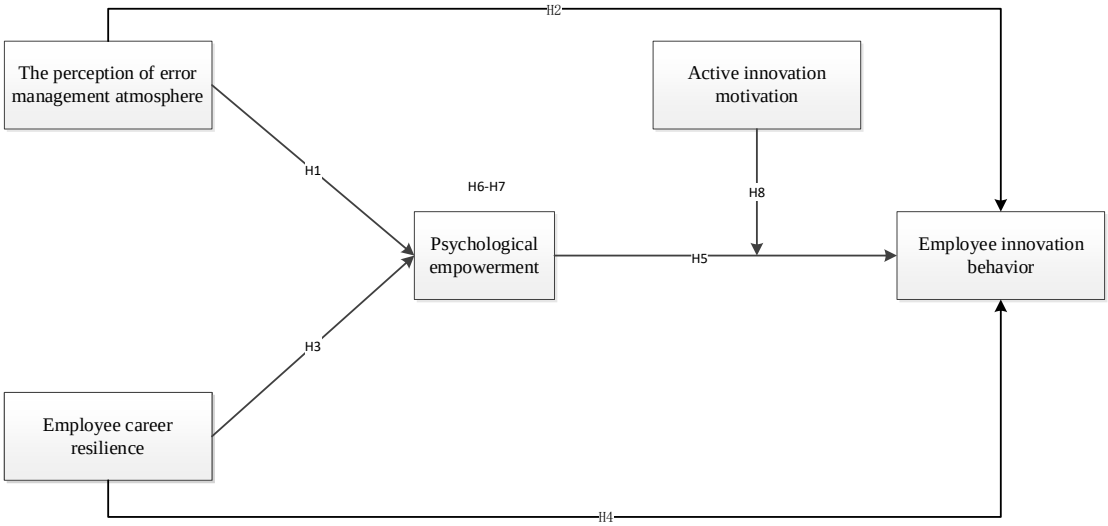

Figure 1.
Hypothetical model.

3. Research Methods

3.1. Data Collection

Considering that employee innovation behavior may be more common in manufacturing enterprises, the survey samples of this study were selected from 8 manufacturing enterprises (4 state-owned enterprises and 4 private enterprises) in Shanghai, Tianjin, Beijing and Jiangsu. In this study, a combination of online questionnaire and paper questionnaire was used to investigate the in-service employees of enterprises, with a total of 525 respondents from April to June 2024. Due to environmental and resource constraints, the researchers did not limit the size and duration of the enterprise. A total of 500 questionnaires were collected in this study, the recovery rate was 95%, 4 were invalid, 496 were valid, and the effective rate was 99%. The number of questionnaires reached the requirement of at least three times the number of questions, so it could meet the needs of follow-up statistical analysis. The details are shown in Table 1.

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Table 1.
Descriptive statistics.

Name	Category	Frequency	Percentage
Gender	Man	320	64.5
	Woman	176	35.5
Age	18-25	74	14.9
	25-35	141	28.4
	35-45	151	30.4
	45-55	75	15.1
	Age more than 50 years	55	11.1
Education background	High school diploma	55	11.1
	Undergraduate diploma	256	51.6
	Graduate diploma	139	28
	Doctor's degree	46	9.3
Length of service	Less than a year	103	20.8
	1-3 years	114	23
	4-10 years	93	18.8
	11-25 years	79	15.9
	More than 25 years	107	21.6
Position	Research personnel	79	15.9
	Planning personnel	59	11.9
	Stylist	70	14.1
	Engineer	288	58.1

3.2. Measurement

This research scale includes 5 scales: the perception of error management atmosphere, employee career resilience, psychological empowerment, active innovation motivation, and employee innovation behavior. All scales in this study were rated on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). The six items for error management perception refer to Fischer et al. [8], Klamar et al. [16] and Van Mourik et al. [17]. The scale is designed to measure the perception of error management with six items to comprehensively assess the attitude and behavior towards error in the organizational culture. The employee career resilience scale refers to Näswall et al. [18], Soer et al. [19]and Katsiana et al. [20]. The scale is designed with six items to comprehensively assess an individual's resilience in the face of career difficulties and challenges. The psychological empowerment scale refers to the studies of Ambad et al. [21] and Mahmoud et al. [5]. The six items designed in the scale are designed to comprehensively evaluate employees' sense of control, competence, autonomy and influence at work. The items in the active innovation motivation scale are based on the studies of Hirschi et al. [22]and Xu et al. [23]. The scale contains 6 items to comprehensively evaluate the active innovation motivation of employees. According to the studies of Janssen [24] and Lambriex-Schmitz et al. [25], the employee innovation behavior scale designed in this study contains 6 items to measure employees' innovation activities.

4. Result Analysis

4.1. Reliability analysis

As can be seen from Table 2, the α coefficient of the perception of error management atmosphere is 0.887, greater than 0.8, indicating high data reliability of this dimension. The CITC values of the analysis items were all greater than 0.4, indicating that there was a good correlation between the analysis items. The α coefficient of employee career resilience is 0.883, which is greater than 0.8, indicating that the data reliability of this dimension is high. The CITC values of the analysis items

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were all greater than 0.4, indicating that there was a good correlation between the analysis items. The α coefficient of psychological empowerment is 0.890, which is greater than 0.8, indicating that the data reliability of this dimension is high. The CITC values of the analysis items were all greater than 0.4, indicating that there was a good correlation between the analysis items. The α coefficient of active innovation motivation is 0.898, which is greater than 0.8, indicating that the data reliability of this dimension is high. The CITC values of the analysis items were all greater than 0.4, indicating that there was a good correlation between the analysis items. The α coefficient of employee innovation behavior is 0.909, which is greater than 0.8, indicating that the data reliability of this dimension is high. The CITC values of the analysis items are all greater than 0.4, indicating that there is a good correlation between the analysis items. In summary, the reliability quality of the research data meets the standards and can be used for further analysis.

Table 2.
Cronbach reliability analysis.

Dimension	Item	CITC	The term has been deleted for the α coefficient	Cronbach'α
The perception of error management atmosphere	In my organization, when an employee makes a mistake, management usually provides support and guidance, not punishment.	0.641	0.877	0.887
	I think my organization encourages learning and growth from mistakes.	0.797	0.854	
	When an employee makes a mistake, my organization tends to explore the reasons behind the mistake rather than immediately blame them.	0.675	0.871	
	I work in an environment where mistakes are seen as opportunities for improvement and innovation.	0.675	0.872	
	My organization allows people to make mistakes, which makes us more willing to try new approaches.	0.790	0.854	
	I am willing to openly discuss mistakes in my work and provide feedback and summary In the face of difficulties and challenges at work, I am usually able to maintain a positive and optimistic attitude.	0.660	0.875	
Employee career resilience	I am willing to openly discuss mistakes in my work and provide feedback and summary In the face of difficulties and challenges at work, I am usually able to maintain a positive and optimistic attitude.	0.667	0.867	0.883
	I was able to recover quickly from professional setbacks and find the motivation to move forward.	0.653	0.869	

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	I am able to maintain efficient work performance under high pressure.	0.723	0.858	
	In the face of change and uncertainty, I am able to adapt and find solutions.	0.719	0.859	
	I have the ability to overcome obstacles in my work and continue to achieve my goals.	0.694	0.863	
	Even when there are major challenges in my career, I will not give up.	0.707	0.861	
Psychological empowerment	I feel like I have a lot of control and influence over my work.	0.692	0.874	0.890
	I feel capable of making important work decisions.	0.711	0.871	
	I believe I have the ability to complete the difficult task.	0.632	0.885	
	I feel autonomous in my work and able to express my ideas and creativity freely.	0.675	0.877	
	My opinions and suggestions are valued and considered in the work.	0.792	0.859	
	I feel like I have a key role to play in delivering results.	0.773	0.861	
Active innovation motivation	I am constantly looking for new ideas to improve work processes and methods.	0.770	0.875	0.898
	I'm passionate about trying new things and innovative approaches.	0.684	0.887	
	In my work, I strive to seek opportunities for innovation and improvement.	0.719	0.881	
	I enjoy taking on challenging tasks to explore new solutions.	0.744	0.877	
	I often initiate or participate in projects to introduce new technologies or innovations.	0.703	0.884	
	For me, exploring the unknown and achieving innovation is my main driving force.	0.738	0.879	
employee innovation behavior	I often come up with new ideas or solutions to improve the current workflow.	0.691	0.901	0.909
	I am actively involved in projects and activities to introduce new technologies or methods.	0.792	0.887	
	I am willing to try non-traditional methods to solve problems at work.	0.665	0.905	
	I am often a force for innovation and change in my team.	0.769	0.890	
	My innovative ideas were recognized	0.739	0.894	

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	and implemented by my organization.			
	I'm always looking for opportunities to improve efficiency and effectiveness through innovation.	0.834	0.880	

4.2. Exploratory Factor Analysis

In this study, SPSS software and principal component analysis were used for exploratory factor analysis. The test results in Table 3 show that the KMO test value of the research data is 0.929, which is greater than 0.9, indicating that it is very suitable for factor analysis. The significance P-value of Bartlett sphericity test was less than 0.05, showing significance at the level. Therefore, null hypothesis was rejected, there was correlation between variables, factor analysis was effective, and it was suitable for factor analysis.

Table 3.
KMO and Bartlett tests.

KMO and Bartlett tests		
KMO		0.929
Bartlett sphericity test	Approximate chi-square	8796.816
	Degree of freedom	435.000
	Significance	0.000

According to Table 4, factors with eigenvalues greater than 1 were extracted by principal component analysis, and a total of 6 factors were extracted. The cumulative contribution rate of common factors was 66.155%, which was greater than 60%, indicating that the extracted common factors contained sufficient information. After rotation by the orthogonal rotation method, 42 items can be classified into 5 factors, in which the load coefficient value of each item of each factor is higher than 0.5, indicating that the corresponding relationship between each factor and item is good, and there is no situation of high double factor load. All observed variables are aggregated under each dimension according to the theoretical presupposition. The common degree value of all research items is higher than 0.4, which means that there is a strong correlation between research items and factors, and factors can effectively extract information. The above analysis shows that the scale selected in this paper has good construction validity.

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Table 4.
Factor load coefficient after rotation

		Component1	Component2	Component3	Component4	Component5	Common degree
The perception of error management atmosphere	CC1				0.721		0.573
	CC2				0.847		0.774
	CC3				0.697		0.603
	CC4				0.727		0.613
	CC5				0.823		0.756
	CC6				0.710		0.588
Employee career resilience	YG1					0.696	0.597
	YG2					0.713	0.580
	YG3					0.779	0.673
	YG4					0.743	0.664
	YG5					0.753	0.633
	YG6					0.799	0.676
Psychological empowerment	XL1			0.730			0.626
	XL2			0.766			0.656
	XL3			0.726			0.561
	XL4			0.730			0.608
	XL5			0.831			0.759
	XL6			0.794			0.734
Active innovation motivation	ZD1		0.825				0.723
	ZD2		0.766				0.612
	ZD3		0.791				0.656
	ZD4		0.801				0.690
	ZD5		0.791				0.648
	ZD6		0.819				0.692
Employee innovation behavior.	Y1	0.739					0.620
	Y2	0.819					0.749

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	Y3	0.727					0.591
	Y4	0.784					0.716
	Y5	0.750					0.679
	Y6	0.816					0.796
Characteristic root		9.781	3.367	2.392	2.203	2.104	
variance contribution rate %		32.602	11.222	7.974	7.342	7.014	
Accumulating contribution rate %		32.602	43.824	51.798	59.141	66.155	

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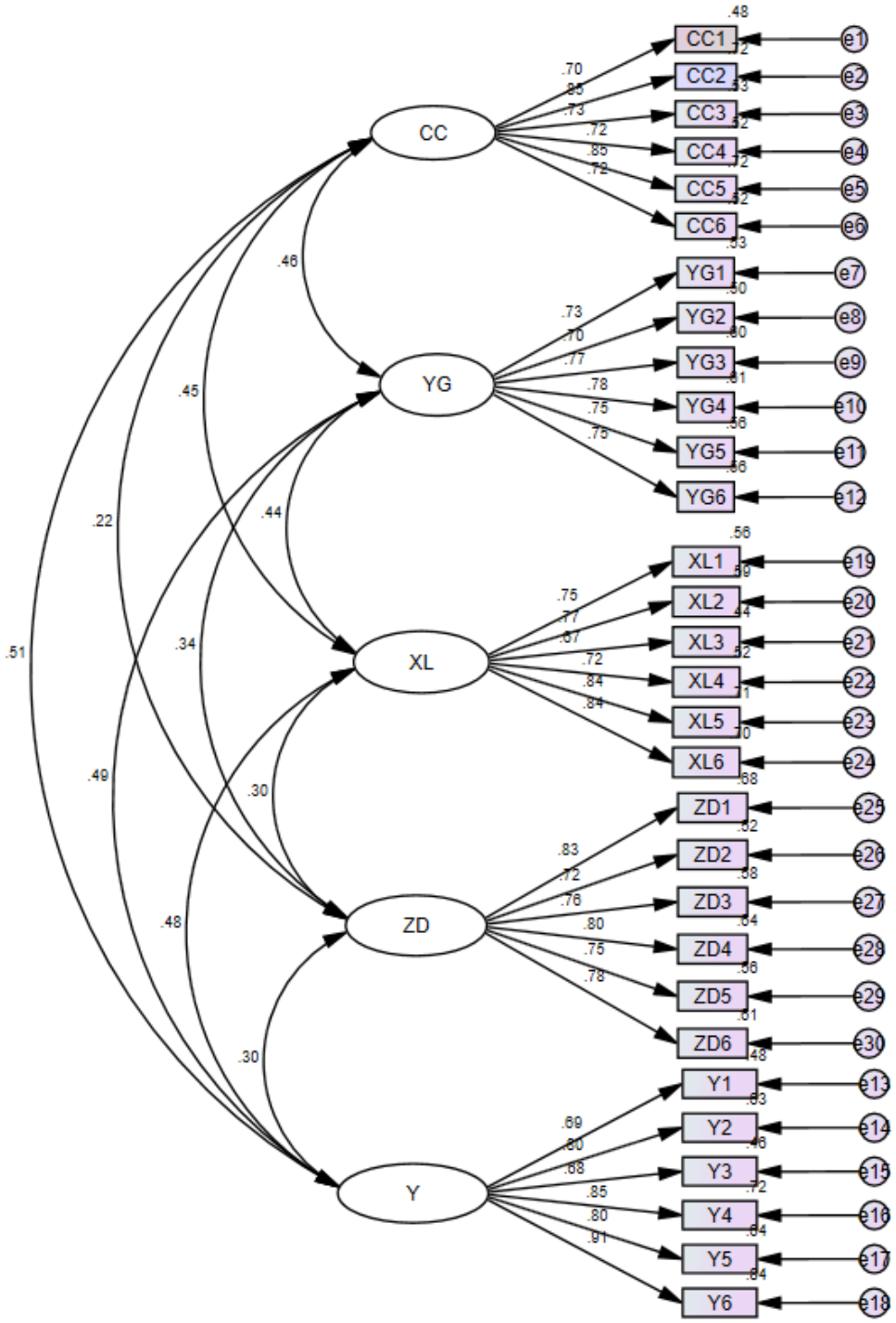

Figure 2.
Model results.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
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4.3. Confirmatory Factor Analysis

As can be seen from Figure 2 and Table 5, the model CMIN is 611.697, DF is 395, and CMIN/DF is 1.549<3, which is ideal. RMSEA is 0.033<0.08, and GFI, CFI, NFI and IFI indexes are all greater than 0.9. Each index is in line with the standard, indicating that the model has a good fit.

Table 5.
Model fitting index.

Index	CMIN	DF	CMIN/DF	GFI	RMSEA	CFI	NFI	IFI
Ideal value	-	-	<3	>0.9	<0.08	>0.9	>0.9	>0.9
Reach the standard value	-	-	<5	>0.8	<0.10	>0.8	>0.8	>0.8
Fitted value	611.697	395	1.549	0.925	0.033	0.975	0.932	0.975

It can be seen from the factor load coefficient table that the standardized factor load of each item is greater than 0.5, indicating that each item can well explain its dimension.

Table 6.
Table of factor load coefficients.

Factor	Measured item	Non-standard load factor	standard load factor	SE	z (C.R.)	p
The perception of error management atmosphere	CC1	1.000	0.695			
	CC2	1.047	0.848	0.061	17.205	***
	CC3	1.000	0.726	0.067	14.951	***
	CC4	1.031	0.720	0.070	14.831	***
	CC5	1.097	0.848	0.064	17.209	***
	CC6	1.087	0.723	0.073	14.887	***
Employee career resilience	YG1	1.000	0.727			
	YG2	0.896	0.704	0.060	14.933	***
	YG3	1.005	0.774	0.061	16.414	***
	YG4	1.028	0.780	0.062	16.539	***
	YG5	0.962	0.747	0.061	15.845	***
	YG6	0.962	0.750	0.061	15.900	***
Employee innovation behavior	Y1	1.000	0.692			
	Y2	1.104	0.796	0.067	16.527	***
	Y3	0.997	0.677	0.070	14.194	***
	Y4	1.213	0.847	0.069	17.497	***
	Y5	1.199	0.798	0.072	16.549	***
	Y6	1.368	0.915	0.073	18.681	***
Psychological empowerment	XL1	1.000	0.746			
	XL2	0.965	0.769	0.056	17.087	***
	XL3	0.969	0.667	0.066	14.657	***
	XL4	1.026	0.720	0.064	15.923	***
	XL5	1.032	0.843	0.055	18.872	***
	XL6	1.067	0.837	0.057	18.717	***
Active innovation motivation	ZD1	1.000	0.827			
	ZD2	1.015	0.723	0.058	17.629	***
	ZD3	1.034	0.763	0.055	18.959	***
	ZD4	1.060	0.801	0.052	20.244	***
	ZD5	1.006	0.751	0.054	18.547	***

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	ZD6	0.981	0.780	0.050	19.518	***

Note: *** p<0.001.

The results in Table 7 show that the combined reliability CR of each factor is greater than 0.7, indicating that all the measured items in each latent variable can consistently explain the latent variable. If AVE values are all greater than 0.5, it indicates that they have good convergent validity. In addition, it can be seen from Table 8 that the AVE square root value of any latent variable is greater than the correlation coefficient between this latent variable and other latent variables, indicating that the scale has good discriminative validity.

Table 7.
Results of AVE and CR indexes in the model.

Factor	Average variance extraction AVE value	CR
The perception of error management atmosphere	0.582	0.892
Employee career resilience	0.558	0.884
Psychological empowerment	0.587	0.894
Active innovation motivation	0.600	0.900
Employee innovation behavior	0.627	0.908

Table 8.
Pearson correlation and AVE square root values.

	Active innovation motivation	Psychological empowerment	Employee innovation behavior	Employee career resilience	The perception of error management atmosphere
Active innovation motivation	0.775				
Psychological empowerment	0.298	0.766			
Employee innovation behavior	0.297	0.48	0.792		
Employee career resilience	0.339	0.438	0.491	0.747	
The perception of error management atmosphere	0.218	0.454	0.509	0.457	0.763

4.4. Structural Equation Model

As can be seen from Figure 3 and Table 9, CMIN of the model is 754.543, DF is 427, and CMIN/DF is 1.767<3, which is ideal. RMSEA is 0.039<0.08, and GFI, CFI, NFI and IFI indexes are all greater than 0.9. In summary, all the indicators are in line with the standard, indicating that the model has a good fit.

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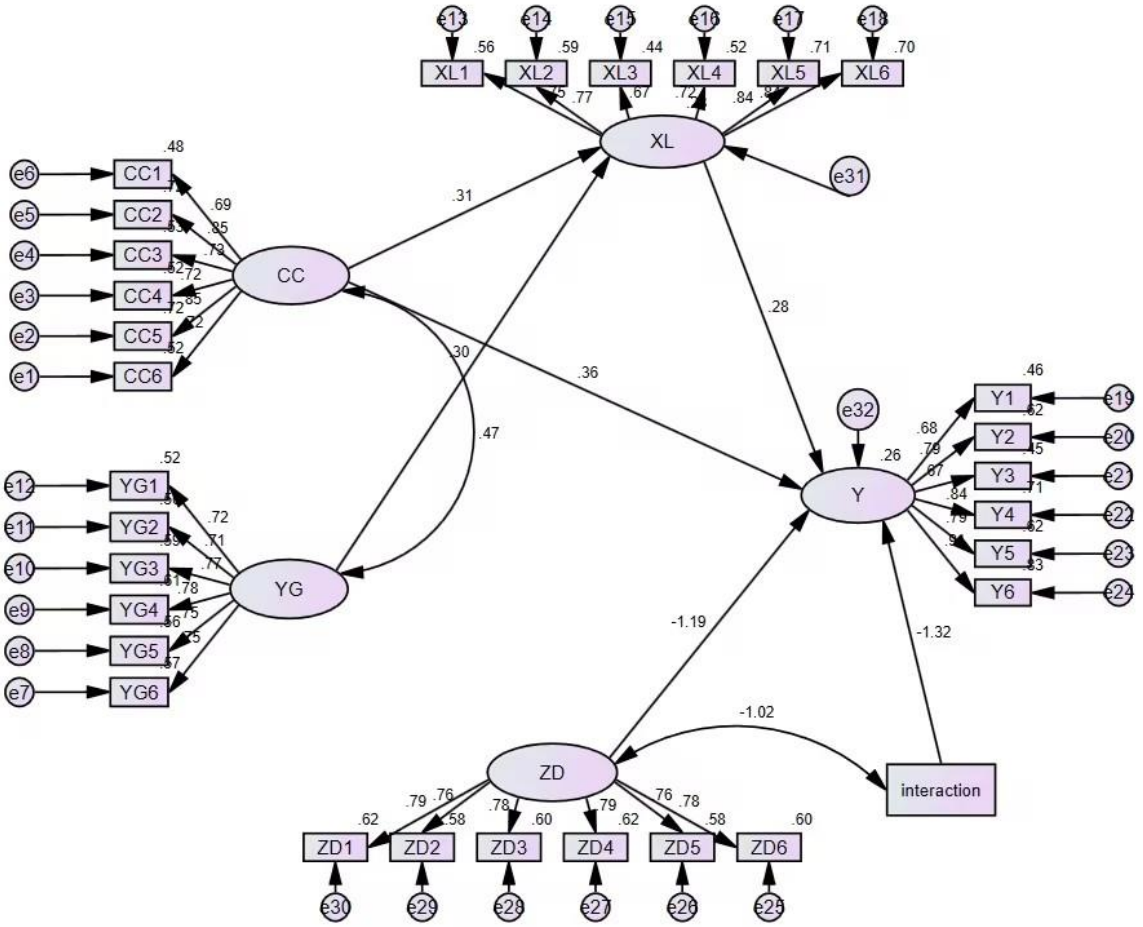

Figure 3.
Structural equation model diagram.

Table 9.
Model fitting index.

Index	CMIN	DF	CMIN/DF	GFI	RMSEA	CFI	NFI	IFI
Ideal value	-	-	<3	>0.9	<0.08	>0.9	>0.9	>0.9
Reach the standard value	-	-	<5	>0.8	<0.10	>0.8	>0.8	>0.8
Fitted value	754.543	427	1.767	0.912	0.039	0.967	0.927	0.967

As can be seen from Table 10, the standardized path coefficient of the perception of error management atmosphere to psychological empowerment is 0.300 (z=6.682, p=0.0<0.05), indicating that the perception of error management atmosphere has a significant positive impact on psychological empowerment, that is, the higher the perception of error management atmosphere, the higher the psychological empowerment. The standardized path coefficient of employee innovation behavior perceived by error management is 0.285 (z=7.040, p=0.0<0.05), indicating that the perception of error management atmosphere has a significant positive impact on employee innovation behavior, that is, the higher the perception of error management atmosphere, the higher employee innovation behavior. The standardized path coefficient from employee career resilience to psychological empowerment is 0.274 (z=6.003, p=0.0<0.05), indicating that employee career resilience has a significant positive effect on

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6: 134-151, 2024
DOI: 10.55214/25768484.v8i6.2030

psychological empowerment, that is, the higher the employee career resilience, the higher the psychological empowerment. The standardized path coefficient from employee career resilience to employee innovation behavior is 0.245 (z=6.203, p=0.0<0.05), indicating that employee career resilience has a significant positive impact on employee innovation behavior, that is, the higher the employee career resilience, the higher the employee innovation behavior. The standardized path coefficient from psychological empowerment to employee innovation behavior is 0.226 (z=5.578, p=0.0<0.05), indicating that psychological empowerment has a significant positive effect on employee innovation behavior, that is, the higher the psychological empowerment, the higher the innovation behavior.

Table 10.
Summary table of model coefficients.

Path	Standardized path coefficient	SE	z (C.R.)	p
The perception of error management atmosphere -> Psychological empowerment	0.300	0.044	6.682	***
The perception of error management atmosphere-> Employee innovation behavior	0.285	0.040	7.040	***
Employee career resilience -> Psychological empowerment	0.274	0.046	6.003	***
Employee career resilience -> Employee innovation behavior	0.245	0.039	6.203	***
Psychological empowerment -> Employee innovation behavior	0.226	0.041	5.578	***

4.5. Mediation Effect Analysis

In this paper, bootstrap method was adopted, and the sample size of bootstrap was set to 2000. At 95% confidence level, mediation effect test was performed. As can be seen from Table 11, the mediating effect is significant for the path: employee career resilience -> psychological empowerment -> employee innovation behavior, and the independent variable employee career resilience has a significant impact on the dependent variable employee innovation behavior, which is part of the mediating effect. For the path: the perception of error management atmosphere-> psychological empowerment -> employee innovation behavior, the mediating effect is significant, and the independent variable the perception of error management atmosphere has a significant impact on the dependent variable employee innovation behavior, which is part of the mediating effect.

Table 11.
Path verification.

Path	Direct effect	Indirect effect	Bias-corrected（95%）		p	Conclusion
			Lower bounds	Upper bounds		
The perception of error management atmosphere,	0.245 (***)	0.062	0.034	0.096	0.000	Partial mediation
The perception of error management atmosphere-> Psychological Empowerment -> Employee innovation behavior	0.285 (***)	0.067	0.040	0.100	0.000	Partial mediation

Note: *** p<0.001.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6: 134-151, 2024
DOI: 10.55214/25768484.v8i6.2030

4.6. Regulatory Effect Analysis

Table 12 examines the standardized path coefficient values of "psychological empowerment", "active innovation motivation" and "employee innovation behavior" respectively. Among them, the path coefficient of "psychological empowerment --> employee innovation behavior" is 0.192 (p=0.000). The path coefficient of "active innovation motivation --> employee innovation behavior" is 0.118 (p=0.006), and the path coefficient of "interaction item --> employee innovation behavior" is 0.103 (p=0.003). The path coefficient of interaction item is significant, indicating that the adjustment effect is valid. In summary, the hypothesis is that the moderating effect of active innovation motivation has a significant moderating effect on the influence path of psychological empowerment on employees' innovation behavior, which is supported by the sample data.

Table 12.
Test of adjustment effect.

	Non-Standardized path coefficient	Standardized path coefficient	SE	z (C.R.)	p
Psychological empowerment --> Employee Innovation behavior	0.194 (a)	0.192	0.043	4.553	0.000
Psychological empowerment --> Employee innovation behavior	0.115(b)	0.118	0.042	2.75	0.006
Interaction item --> Employee innovation behavior	0.104(c)	0.103	0.034	3.059	0.002

To sum up, all hypotheses have been tested by structured equation model. In this study, 5 direct effects, 2 intermediate effects and 1 moderating effect were proposed. Table 13 shows the hypothesis results:

Table 13.
Hypothesis results table.

	Hypothesis	Result
H1	The perception of error management atmosphere has a significant positive impact on psychological empowerment.	Support
H2	The perception of error management culture atmosphere has a significant positive impact on employee innovation behavior.	Support
H3	Employee career resilience has a significant positive impact on psychological empowerment.	Support
H4	Employee career resilience has a significant positive impact on employee innovation behavior.	Support
H5	Psychological empowerment has a significant positive impact on employee innovation behavior.	Support
H6	Psychological empowerment plays a mediating role between the perception of error management atmosphere and employee innovation behavior.	Support
H7	Psychological empowerment plays an intermediary role between employee career resilience and employee innovation behavior.	Support
H8	Active innovation motivation plays an enhanced moderating role between psychological empowerment and employee innovation behavior.	Support

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6: 134-151, 2024
DOI: 10.55214/25768484.v8i6.2030

5. Conclusion

This paper builds a comprehensive theoretical framework that integrates research findings from organizational culture, individual psychology, motivation, and behavior to deepen our understanding of how these factors work together to promote or inhibit employee innovation. This framework not only provides a solid theoretical foundation for future academic research, but also provides new research directions and ideas for researchers in related fields. At the same time, the research results of this paper have high application value to enterprise managers. It provides specific strategic advice on how to build a culture that encourages innovation and tolerates error. By enhancing employees' sense of psychological empowerment - meaning, self-efficacy, self-determination, and influence - companies can stimulate employees' intrinsic motivation and make them more actively engaged in innovative activities. By fostering professional resilience, a mental state of perseverance in the face of challenges and difficulties, companies can ensure that employees can recover quickly and move forward even if they fail in the innovation process. In addition, this paper also emphasizes the importance of motivating employees to take the initiative to innovate, pointing out that enterprises need to stimulate employees' innovation desire and motivation through reasonable incentive mechanism and working environment design.

Of course, this paper also has the following shortcomings: First, as a mediating variable, psychological empowerment may be affected by other unconsidered variables, which may lead to inaccurate estimation of the mediating effect. Secondly, as a moderating variable, the moderating effect of active innovation motivation may be different in different situations, and this situational dependence may not be fully explored in the research. Moreover, as a moderating variable, the moderating effect of active innovation motivation may be different in different situations, and this situational dependence may not be fully explored in the research. Therefore, in future studies, more accurate and refined measurement tools can be developed to improve the reliability and validity of data for variables with strong subjectivity such as psychological empowerment and active innovation motivation. We can further subdivide the mechanism of psychological empowerment and other mediating variables, and explore their specific manifestations and influence paths in different situations.

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Edelweiss Applied Science and Technology
ISSN: 2576-8484
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DOI: 10.55214/25768484.v8i6.2030