

The Impact of Boundary-Spanning Leadership on Employee Innovative Behavior—The Mediating Role of Job Crafting

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Abstract: *Based on social information processing theory, this study constructs a mechanism through which boundary-spanning leadership influences employee innovative behavior. By analyzing survey data from 382 corporate employees, the study found that: boundary-spanning leadership has a positive impact on employee innovative behavior and job crafting; job crafting plays a mediating role between boundary-spanning leadership and employee innovative behavior; climate for change moderates the relationship between boundary-spanning leadership and employee innovative behavior. The findings not only enrich theoretical research on boundary-spanning leadership but also provide practical pathways for promoting employee innovative behavior in organizational management.*

Keywords: Boundary-Spanning Leadership, Job Crafting, Innovative Behavior, Climate for Change.

1. INTRODUCTION

Employee innovative behavior is the foundation of organizational innovation and a key link for sustainable development and maintaining competitive advantage of enterprises in the digital era. In the workplace, employee innovative behavior is influenced by multiple factors. Leadership-related factors have always been a focus in the field of organizational management. Scholars have revealed the impact of different leadership behaviors, styles, and types on employee innovation behavior based on various theories. Boundary-spanning leadership, as a new type of leadership emerging in the internet age, has not yet received widespread attention and research regarding its impact mechanism on employee innovative behavior. Can boundary-spanning leadership directly or indirectly influence employee innovative behavior within organizations? Through what intrinsic mechanisms and boundary conditions does boundary-spanning leadership affect employee innovative behavior? These questions remain to be explored.

In the digital economy era, traditional top-down job design and task assignment struggle to motivate employees to participate in corporate digital transformation and respond to external environmental challenges. Adapting to the changes of the times requires not only digital transformation at the enterprise level but also job crafting at the employee level. Job crafting refers to the physical and cognitive changes that individuals make within the boundaries of work tasks or work relationships [1]. It is an important way for employees to adapt to the social environment. This study introduces the variable of employee job crafting to explore its mediating role between boundary-spanning leadership and innovative behavior, analyzing the intrinsic mechanism through which employee innovative behavior is influenced by boundary-spanning leadership.

Social information processing theory suggests that employees' work attitudes and behaviors are influenced not only by internal factors but also significantly by their surrounding environment. Organizational climate, as a collection of environmental circumstances perceived by employees, may moderate the relationship between boundary-spanning leadership and employee innovative behavior. Some scholars have studied the impact mechanisms of different types of organizational climate (e.g., innovation climate [2], affective climate [3], differential atmosphere, and justice climate [4]) on employee innovative behavior [5]. However, fewer studies have focused on how climate for change within organizations affects employee innovative behavior. Therefore, from the perspective of social information processing theory, this study treats climate for change as a moderating variable in the theoretical model, collects enterprise sample data, and empirically investigates the theoretical mechanism through which boundary-spanning leadership influences employee innovative behavior.

2. RESEARCH HYPOTHESES AND MODEL CONSTRUCTION

2.1 Boundary-Spanning Leadership and Innovative Behavior

The definition of employee innovative behavior is relatively rich. From a personal trait perspective, it is considered the willingness of employees to change their status quo [6]. From a process perspective, it is seen as employees seeking solutions to problems and building alliances with innovation supporters, involving a multi-stage, discontinuous process [7]. Other scholars, from a comprehensive perspective, define employee innovative behavior as the generation of novel and useful ideas within the organizational context that help improve products, services, processes, and methods. The causes of employee innovative behavior are numerous [8]. Among them, leadership style or behavior, as a key factor influencing employee work attitudes and behaviors, has always been a popular topic in the analysis of causes for innovative behavior. Leadership styles such as transformational leadership, distributed leadership, servant leadership, inclusive leadership, self-sacrificial leadership, authentic leadership, coaching leadership, paradoxical leadership, and affective leadership have been confirmed to positively promote employee innovative behavior; whereas insincere leadership, despotic leadership, exploitative leadership, avoiding leadership, laissez-faire leadership, and abusive leadership have been shown to potentially negatively impact employee innovative behavior [9] [10].

"Boundary-spanning leadership" refers to "the ability to establish direction, alignment, and commitment across boundaries to achieve a higher vision, mission, or goal" [11]. Currently, there is no complete consensus in academia on the definition of boundary-spanning leadership. Yu Hongsheng (2014) views Boundary-spanning leadership as a leadership activity where leaders operate across two or more domains or sectors simultaneously. Liu Qi (2014) believes that boundary-spanning leadership refers to the process in which leaders cross the sectoral limitations of different fields and build an overall collaborative cross-border governance mechanism through communication, consultation, recognition, consensus-building, and win-win collaboration. Xi Jieren (2014) considers boundary-spanning leadership a comprehensive competency, encompassing foresight, conversion, communication, integration, coordination, innovation, strategic leadership, and improving situational IQ, but not simply equivalent to or a combination of these qualities. Overall, the process-oriented definition by Ernst et al. (2009) has been widely cited by scholars, leading to a series of studies [12] [13] [14]. Research confirms that boundary-spanning leadership positively influences proactive work behavior [15], creativity, contextual performance [16], job performance [17], task performance [18], job crafting [19], etc., within organizations. Based on this, since employee innovative behavior is a proactive and positive behavior, boundary-spanning leadership can provide a favorable environment for employee innovation. This study proposes hypothesis H1.

H1: Boundary-spanning leadership positively promotes employee innovative behavior.

2.2 The Mediating Role of Job Crafting

Job crafting refers to "the physical and cognitive changes individuals make in the task or relational boundaries of their work" [20], emphasizing employees' proactive, bottom-up adjustment of work content and methods [21]. Wrzesniewski and Dutton (2001) proposed that job crafting includes three dimensions: task crafting, relational crafting, and cognitive crafting. Scholars from a resource perspective view job crafting as an activity to balance job resources and job demands [22]. Tims et al. (2012), based on the JD-R model, divided job crafting into increasing structural job resources, increasing social job resources, increasing challenging job demands, and reducing hindering job demands [23]. The first three dimensions are often grouped as promotion-focused Job Crafting, while reducing hindering job demands is seen as prevention-focused Job Crafting. Promotion-focused Job Crafting primarily reflects withdrawal behavior and has been shown to potentially reduce work engagement and increase turnover risk by decreasing hindering demands and lowering work goals [24]. In contrast, promotion-focused Job Crafting mainly reflects employees' proactive and expansive behaviors and has been primarily associated with positive outcomes for organizations [25]. Boundary-spanning leadership has been confirmed to be related to employee proactive behaviors [26].

This study focuses on the impact of boundary-spanning leadership on promotion-focused Job Crafting. Boundary-spanning leadership means helping organizations cope with the challenges posed by uncertain environments by crossing boundaries, increasing interaction with the external environment, and establishing more connections with the outside world through representative behaviors such as buffering and reflection, connection and mobilization, weaving and transformation [27]. In the workplace, leadership style can convey certain social information to employees. Based on social information processing theory, social information plays a significant indicative and guiding role for employee work attitudes or behaviors. Boundary-spanning leadership is a type of leadership that helps organizations achieve sustainable development and realize higher visions and goals. By conveying messages of openness, support, and inclusion to employees, it provides support for employees' promotion-focused job crafting. Based on this, this study proposes hypothesis H2.

H2: Boundary-spanning leadership positively promotes employee promotion-focused Job Crafting.

Job crafting affects employees' psychological resources, work attitudes, work behaviors, and work outcomes. The specific impacts include both positive and negative results. In terms of positive work behaviors, job crafting can enhance individual creativity, organizational citizenship behavior, work-family balance, and job performance [28]; negative outcomes include reduced work engagement and turnover. Furthermore, scholars have confirmed that job crafting can promote innovative behavior among different groups (e.g., new generation employees [29], teachers [30], knowledge workers [31]). Therefore, job crafting positively promotes employee innovative behavior. Based on the above analysis, this study further proposes the following hypothesis.

H3: Job crafting mediates the relationship between boundary-spanning leadership and employee innovative behavior.

2.3 The Moderating Role of Climate for Change

Organizational climate reflects the characteristics of the internal environment perceived by employees within the organization or team, serving as an organizational context that can directly influence employee behavior. Different types of climate reflect specific value orientations of the organization or team. Climate for change refers to the organizational situation perceived by employees as conducive to the implementation of change, reflecting a strong change orientation within the organization [32]. Research has found that climate for change can positively influence work outcomes, employee creativity, commitment to change, and job crafting [33] [34], but fewer studies have focused on its impact on employee innovative behavior.

Generally, different organizational climates create specific organizational contexts for employees, which can have a stronger influence on related behaviors. Change implies breaking the balance. The climate for change perceived by employees brings about organizational change while also introducing uncertainty and instability for employees. Social information processing theory indicates that when the social environment is more uncertain, employees rely more on obtaining social information related to work attitudes and behaviors from that environment. While climate for change brings uncertainty and pressure to employees, it also makes the influence of boundary-spanning leadership on employee innovative behavior more potent. Therefore, climate for change moderates the relationship between boundary-spanning leadership and employee innovative behavior. The stronger the perceived climate for change, the more significant the positive impact of boundary-spanning leadership on employee innovative behavior. This paper proposes hypothesis H4.

H4: Climate for change positively moderates the relationship between boundary-spanning leadership and employee innovative behavior.

In summary, this paper constructs the theoretical research model, as shown in Figure 1 below.

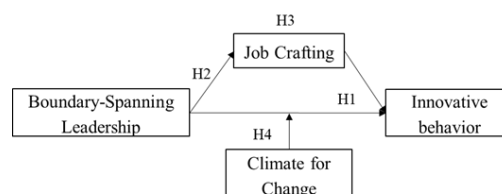


Figure 1: Theoretical Research Model

3. RESEARCH DESIGN

3.1 Data Source and Sample Characteristics

This study collected sample data through online and offline channels. The project team distributed 300 questionnaires to relevant enterprises and organizations in the southwest region. Simultaneously, the sample size was expanded using the help of friends and family, collecting questionnaires through a "snowball" method. After excluding invalid questionnaires that were illogical, a total of 382 valid samples were obtained.

The basic characteristics of the research sample are as follows: Regarding gender, males accounted for 55.8% and females for 44.2%; Regarding age, those aged 25 and below, 26-30, 31-35, 36-40, 41-45, and 46 and above

accounted for 7.9%, 20.4%, 31.4%, 20.4%, 8.9%, and 11% respectively; Regarding education, those with associate degree or below, bachelor's degree, and master's degree or above accounted for 44.5%, 50.3%, and 5.2% respectively; Regarding organization type, state-owned enterprises, private enterprises, joint ventures, government agencies, public institutions, and others accounted for 11.8%, 40.6%, 0.8%, 6.3%, 32.2%, and 8.4% respectively; Regarding hierarchical position, senior management, middle management, junior management, and general staff accounted for 2.9%, 13.6%, 22.8%, and 60.7% respectively; Regarding work tenure, 1 year and below, 1-3 years, 4-6 years, 7-9 years, and 10 years and above accounted for 14.1%, 18.7%, 20.8%, 16.3%, and 30% respectively; Regarding monthly income level, 4000 yuan and below, 4001-8000 yuan, 8001-12000 yuan, and 12000 yuan and above accounted for 29.1%, 50.8%, 14.4%, and 5.8% respectively. Overall, the survey sample is generally logical and realistic.

3.2 Variable Measurement Tools

The scales used in this study are all mature scales from domestic and international sources. For scales that have been validated locally in China, the Chinese version was used directly; for scales not yet locally validated, they were processed according to Brislin's (1986) "translation-back translation" procedure. Except for basic personal information, all variables in the questionnaire were measured using a 5-point Likert scale, where 1 means "strongly disagree" and 5 means "strongly agree".

Independent Variable: Boundary-Spanning Leadership. Adapted and revised from scales used by Ernst et al. (2011), Meerkerk et al. (2018), and Igalla et al. (2020) to measure employee-perceived boundary-spanning leadership. Items include " [Management] works closely with others (outside the organization) to achieve results", " [Management] spends a lot of time maintaining contact with parties outside the organization", etc., totaling 5 items. The Cronbach's α reliability coefficient for this scale was 0.921.

Dependent Variable: Innovative Behavior. Employed the mature employee innovative behavior scale revised by Zhang Zhengang et al. (2016), Zhou (2003), and Kleysen et al. (2001) based on actual situations. Measured primarily through employee self-assessment. Items include: "I often seek opportunities to improve work methods and processes", "I often try new methods to solve problems at work", etc., totaling 8 items. The Cronbach's α reliability coefficient for this scale was 0.917.

Mediating Variable: Job Crafting. Used the promotion-focused job crafting scale developed by domestic scholars Hu Qiaoting et al. (2020) based on the work of Petrou et al. (2012). Items include "I actively seek advice from supervisors or colleagues", "I try my best to learn new things at work", "If I finish my work, I actively request more tasks", etc., totaling 8 items. The Cronbach's α reliability coefficient for this scale was 0.903.

Moderating Variable: Climate for Change. Adapted the two-dimensional scale developed by Poel et al. (2012) to measure the climate for change perceived by employees in the organization. Items include "Members of my organization are always looking for new ways to view problems", "This organization I am in can respond quickly when change is needed", etc., totaling 4 items. The Cronbach's α reliability coefficient for this scale was 0.906.

Referring to existing research, this study controlled for basic employee demographics such as gender, age, education level, organization type, department type, hierarchical position, work tenure, and income. Differences in organization type and hierarchical position might affect employees' perceived boundary-spanning leadership and climate for change, hence these variables were controlled during data analysis.

3.3 Statistical Methods and Analysis Approach

The study primarily used SPSS 26.0 for statistical data analysis. The specific statistical analysis process was as follows: SPSS 26.0 was used for descriptive statistical analysis, reliability analysis, correlation analysis, and multiple regression analysis to test the research hypotheses. When verifying the research hypotheses, the PROCESS macro program developed by Hayes was also used for secondary verification of the mediating effect.

4. DATA ANALYSIS AND RESULTS

4.1 Reliability and Validity Tests

The results for the mean, standard deviation, CR, AVE, and \sqrt{AVE} of the research variables are shown in Table 1.

The Cronbach's α and composite reliability (CR) for each variable are shown in Table 1. According to Fornell's (1981) statistical criteria, both values were above 0.8 and 0.7 respectively, indicating high reliability of the measurement scales for each variable and good consistency among the measurement items [35]. Furthermore, the average variance extracted (AVE) for all research variables was greater than 0.5, indicating good convergent validity of the scales. Table 1 also shows the test results for the uniqueness, distinctiveness, and inter-correlations of the items. The square root of the AVE ($\sqrt{\text{AVE}}$, data in parentheses in Table 1) for each variable was significantly greater than the absolute value of the correlation coefficients, indicating good discriminant validity of the scales.

Table 1: Reliability, Validity Tests, and Correlation Analysis Results

Variable	Cronbach's α	M	SD	CR	AVE	1	2	3	4
1.BSL	0.921	3.484	0.730	0.945	0.775	(0.880)			
2.JC	0.903	3.994	0.559	0.926	0.612	0.542***	(0.782)		
3.IB	0.917	3.903	0.605	0.936	0.646	0.526***	0.733***	(0.804)	
4.CFO	0.906	3.787	0.847	0.934	0.781	0.460***	0.468***	0.379***	(0.884)

Note: Sample $N=382$; Figures in parentheses are the square root of AVE($\sqrt{\text{AVE}}$); * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed test). Same below. BSL = Boundary-Spanning Leadership; JC= Job Crafting; IB= Innovative Behavior; CFC= Climate for Change.

4.2 Correlation Analysis

The correlation coefficients between the research variables are shown in Table 1. Boundary-spanning leadership was significantly positively correlated with job crafting ($r = 0.542$, $p < 0.001$); boundary-spanning leadership was significantly positively correlated with innovative behavior ($r = 0.526$, $p < 0.001$); boundary-spanning leadership was significantly positively correlated with climate for change ($r = 0.460$, $p < 0.001$); job crafting was significantly positively correlated with innovative behavior ($r = 0.733$, $p < 0.001$) and with climate for change ($r = 0.468$, $p < 0.001$); climate for change was significantly positively correlated with innovative behavior ($r = 0.379$, $p < 0.001$). Overall, the correlation analysis results preliminarily verified the study's hypotheses and provided a basis for subsequent regression analysis.

4.3 Regression Analysis

SPSS 26.0 was used for regression analysis on the sample data. The data analysis results are shown in Table 2. After controlling for demographic variables such as gender, age, education level, organization type, department type, hierarchical position, work tenure, and monthly income level, this study conducted regression analysis with employee innovative behavior as the dependent variable, boundary-spanning leadership as the independent variable, job crafting as the mediating variable, and climate for change as the moderating variable to verify the direct, mediating, and moderating effects proposed in the initial model.

4.3.1 Direct Effect

Based on the data analysis results from Model 1 and Model 2 in Table 2, boundary-spanning leadership has a significant positive impact on employee innovative behavior ($b = 0.431$, $p < 0.001$). Thus, the main effect of the research hypothesis model is significant, and research hypothesis H1 is supported.

Table 2: Regression Analysis Results

Variable	Direct Effect		Mediating Effect				Moderating Effect
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	IB	IB	JC	JC	IB	IB	IB
Intercept	4.383	2.654	4.569	4.403	0.268	0.188	0.4282
Gender	-0.125	-0.044	-0.153*	-0.076	0.013	0.020	0.0222
Age	-0.029	-0.014	-0.035	-0.021	0.002	0.003	0.0048
Education level	-0.075	-0.027	-0.096	-0.057	0.011	0.015	0.0134
Organization type	-0.002	0.004	0.004	0.007	-0.005	-0.004	-0.0003
Position level	-0.074	-0.040	-0.074	-0.038	-0.007	-0.004	-0.0088
Working years	0.003	0.005	0.000	0.001	0.003	0.003	0.0033
Income	-0.024	-0.044	-0.003	-0.023	-0.021	-0.025	-0.0250
BSL		0.431***		0.404***		0.088***	0.1005***
JC					0.901***	0.841***	
BSL \times CFC							0.0416*
R ²	0.035	0.288	0.041	0.3036	0.700	0.707	0.711
F	1.511	15.043***	1.768	8.000***	86.442***	81.268***	11.000***

Note: Sample N=382; Organized based on data analysis results. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. BSL = Boundary-Spanning Leadership; JC= Job Crafting; IB= Innovative Behavior; CFC= Climate for Change.

4.3.2 Mediating Effect

Research hypothesis H2 proposes that boundary-spanning leadership positively influences employee job crafting. Continuing to control for the model's control variables, boundary-spanning leadership was entered as the independent variable and job crafting as the dependent variable into the equation. According to the data analysis results from Model 3 and Model 4 in Table 2, the positive impact of boundary-spanning leadership on job crafting is significant ($b = 0.404$, $p < 0.001$). This indicates that hypothesis H2 of this study is verified.

Hypothesis H3 proposes that job crafting mediates the relationship between boundary-spanning leadership and innovative behavior. Controlling for the control variables in the hypothesis model, boundary-spanning leadership was entered as the independent variable, job crafting as the mediating variable, and employee innovative behavior as the dependent variable into the equation. Regression analysis was performed using the PROCESS plugin in SPSS. The data analysis results from Model 5 in Table 2 show that the positive impact of job crafting on employee innovative behavior is significant ($b = 0.901$, $p < 0.001$). The results from Model 6 show that after adding the job crafting variable, the positive impact of boundary-spanning leadership on employee innovative behavior remains significant ($b = 0.088$, $p < 0.001$), and the positive impact of job crafting on employee innovative behavior is also significant ($b = 0.841$, $p < 0.001$). Thus, hypothesis H3 is verified, preliminarily confirming the mediating effect of job crafting. This indicates that job crafting plays a partial mediation effect between boundary-spanning leadership and employee innovative behavior.

Furthermore, this study used the PROCESS macro program developed by Hayes for secondary verification of the mediating effect. Setting a 95% confidence interval, the Bootstrap method was used with 5000 repeated samples. The data results, as shown in Table 3, indicate that the indirect effect of boundary-spanning leadership on employee innovative behavior through job crafting is significant ($b = 0.3394$), with a 95% confidence interval CI of [0.2602, 0.4260], which does not include zero. Therefore, hypothesis H3 of this study is verified again, confirming the mediating effect of job crafting.

Table 3: Mediating Effect Test Results

Paths	Effect	SE	LLCI	ULCI
Total Effect: BSL - IB	0.4297***	0.0369	0.3571	0.5023
Direct Effect: BSL - IB	0.0903***	0.0279	0.0355	0.1451
Indirect Effect: BSL - JC - IB	0.3394***	0.0428	0.2602	0.4260

Note: Sample N=382; Organized based on data analysis results. BSL = Boundary-Spanning Leadership; JC= Job Crafting; IB= Innovative Behavior; CFC= Climate for Change.

4.3.3 Moderating Effect

Research hypothesis H4 proposes that climate for change positively moderates the relationship between boundary-spanning leadership and employee innovative behavior. The data analysis results from Model 7 in Table 2 show that the interaction term between boundary-spanning leadership and climate for change has a significant positive impact on innovative behavior ($b = 0.0416$, $p < 0.05$). This preliminarily verifies the positive moderating role of climate for change proposed in hypothesis H4.

Furthermore, a simple slope test was conducted. The moderating effect of climate for change between the two variables is shown in Figure 2. When climate for change is high (mean plus one standard deviation), the relationship between boundary-spanning leadership and employee innovative behavior is positively significant (Simple Slope = 0.142, $p < 0.001$); when climate for change is low (mean minus one standard deviation), the relationship between boundary-spanning leadership and employee innovative behavior is also positively significant (Simple Slope = 0.101, $p < 0.001$). However, as the level of climate for change decreases from high to low, the effect of boundary-spanning leadership on innovative behavior is weakened. Thus, the moderating effect of climate for change is established, and hypothesis H4 is verified.

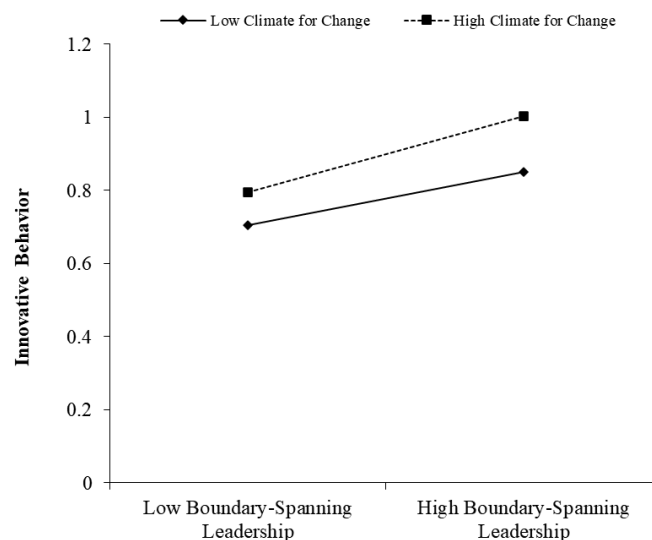


Figure 2: Moderating Effect of Climate for Change between Boundary-Spanning Leadership and Innovative Behavior

5. CONCLUSION AND DISCUSSION

The study constructed and verified the mechanism through which boundary-spanning leadership influences employee innovative behavior, including the mediating role of job crafting and the moderating role of climate for change in the theoretical model. The main conclusions are as follows. (1) Boundary-spanning leadership has a positive impact on employee innovative behavior. (2) Job crafting mediates the relationship between boundary-spanning leadership and employee innovative behavior. (3) Climate for change positively moderates the relationship between boundary-spanning leadership and employee innovative behavior. The research content focuses on discussing the impact and internal mechanism of the social environment on employee behavior. From the perspective of social information processing theory, it unveils the "black box" between boundary-spanning leadership and employee innovative behavior, explaining "why" climate for change can positively moderate the impact of boundary-spanning leadership on employee innovative behavior.

The research conclusions offer several implications for organizational management practice. First, boundary-spanning leadership is crucial for enhancing employee innovative behavior. Organizations need to consciously select leaders with boundary-spanning leadership capabilities or enhance leaders' boundary-spanning leadership through training, creating favorable conditions for its effective exercise in organizational management processes. Second, in employee management processes, emphasize the transmitting role of job crafting between boundary-spanning leadership and employee innovative behavior. Managers need to recognize that the social environment can not only directly affect employee work performance but may also influence explicit work performance by altering employees' work attitudes or methods. In management practice, the positive impact of employee job crafting should not be overlooked. Taking measures to create favorable conditions for employee job crafting can also enhance employee innovative behavior. Third, leaders need to focus on fostering an organizational climate for change. In the workplace, the interaction between climate for change and boundary-spanning leadership can maximally stimulate employee innovation. Climate for change can convey a value orientation of "breaking the old and establishing the new" to employees, providing both motivation and pressure for change, while also enhancing the stimulating effect of boundary-spanning leadership on employee innovative behavior.

This study has some limitations. (1) It only focused on the impact of the social environment on behavior. The study explored the mechanism of boundary-spanning leadership on employee innovative behavior solely from the perspective of social information processing theory. The process through which boundary-spanning leadership affects employee innovative behavior might also be influenced by internal employee factors. Future research could expand the study based on different theoretical perspectives. (2) Limited sample data. Employees in different industries or occupations may have different workplace requirements and performances. For example, knowledge workers and employees engaged in R&D work have a greater need for innovation in the workplace. Limited by reality, this study did not target employees in specific industries or occupational types. Future research could continue to explore situations in different industries or among different types of employees. (3) Limitations of the

research method. This study only used quantitative research methods and cross-sectional data to test the theoretical model, which might limit the explanatory power of the model. Future research could integrate multiple research methods and use longitudinal data to further validate the theoretical model.

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