

Research Article

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The Impact of Innovation Intention on Innovation Behavior of University Personnel: Mediating Effect of Challenging Pressure

Xinjian Zhang, Khunanan Sukpasjaroen, Aroonroj Boonkrong, Rerkchai Fooprateepsiri

Abstract

Background/purpose. The innovation behavior of university personnel has garnered much attention, with innovation intention being a crucial factor in this process. This study aimed to investigate the impact of university personnel's innovation intention on their innovation behaviors, focusing on the mediating effect of challenging pressure in the relationship between innovation intention and innovation behavior.

Materials/methods. This research utilized a quantitative methodology, gathering data from personnel at 38 universities in Guangdong Province, China, through a structured questionnaire survey. Statistical analysis and structural equation modeling were employed to investigate the influence of innovation intention on innovation behavior.

Results. The findings indicated a favorable correlation among the three characteristics of innovation intention: behavioral attitude, perceived organizational support, and innovation self-efficacy. Behavioral attitude, and innovation self-efficacy positively influenced innovation behavior; however, perceived organizational support exerted no significant effect on innovation behavior. Challenging pressure moderated the connection between innovation intention and innovation behavior.

Conclusion. This study provides novel insights into the mechanisms that drive innovative behavior among university personnel, a previously underexplored domain. The findings highlight the importance of individual, organizational, and environmental factors in influencing employee innovation behavior, offering important guidance for university personnel's innovation behavior and university development, and providing valuable insights for other organizational and employee management practices.

1. Introduction

Innovation is recognized as a vital component in economic and social advancement, with extensive research focusing on innovation at both the macro-industry and meso-firm levels (Yang et al., 2022; Yin & Tian, 2021). Regrettably, investigations into employee innovation behavior at the micro level are still rather scarce. The processes governing the interplay among elements that promote employee innovation behavior remain inadequately investigated (Anderson et al., 2014; Zhou & Hoefer, 2014).

In recent years, the international innovation accomplishments of Chinese universities have surged dramatically, progressively transitioning their status in the global innovation arena from "following" to "competing," and even attaining "leading" positions in certain domains. This advancement is chiefly evidenced by the production of high-caliber scientific research articles, the filing of international patents, and substantial original contributions in pioneering scientific domains such as artificial intelligence, aerospace, and renewable energy. The innovation behavior of university personnel and the determinants affecting this conduct are garnering heightened interest (Ozdemir & Cakalci, 2022).

The Theory of Planned Behavior model (Ajzen, 1991) posits that the primary determinants of behavior are behavioral intention and perceived behavioral control. Behavioral intention is directly influenced by three factors: behavioral attitude, subjective norm, and perceived behavioral control. This model aims to elucidate how these three factors influence behavior through behavioral intention.

Nonetheless, prior research regarding the influence of behavioral intention on behavior is contentious: certain studies indicate a positive correlation between behavioral intention and employee behavior (Saifulina et al., 2023), whereas others suggest that the relationship is relatively weak (Wu & Sun, 2006). According to Rhodes and de Bruijn (2013), behavioral intention should not be conflated with actual behavior. Individuals are influenced by various factors when engaging in a particular behavior. Many persons may possess a distinct intention, yet not exhibit corresponding behavior. Consequently, scientists assert that the predictive power of intention on behavior can be enhanced through two approaches: incorporating more factors and synthesizing diverse models.

Simultaneously, the digital revolution is permeating Chinese universities. Faced with the challenges of this transformation, university personnel must aggressively investigate and utilize these opportunities, consistently broaden their perspectives, and creatively work and solve problems. This is the sole method for universities to prosper in a swiftly evolving society and attain an enhanced competitive edge (Li et al., 2020). Digital change presents challenges for university personnel, while simultaneously offering opportunities. This has emerged as a significant advancement in educational reform methodologies, especially in pedagogical innovation (Zhu & Hu, 2022).

Nevertheless, researchers have predominantly examined the detrimental facets of pressure, infrequently its beneficial sides. Pressure originates from the interactive link between persons and their surroundings, with the nature of pressure influenced by individuals' cognitive evaluations of the environment (Lazarus & Folkman, 1984). Positive pressure typically yields beneficial outcomes by fully engaging employees' initiative, optimizing their performance, and allowing them to get double the results with half the effort (Yan, 2019). Digital transformation in higher education not only facilitates the acquisition of employee resources and information exchange but also enhances skills and abilities, deepening the understanding of capabilities and thereby amplifying innovation intentions, as well as increasing initiative and enthusiasm in innovative activities (Ye et al., 2022). In this context, challenging pressure is characterized as work-related pressure stemming from digital transformation that elicits good emotions, amplifies feelings of achievement, and heightens the inclination for

challenges, ultimately leading to beneficial outcomes for employees. This illustrates individuals' perceptions and reactions to pressure.

This study aims to elucidate the influence of innovation intention on innovation behavior by delineating three primary components of innovation intention. It categorizes various influencing factors, including individual factors (Xu & Li, 2024) and organizational factors (Wang, 2020), related to employee innovation behavior. Additionally, it incorporates mediating variables to propose an enhanced innovation behavior model for university personnel, building upon the original planned behavior model.

This study seeks to examine the mechanisms driving innovation behavior among university personnel, emphasizing the mediating effect of challenging pressure. This study examines deficiencies in current research by addressing the following inquiry: What is the correlation among the three characteristics of innovation intention? What is the correlation between the three characteristics of innovation intention and innovation behavior? Does challenging pressure act as a mediator between innovation intention and innovation behavior?

These works theoretically analyze and empirically examine the various aspects that affect employee behavior through the lens of the theory of planned behavior, thereby providing a more comprehensive theoretical framework for understanding the mechanisms that influence employee behavior and broadening its applicability. This elucidates the mechanisms that affect employee innovation in specific situations and may offer targeted policy initiatives for firms to enhance employee innovation.

2. Literature Review

2.1. Innovation Intention

The connotation of innovation intention can be categorized into two primary levels. The initial level emphasizes psychological perception. Zaltman et al. (1973) describe innovation intention as the psychological acceptance of novel methods, concepts, and innovation behaviors. Xing and Wang (2015) examined the influence of innovation intention on the innovation performance of incubated enterprises, asserting that innovation intention represents a psychological state or subjective inclination in which organizational members are prepared to dedicate time and effort to achieve innovative behavior. She asserted that innovation intention includes self-efficacy for creativity, perceived organizational support, a collective vision, and open-mindedness. The second level, grounded in the theory of planned behavior (Ajzen, 1991), posits that behavior intention is influenced by an individual's internal factors (e.g., attitudes), external factors (e.g., norms and opportunities), and perceived behavioral control. The significance of each element in forecasting intention is contingent upon the behavior type and the contextual framework. Choi (2004) defines innovation intention as the motivation and intensity of an individual's desire to innovate in a certain situation. It specifically denotes the readiness to attempt and the degree of effort necessary to accomplish a particular endeavor.

This study defines innovation intention as the attitudes, beliefs, and subjective feelings of employees about the execution of creative actions. It indicates the motivation and intensity of employees to engage in innovative behaviors in a certain context, as well as the extent to which individuals exert effort to attain their objectives. Innovation intention encompasses three components: behavioral attitude, innovation self-efficacy, and perceived organizational support (Ajzen, 1991; Xing & Wang, 2015).

2.1.1. Behavioral Attitude and Innovation Self-Efficacy

Behavior attitudes represent cognitive and emotional reactions to innovation, whereas self-efficacy elucidates human motivation, learning, self-regulation, and achievement (Schunk et al., 2005). Positive behavioral attitudes can augment individuals' confidence and motivation, rendering them more inclined to embrace new experiences and confront problems. Positive behavior attitudes facilitate the acquisition of new talents and enhance the demonstration of existing ones. Self-efficacy is intricately linked to "cognitive outcomes" and functions with outcome expectancies within the action process framework (Schwarzer & Luszczynska, 2006).

The Theory of Planned Behavior posits that the antecedent determinants of attitude encompass ideas regarding outcomes and assessments of those outcomes (Ajzen, 1985, 1991). Innovation self-efficacy denotes beliefs on outcomes and signifies an employee's confidence in their capacity to achieve innovation. Employees with elevated innovation self-efficacy are confident in their ability to overcome environmental problems, exhibit substantial confidence in their skills and perspectives, maintain favorable attitudes towards their actions, and anticipate beneficial outcomes (Liu et al., 2018). Gigante and Gilmore (2020) identified a substantial positive association between efficacy and attitude.

Consequently, this study posits the subsequent hypothesis:

H1: The interaction between behavioral attitude and innovation self-efficacy is substantial.

2.1.2. Behavioral Attitude and Perceived Organizational Support

Behavior attitudes include both cognitive and emotional components. The former concentrates on converting fragmented knowledge into conclusive knowledge via processing (Chen, 2006), whilst the latter underscores the significance of the actor's perception and judgment in the information processing procedure (Shi, 2008). Positive behavior attitudes can enhance employee motivation and creativity, facilitate cooperation and collaboration, augment mutual trust and cohesion among members, and cultivate an environment of support and encouragement. An individual's proactive attitude increases the likelihood of influencing and altering the cognition and attitudes of others, thus securing their acknowledgment and support.

Behavior attitudes are shaped by both individual cognition and the surrounding work and residential contexts. In the face of difficulties and challenges, individuals who initially exhibited negative attitudes, such as avoidance and resignation, can become proactive through support from their organizations and immediate social circles, including material resources, guidance, assistance, and examples from colleagues and friends. Research (Han, 2013; Liu, 2012) indicates that robust perceived organizational support cultivates favorable employee attitudes, and when their efforts are acknowledged and commended by the business, it engenders a sense of ownership, accountability, and belonging.

Consequently, this study posits the subsequent hypothesis:

H2: The interaction between behavioral attitude and perceived organizational support is substantial.

2.1.3. Perceived Organizational Support and Innovation Self-Efficacy

Social Learning Theory posits that self-efficacy is shaped by experience, emotions, and the social environment (Bandura, 1986). Individuals will modify their conduct in accordance with the organization's dedication to their professional and personal lives. Increased perceived organizational support correlates with enhanced employee confidence in job completion and a heightened sense of self-efficacy. Bakker and Demerouti (2007) conducted a follow-up survey of employees across diverse

industries and discovered that working environment, leader interactions, and corporate culture can substantially improve employee self-efficacy.

Bandura's (1986) Social Cognitive Theory and Hobfoll's (1989) Conservation of Resources Theory suggest that cultivating psychosocial resources, such as self-efficacy, establishes a reserve of resources that shapes employees' perceptions and interpretations of their work, thereby aiding them in managing various role demands. Hobfoll and Lilly (1993) notably observed that employees with elevated self-efficacy demonstrate increased devotion and, via this endeavor, seek to get diverse work resources and improve job performance. Increased self-efficacy is associated with a greater inclination to select conducive conditions for achieving personal work objectives and a heightened responsiveness to external influences that enhance job performance (VanderZee et al., 1997).

Consequently, this study posits the subsequent hypothesis:

H3: The interaction between innovation self-efficacy and perceived organizational support is substantial.

2.2. Innovation Intention and Innovation Behavior

2.2.1. Behavioral Attitude and Innovation Behavior

Individuals' behavior attitudes include both internal and extrinsic dimensions (Phan et al., 2002). Individuals with a favorable inherent attitude towards innovation will emphasize their fundamental need for achievement, thereby enhancing their self-interest, achievement motivation, and internal spiritual impetus, which results in constructive innovative actions. When individuals possess a favorable extrinsic attitude towards innovation behavior, driven by the quest for material rewards and external recognition, they will exhibit positive innovation behavior. Studies indicate that the behavioral attitudes of tourist SME operators are crucial in fostering their innovation behavior (Lü et al., 2021) and that researchers' attitudes towards green innovation substantially affect their green innovation practices (Li et al., 2019).

Consequently, this study posits the subsequent hypotheses:

H4: Behavioral attitude significantly influences innovation behavior.

2.2.2. Perceived Organizational Support and Innovation Behavior

Social Exchange Theory posits that when employees recognize their organization's support and value, they develop a heightened sense of belonging and an inclination to reciprocate, thereby unlocking their job potential and fostering innovative behavior. Elevated perceptions of perceived organizational support signal to employees that their innovation behaviors are acknowledged, thereby motivating them to adopt a more proactive stance, which fosters independent innovation and facilitates organizational advancements (Fang et al., 2019). Specifically, when employees view their supervisors or leaders as validating or acknowledging their innovations, they are more inclined to exhibit innovative behavior (Pang & Lu, 2018; Yang & Yang, 2020).

Consequently, this study posits the subsequent hypotheses:

H5: Perceived organizational support significantly influences innovation behavior.

2.2.3. Innovation Self-efficacy and Innovation Behavior

Social Cognitive Theory posits that self-efficacy has a significant impact on individuals' motivation and behavior. Employees' self-efficacy is a crucial determinant of inventive awareness and innovative behavior, influencing their motivation and perseverance in innovation (Ford, 1996). Engaging in innovation activities carries inherent risks; therefore, personnel must possess substantial inner strength, rooted in their knowledge and abilities, to propose new ideas and adopt innovative

behaviors (Gong et al., 2009). Innovative self-efficacy can inspire employees to consistently produce and execute innovative ideas in their daily tasks (Anderson & West, 1998) and further empower them to proactively confront challenges and setbacks encountered during the innovation process, along with the uncertainty and risk associated with the outcomes of innovation behavior.

Consequently, this study posits the subsequent hypotheses:

H6: Innovation self-efficacy significantly influences innovation behavior.

2.3. Challenging Pressure

2.3.1. Behavioral Attitude and Challenging Pressure

Behavioral attitudes represent an individual's cognition and perception of innovation, a psychological inclination developed following a value evaluation (Zhao et al., 2013). Individuals develop value judgments regarding the influence of challenging pressure on innovation behaviors through the process of information processing. When individuals perceive that challenging pressure is beneficial for their innovation and that such pressure enhances innovation performance while simultaneously lowering costs and mitigating risks, they are more likely to believe that implementing innovation yields positive outcomes, including economic benefits, social recognition, and social approval. Individuals exhibiting good behavior attitudes are more inclined to surmount pressure, pursue possibilities, and respond with innovation (Li et al., 2014). Behavioral attitudes signify an individual's propensity to innovate. Under pressure, sustaining a positive behavior attitude is more beneficial in promoting pressure adaptation (Wang et al., 2015).

Consequently, this study posits the subsequent hypothesis:

H7a: Behavioral attitude significantly influences challenging pressure.

2.3.2. Perceived Organizational Support and Challenging Pressure

Perceived organizational support can augment employees' self-assurance and sense of job fulfillment. It is an essential element of employees' emotional requirements. According to George and James (1993), employees encountering pressured work conditions marked by substantial workloads and elevated demands can alleviate or counteract the detrimental physical and psychological impacts of pressure, including anxiety and burnout, if they perceive the organization's emotional or material support. Research by Asad and Khan (2003) indicates that firms with substantial perceived organizational support foster a predictable work environment, hence diminishing blind compliance and enhancing predictability. Employees in such a setting encounter minimal pressure levels. Research by Van Dick and Wagner (2001) substantiates that perceived organizational support for employees, in both professional and personal domains, is a crucial determinant in alleviating work-related pressure.

Consequently, this study posits the subsequent hypothesis:

H7b: Perceived organizational support significantly influences challenging pressure.

2.3.3. Innovation Self-Efficacy and Challenging Pressure

Self-efficacy denotes an individual's assessment and confidence in their capacity to do a specific activity (Bandura, 1997). Self-efficacy is crucial in understanding the causes of job-related pressure, and its impact on the correlation between work pressures and their consequences has been acknowledged by researchers worldwide (Bandura, 1997; Gu, 2010). The Conservation of Resources Theory posits that people's resource-management decisions are mostly based on whether the anticipated resource compensation surpasses the resource depletion. Individuals possessing elevated self-efficacy exhibit a greater propensity to confront formidable pressures, dedicating time, energy, and various resources to achieve compensatory rewards, including status, financial gain, and

a sense of fulfillment. Employees with elevated self-efficacy possess enhanced self-confidence and a conviction in their capacity to confront demanding tasks. This demonstrates a heightened degree of goal dedication, which influences their work behavior and enhances the likelihood of improved performance, potentially resulting in greater promotional opportunities (Zhou & Guo, 2006).

Consequently, this study posits the subsequent hypothesis:

H7c: Innovation self-efficacy significantly influences challenging pressure.

2.3.4. Challenging Pressure and Innovation Behavior

The Conservation of Resources Theory posits that individuals choose to allocate their current resources towards low-risk or high-reward endeavors to augment their resource reserves. This indicates that individuals are prepared to confront challenging pressure that present the possibility of substantial rewards. As a result, people produce innovative ideas and creativity in this challenging circumstance, cultivating a robust motivation to address issues and promoting creative results (Prem et al., 2017). Studies indicate that persons who generally view time constraints and job autonomy as significant pressures are more proactive in the workplace and demonstrate elevated creative levels. Challenging pressure can facilitate goal attainment and personal development. Employees experiencing significant challenging pressure possess robust intrinsic motivation. They strive for their "ideal selves" and confront affirmative objectives such as growth, optimism, and achievement. They typically adopt proactive techniques to alter the status quo, thereby augmenting staff creativity (Rhee & Fiss, 2014; Zhou et al., 2012) and promoting innovative behavior.

Consequently, this study posits the subsequent hypothesis:

H7d: Challenging pressure significantly influences innovation behavior.

2.3.5. The Intermediary Function of Challenging Pressure

The influence of beliefs on innovative performance differs among various innovation challenges (Ding, 2018). Individuals in difficult circumstances endeavor to manage their stress responses, a relationship shaped by personal worldview differences. Crum et al. (2013) argue that beliefs are a distinct and significant factor in shaping pressure responses, influencing individual well-being and performance in high-pressure situations. Proactive coping strategies are more effective in employing good and healthy methods when confronted with pressure (Cui & Wang, 2017), which can enhance the development of sustainable personal resources (Fredrickson, 2013; Shao et al., 2018), thereby promoting innovative behavior.

Consequently, this study posits the subsequent hypotheses:

H7: Challenging pressure may mediate the relationship between holistic innovation attitudes and innovation behavior.

2.4. Research Framework

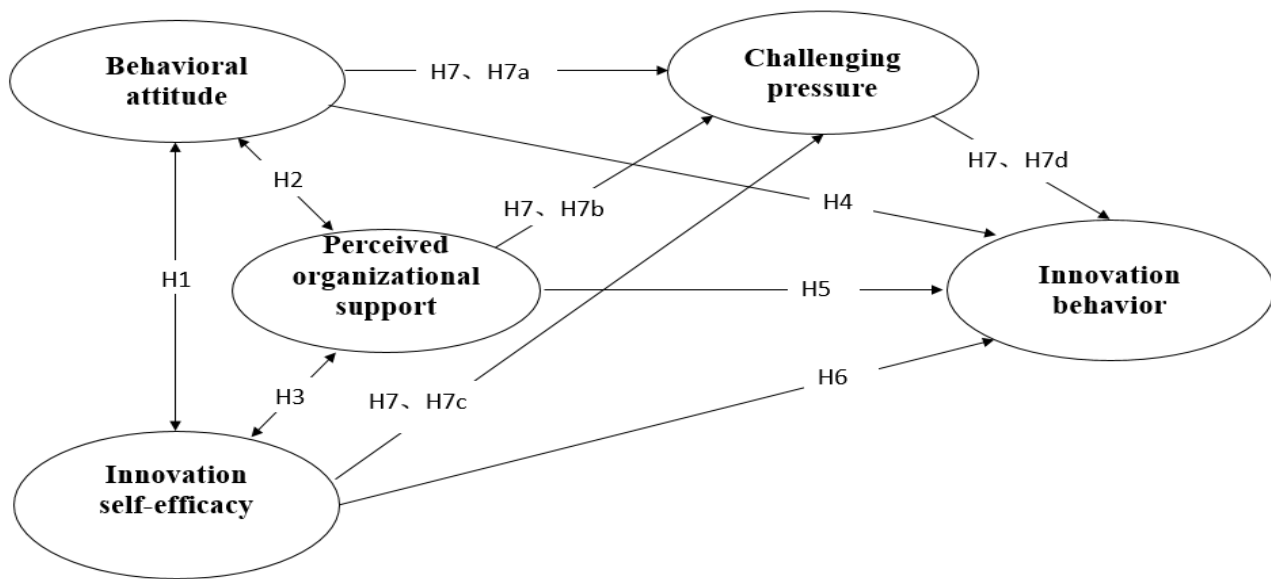


Figure 1. Research Framework. Source: Adjusted from Ajzen (1991).

3. Methodology

This study must utilize data to validate the link between variables and substantiate the assumptions and models established in the preceding article. The forthcoming research will primarily be conducted through a questionnaire survey. The questionnaire survey method is a prevalent technique in quantitative research. It is a distinct method characterized by a clear positivist methodological orientation in social survey research. It typically employs hypothesis deduction as the internal logical reasoning, standardization, and standardized operational procedures as its primary characteristics, and persons as the subjects of investigation. This survey method is very effective for delineating the attributes of extensive sample populations (Wu, 2000). It integrates meticulously chosen probability samples with standardized surveys, enabling precise descriptive assertions about any group. It is a superior instrument for examining individual attitudes and actions (Babbie, 2020).

3.1. Research Design

3.1.1. Research Cohort

This study utilized Guangdong Province, China, as a typical region and surveyed all 38 universities within the province using a questionnaire to thoroughly gather pertinent data on the innovation behaviors of university personnel. Statistics from the Guangdong Provincial Department of Education indicate that, as of December 2024, there were 53,596 university personnel in Guangdong Province. The target demographic for the questionnaire survey comprised all 53,596 university personnel in Guangdong Province.

Simultaneously, each university personnel member possesses a distinct interpretation of challenging pressure and innovation behavior, influenced by characteristics such as their tenure and the nature of their role. To get information more pertinent to the research topic (Feng, 2022), demographic variables such as age, gender, and position are incorporated into the personnel's basic information to aid in analysis and streamline future data processing. This type of survey is beneficial in elucidating the inherent link between variables.

3.1.2. Sample Size

The sample size for this investigation was determined using the limited population sampling formula (Webb et al., 2017; Wu, 2010). The study's sample population, N , was 53,596, resulting in a

calculated sample size, n , of 374.61 based on the formula. Consequently, the necessary effective sample size was 375 people. Taking into account design effects in complex samples and adhering to the guideline (Hair et al., 2019) that an appropriate sample-to-observation ratio is 20:1, and considering that this study included 37 observed variables, the requisite sample size was calculated to be 740 individuals.

3.1.3. Methodology for Sampling

This study encompassed all universities in Guangdong Province under its sample framework, employing quota sampling as its foundation, alongside various methodologies, including stratified sampling and basic random sampling. The sample size for each university was allocated using quota sampling, based on a predefined figure. Concerned about the potential impact of various job positions on employee innovation behavior, the researchers instructed the survey directors at each university to select employees from diverse job roles, stratified according to specific principles, as their survey subjects. Moreover, random sampling improves sample representativeness, thereby increasing the accuracy, validity, and reliability of study findings (Ma, 2002). The researchers employed random sampling to identify the particular sample.

3.1.4. Variables and Measurement

The variables examined in this study, including innovation behavior, challenging pressure, innovation self-efficacy, perceived organizational support, and behavioral attitude, have been previously analyzed by questionnaire surveys. This study reviewed the literature and compiled measurement scales of pertinent variables utilized by scholars both domestically and internationally, from which we selected scales that align with the study's scope and are widely acknowledged, ensuring high reliability and structural validity.

This study employed the scale developed by Gu and Peng (2011), which encompasses two dimensions: the development of innovative ideas and the application of innovative ideas, to assess innovation behavior. The scale comprises 12 items, and the Cronbach's alpha is 0.901, indicating strong reliability.

This study employed the scale developed by Lao & Wang (2015), which encompasses two dimensions: cognitive and emotional components, to assess behavioral attitude. The scale comprises 6 items, and the Cronbach's alpha is 0.9, indicating strong reliability.

This study employed the scale developed by Carmeli and Schaubroeck (2007), which encompasses two dimensions: efficacy in problem-solving and efficacy in idea generation, to assess innovation self-efficacy. The scale comprises 8 items, and the Cronbach's alpha is 0.92, indicating strong reliability.

This study employed the scale developed by Eisenberger et al. (2001), which encompasses two dimensions: emotional support and instrumental support, to assess perceived organizational support. The scale comprises 6 items, and the Cronbach's alpha is 0.81, indicating strong reliability.

This study employed the scale developed by Cavanaugh et al. (2000), which encompasses three dimensions: workload pressure, time pressure, and responsibility pressure, to assess challenging pressure. The scale comprises 6 items, and the Cronbach's alpha is 0.87, indicating strong reliability.

This study systematically refined the measuring items of the variables through expert evaluation and preliminary surveys, ultimately resulting in the final questionnaire for this research. The questionnaire comprises three sections: the First is the title and instructions for the questionnaire. This document primarily outlines the survey's objectives and content, highlighting its secrecy and academic intent. The next is demographic details of the respondents. It encompasses demographic

details such as gender, age, and educational attainment, along with additional pertinent information such as job position. Finally, there are measurement elements corresponding to each variable.

3.2. Data Acquisition

The survey questionnaire for this study was available in both paper and online formats. The paper questionnaire was manually collected and aggregated, whereas the internet questionnaire was gathered and aggregated via a questionnaire platform. Survey professionals from each university administered the questions in person, aided respondents in completing the online version, and created a limited quantity of paper questionnaires for exceptional circumstances. In contrast to administering paper surveys in person, online questionnaires offer greater convenience and enhance the efficiency of data collecting and processing post-return (Xia et al., 2017).

To ensure the validity of the sample and the accuracy of the survey, several essential measures were implemented during the sampling and survey process. Diverse public relations initiatives were undertaken to obtain the support and understanding of the surveyed university staff, facilitating the seamless completion of the questionnaire. Regarding questionnaire dissemination, face-to-face distribution was done whenever possible to increase the response rate. The principle of informed consent was maintained throughout the questionnaire dissemination, with the survey's goal, importance, and confidentiality measures clearly articulated to the respondents. Questionnaires were gathered with participant agreement to assure data integrity.

3.3. Data Analysis

To guarantee high-quality sample data for empirical analysis, all collected data need both automatic and manual screening. (Kline, 2015) points out that data screening helps uncover potential multicollinearity in the data. The automatic screening in this study was performed on the questionnaire platform. Essential measures encompassed restricting duplicate submissions by individual respondents and prohibiting individuals from disseminating questionnaire URLs to respondents within the jurisdiction. Manual screening generally entailed accessing the platform's backend to evaluate user-submitted questionnaires, eliminating redundant questionnaires, and discarding those with significant gaps in responses.

The data analysis for this study was mostly conducted using SPSS statistical software version 26.0 and AMOS structural equation software version 26.0. The analysis was conducted using data quality assessments (including reliability testing, normal distribution evaluation, and common method bias examination), variable correlation analysis, model fit evaluation, effect analysis, and hypothesis testing.

4. Results

4.1. Descriptive Statistical Analysis

This study performed a descriptive statistical analysis utilizing 628 valid samples obtained via a structured questionnaire. The characteristics of the interviewed university personnel reveal a predominance of males, aged under 44, who occupy professional and technical roles and hold a significant number of university degrees. This often represents the allocation of university personnel in my country. The chosen sample of university personnel is exceptionally representative and fulfills the design criteria of this study.

Table 1. Distribution of Sample Characteristics. Source: Authors

Characteristics	Feature Description	n	Percentage
Gender	Male	367	58.4
	Female	261	41.6
Age	Under 44 years old	316	50.3
	45 - 59 years old	278	44.3
	60- 74 years old	34	5.4
	75-89 years old	0	0.0
	90 years and above	0	0.0
Job position	Management Positions	195	31.1
	Professional and technical positions	350	55.7
	Skilled workers positions	83	13.2
Education level	University (college and above)	545	86.8
	High school (including technical secondary school)	49	7.8
	Junior high school	25	4.0
	Primary school and below	9	1.4

4.2. Analysis of Reliability

Researchers typically employ Cronbach's coefficient to assess the trustworthiness of questionnaire results. The Cronbach's alpha for all variables in this study exceeds 0.7, signifying strong reliability of the questionnaire data.

Table 2. Variable Cronbach's Alpha. Source: Authors

Variable	Cronbach's alpha	Number of items
Innovation behavior	0.923	12
Behavioral attitude	0.850	5
Innovation self-efficacy	0.894	8
Perceived organizational support	0.889	6
Challenging pressure	0.873	6

4.3. Assessment of Common Technique Bias and Evaluation of Normal Distribution

4.3.1. Test for Common Method Bias

This research, based on the findings of Podsakoff et al. (2003), employed both pre-testing and post-testing to mitigate the influence of common method bias on our results. The study's goal was explicitly articulated in the preamble of the formal survey questionnaire to avert misinterpretation of measuring items. The survey team explicitly addressed confidentiality to alleviate respondents' fears. Following the testing phase, this study employed the Harman single-factor test to assess the data for common method bias. Unrotated principal component analysis of the scales identified five variables with eigenvalues exceeding 1. The initial component accounted for 38.267% of the variation, which is below 40%, suggesting that the data obtained from the formal survey were devoid of substantial common method bias.

Table 3. Unrotated Principal Component Analysis. Source: Authors

Element	Initial eigenvalues			Extracting the sum of squares of loadings		
	Total	Percentage of variance	Accumulation%	Total	Percentage of variance	Accumulation%
1	14.159	38.267	38.267	14.159	38.267	38.267
2	3.011	8.138	46.405	3.011	8.138	46.405
3	2.155	5.825	52.230	2.155	5.825	52.230
4	1.584	4.282	56.511	1.584	4.282	56.511
5	1.360	3.676	60.188	1.360	3.676	60.188

4.3.2. Assessment of Normal Distribution

Per the criteria established by Wu (2010), the absolute values of skewness and kurtosis are about zero, and the absolute values of the skewness and kurtosis Z-scores do not exceed 1.96. The analysis results indicate that the kurtosis, the absolute value of skewness, and the Z-scores for both kurtosis and skewness satisfy the specified criteria, demonstrating that the formal survey data adhere to the properties of a normal distribution and are appropriate for correlation analysis and structural equation modeling.

4.4. Correlation Analysis

This study will utilize data from the formal survey to empirically assess the research hypothesis established in the preceding article, assuring the reliability and validity of the questionnaire data. This study initially performed a correlation analysis on each variable.

This study utilized all 628 questionnaire responses to conduct Pearson correlation analyses. The investigation revealed strong correlations among behavioral attitude (BA), innovation self-efficacy (ISE), perceived organizational support (POS), challenging pressure (CP), and innovation behavior (IB). The correlation coefficients among the primary variables were all below the critical threshold of 0.7, satisfying the criteria for further multiple linear regression analysis. The correlation analysis results offered initial support for the study's hypotheses.

Table 4. Outcomes of Pearson Correlation Analysis of Factors. Source: Authors

	IB	BA	ISE	POS	CP
IB	1				
BA	.631**	1			
ISE	.467**	.444**	1		
POS	.575**	.602**	.540**	1	
CP	.607**	.580**	.464**	.589**	1

4.5. Model Fit Assessment

Correlation analysis indicates a reciprocal influence and interaction across variables; nevertheless, it fails to elucidate the direction and size of this relationship. As a result, this study employed structural equation modeling to assess the research hypothesis and theoretical model derived from the correlation analysis.

In this study, all 628 formal questionnaire responses were imported into structural equation modeling software to estimate model fit parameters. The model is deemed to have a good fit, as the majority of fit indices satisfied the established criteria for a structural equation modeling study.

Table 5. Comprehensive Fit Outcomes of the Structural Equation Model. Source: Authors

Fit index	Fitting results
Absolute Fit Index	Chi-sq=1002.213, df=591, GFI=0.923, AGFI=0.908, RFI=0.919, RMSEA=0.033, RMR=0.031
Value-added fit index	NFI=0.928, IFI=0.969, TLI=0.965, CFI=0.969
Simple fit index	Chi-sq/df=1.696, HOELTER=406

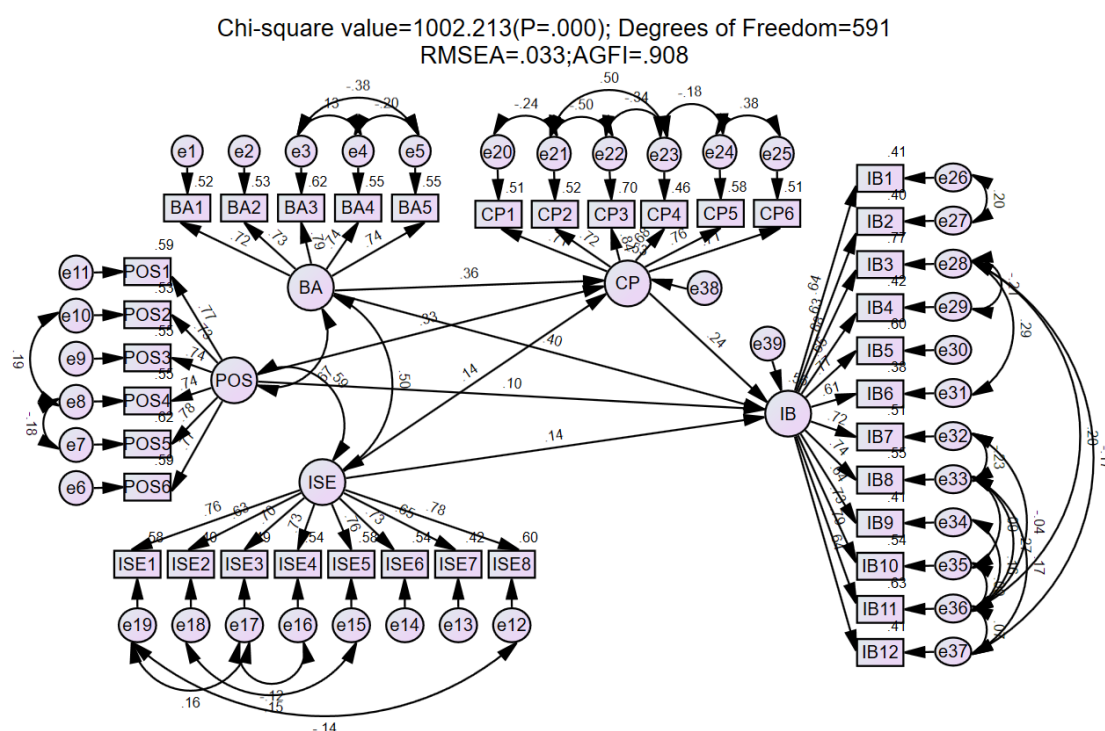


Figure 2. Structural Equation Model Fitting Diagram. Source: Authors

4.6. Effect Analysis and Hypothesis Testing

4.6.1. Direct Effect Analysis and Hypothesis Testing

The findings of the structural equation model indicate significant interactions among behavioral attitude and innovation self-efficacy, behavioral attitude and perceived organizational support, as well as perceived organizational support and innovation self-efficacy. Consequently, H1, H2, and H3 are all endorsed. Behavioral attitude and innovation self-efficacy exert a large and favorable impact on innovation behavior, thereby supporting both H4 and H6. Nonetheless, perceived organizational support does not substantially affect innovation behavior; hence, H5 is not corroborated. Behavior and attitude significantly enhance the ability to cope with challenging pressures, including innovation self-efficacy and perceived organizational support. Consequently, H7a, H7b, and H7c are all validated. Challenging pressure significantly enhances innovation behavior, thereby supporting H7d.

Table 6. Results of Direct Effect Analysis. Source: Authors

			Estimate	SE	CR	P
Perceived organizational support	<-->	Innovation self-efficacy	0.275	0.026	10.374	***
Perceived organizational support	<-->	Behavioral attitude	0.260	0.024	10.673	***
Innovation self-efficacy	<-->	Behavioral attitude	0.201	0.022	9.039	***
Perceived organizational support	--->	Challenging pressure	0.305	0.051	5.972	***
Innovation self-efficacy	--->	Challenging pressure	0.122	0.038	3.216	0.001
Behavioral attitude	--->	Challenging pressure	0.380	0.055	6.929	***
Challenging pressure	--->	Innovation behavior	0.196	0.042	4.706	***
Behavioral attitude	--->	Innovation behavior	0.347	0.049	7.155	***
Innovation self-efficacy	--->	Innovation behavior	0.106	0.031	3.444	***
Perceived organizational support	--->	Innovation behavior	0.076	0.041	1.865	0.062

4.6.2. Mediation Effect Analysis and Hypothesis Testing

This study employed a process plug-in, following the methodology of Wen and Ye (2014), to investigate the mediating effect of challenging pressure on the relationship between innovation intention and innovation behavior. The findings indicate that the indirect effect, direct effect, and total effect are significant in the link among behavioral attitude, innovation self-efficacy, perceived organizational support, and innovation behavior, with challenging pressure serving as the mediating variable. The 95% confidence interval excluded 0, signifying that challenging pressure significantly mediated the effect of comprehensive innovation intention on innovation behavior. Consequently, Hypothesis 7 was validated.

Table 7. Outcomes of Mediation Effect Analysis. Source: Authors

Dependent Variable	Mediating variables	Independent Variable	Effect type	Effect	SE	LLCI	ULCI	p
Innovation behavior	Challenging pressure	Behavioral attitude	Total Effect	0.6215	0.0306	0.5615	0.6815	0
			Direct Effect	0.4134	0.0347	0.3453	0.4816	0
			Indirect effects	0.2081	0.0294	0.1509	0.2669	0
		Innovation self-efficacy	Total Effect	0.4388	0.0332	0.3736	0.5040	0
			Direct Effect	0.2215	0.0325	0.1576	0.2854	0

	Indirect effects	0.2173	0.0271	0.1655	0.2725	0
Perceived organizational support	Total Effect	0.5037	0.0287	0.4474	0.5599	0
	Direct Effect	0.2911	0.0324	0.2274	0.3548	0
	Indirect effects	0.2126	0.0315	0.1546	0.2781	0

5. Discussion

The empirical findings of this study distinctly demonstrate the influence of university personnel's innovation intention on innovation behavior, as well as the mediating effect of challenging pressure.

Research demonstrates that innovation intention exerts a partial direct influence on the innovation behavior of university personnel, and prior studies have seldom conducted such an in-depth analysis. Behavioral attitude directly influence innovation behavior, aligning with the findings of Lü et al. (2021), Li et al. (2019), and Abdoulaye et al. (2024). The innovation behavior of university personnel can be attributed to the interplay between individual psychological characteristics and external environmental influences. Behavioral attitude serves as the intrinsic motivator for innovative behavior, stimulating university personnel's inventive awareness and enhancing their propensity to engage in innovation. Innovation self-efficacy directly influences innovation behavior, aligning with the findings of Ford (1996), Gong et al. (2009), and Anderson & West (1998). This phenomenon can be attributed to high levels of innovation self-efficacy, which instill confidence and a belief in university personnel's capacity to accomplish innovative tasks. This idea enhances employees' expectations and trust in innovative behavior while also motivating them to actively participate in such activity. The negligible effect of perceived organizational support on innovation behavior contradicts the findings of Fang et al. (2019), Pang and Lu (2018), and Yang and Yang (2020). This can be elucidated by the following: Firstly, there exists a discrepancy between perceived support and real resource allocation. When firms communicate innovation support solely through slogans or policy documents, without providing substantial resources like R&D cash and equipment enhancements, employees cultivate a cognitive bias towards "symbolic support," leading to a diminishment of tangible incentives in formal support. Secondly, authoritarian management undermines psychological safety. When businesses excessively prioritize performance evaluations and accountability for innovation failures, it undermines the psychological safety of perceived organizational support, leading to accountability procedures that stifle risk-taking. When firms display "administrative dominance," management excessively intervenes in the choice of particular innovation trajectories, resulting in a clash between bureaucracy and an innovative culture, thus constricting the opportunities for grassroots people to execute their creative concepts.

Research demonstrates a connection among the three components of innovation intention, aligning with Ajzen's (1991) findings, which were overlooked in numerous prior investigations. Behavioral attitude directly influences innovation self-efficacy and perceived organizational support. This aligns with the findings of Amabile (1993) and Hebda et al. (2007). When individuals view innovation activities as stimulating and demanding, they are driven by the aspiration to actualize their own visions and the intrinsic gratification derived from engaging in "cutting-edge" inventions, hence enhancing their innovative efficacy. When individuals see that participation in innovative activities may yield external rewards, the pursuit of material benefits, financial remuneration, and intrinsic fulfillment fosters a sense of corporate support. Perceived organizational support directly influences

behavioral attitude and innovation self-efficacy. This aligns with the findings of previous studies (George et al., 1993; Ajzen, 2002). When organizational leaders emphasize innovation initiatives and implement appropriate incentive and evaluation systems, university personnel encounter a degree of organizational pressure that gradually becomes internalized as a behavioral attitude, fostering beliefs such as "innovation is my responsibility" and "I must participate in innovation." Influenced by a predominantly collectivist organizational culture and confronted with pressures including "face culture," "peer pressure," as well as "comparison" and "herd mentality," university personnel are significantly motivated and either actively or passively cultivate a sense of innovation self-efficacy. Innovation self-efficacy directly influences behavioral attitude and perceived organizational support. This aligns with the findings of previous studies (Bandura, 2003; Farmer & Tierney, 2017). Elevated innovation self-efficacy is more likely to enhance innovation attitude and foster a willingness to participate in innovative endeavors. This underscores a person's confidence in their own capabilities, rather than the extent of those capabilities. Ample innovation resources and substantial influence over the innovation process can enhance university personnel's perception of perceived organizational support, bolster their confidence in addressing innovation challenges, and stimulate their innovative aspirations.

Research demonstrates that challenging pressure modulates the connection between innovation intention and innovation behavior. This contradicts earlier studies that have mainly concentrated on the direct influence of innovation intention on innovation behavior (Qi et al., 2023; Yuan et al., 2023) or investigated the effect of challenging pressure as an independent variable (Prem et al., 2017; Rhee & Fiss, 2014; Zhou et al., 2012). The favorable impact of innovation intention on challenging pressure subsequently elevates employee initiative and promotes the judicious utilization of current resources, facilitating effective avenues for innovation and development, thereby augmenting employee creativity. Embracing problems enhances employees' intrinsic motivation, prompting them to invest greater time and effort in exploring various problem-solving strategies. Consequently, individuals with robust innovation intentions, when faced with challenging pressure, perceive themselves as bearing heightened expectations and duties from the group, as well as possessing more decision-making authority and autonomy within the organization. They are more likely to perceive this pressure as benign, as a catalyst for altering their existing work circumstances, and as a motivating factor that encourages individuals to engage in continual learning and self-improvement, thereby promoting innovative behavior. The findings of this study align with those of Abbas and Raja (2019) and further substantiate the Cognitive Interaction Theory proposed by Lazarus and Folkman (1984). The results underscore the crucial significance of challenging pressure in fostering innovative behavior among university personnel. Challenging pressure is a constructive and advantageous type of pressure that can stimulate individuals' cognitive processes and encourage them to employ proactive problem-solving techniques. Innovation behavior constitutes a practical problem-solving technique.

6. Conclusion

This study offers significant insights for policymakers and university personnel by elucidating the direct and indirect effects of three critical aspects of innovation intention on innovation behavior. A thorough understanding of these contributing elements can aid in formulating effective strategies to promote and encourage innovative behavior among university personnel in various contexts. The findings demonstrate that behavioral attitude and innovation self-efficacy exhibit a significant interactive effect (H1); behavioral attitude and perceived organizational support show a significant interactive effect (H2); and innovation self-efficacy and perceived organizational support reveal a significant interactive effect (H3). Behavioral attitude markedly affects innovation behavior (H4); perceived organizational support does not significantly impact innovation behavior (H5); innovation

self-efficacy substantially influences innovation behavior (H6); and challenging pressure mediates the relationship between innovation intention and innovation behavior (H7).

Challenging pressure, as a significant mediating variable, substantially enhances innovation behavior among university personnel influenced by their innovative aspirations. This discovery is original, as this study is the inaugural investigation into challenging pressure as a mediator variable between innovation intentions and innovation behavior. Challenging pressure correlates with beneficial elements such as employee acknowledgment, and a perception of autonomy in one's role affects employees' assessments of challenge-related pressure. The significant job demands associated with innovative intentions are typically arduous, and the consequent work pressure can positively impact employee initiative, improving their capacity to effectively leverage existing resources and thereby facilitating innovation, development, and augmenting employee creativity. Proactively embracing problems enhances employees' intrinsic motivation, prompting them to invest greater time and effort in exploring diverse problem-solving strategies.

6.1. Theoretical Ramifications

This study synthesizes the impact of individual and contextual elements, enhancing the research on employee innovation behavior. Social Cognitive Theory (Bandura, 1989) and Self-determination Theory (Deci et al., 1989; Deci & Ryan, 2000) propose that employee innovation behavior is influenced not solely by individual cognition but by the interplay between the environment and the individual. Nonetheless, the particular environmental elements remain inadequately examined. This study examines individual and organizational factors that affect employee innovation behavior, including behavioral attitudes, innovation self-efficacy, and perceived organizational support. It also addresses the environmental factor of challenging pressure within the framework of digital transformation, elucidating the mechanism through which innovation intention impacts innovation behavior. This study enhances the investigation of the precursors to employee innovation behavior, introduces a new rationale to elucidate environmental conditions, and augments the pertinent aspects of Social Cognitive Theory and Self-determination Theory.

This study enhances our understanding of pressure management and contributes to the study of coping with pressures. The Motivation Theory (Scott & Bruce, 1994) asserts that job-related pressure can activate individuals' work motivation, enhance enthusiasm and passion, and eventually elevate work performance. Consequently, challenging pressures are seen as "beneficial" pressures. In the digital transformation of universities, it is crucial to avoid setting overly modest transformation objectives, as this will hinder the promotion of innovative behavior among university personnel. This coincides with the objective of pressure management: it is not about eradicating pressures, but rather about harmonizing pressure with performance and both physical and mental growth. In handling challenging pressure, it is essential to prioritize its arousal function while fully using its beneficial consequences. This work enhances the comprehension of challenging pressure and offers further insights for researchers in the field.

This study presents a novel model of innovation behavior, grounded in Ajzen's (1991) Theory of Planned Behavior and Lazarus and Folkman's (1984) Cognitive Interaction Theory, through a comprehensive literature review that incorporates innovative intention and challenging pressure. This is uncommon in prior research and seeks to rectify the shortcomings of earlier systems. The analysis of the research data indicated that perceived organizational support did not directly influence the innovation behavior of university personnel. Consequently, the new model required revision. The updated model is as follows:

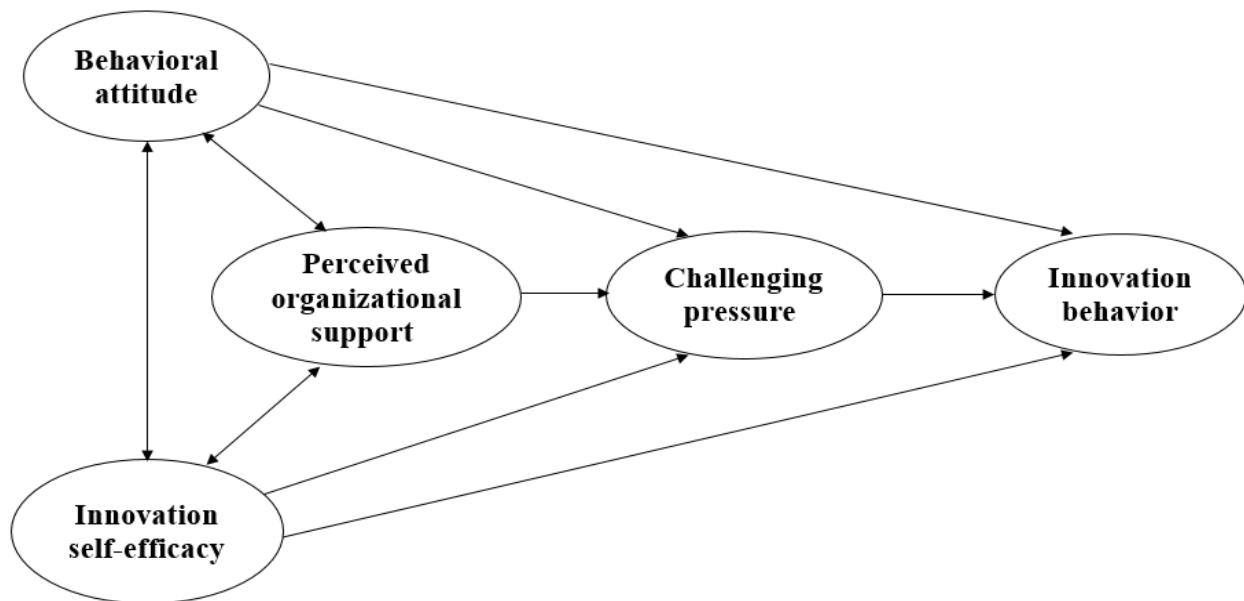


Figure 3. Conclusive Model. Source: Authors

6.2. Pragmatic Importance

The empirical findings of this study provide significant practical insights aimed at enhancing the innovation behavior of university personnel.

The behavioral attitudes of university personnel positively influence their innovative intentions and actions. It is essential to guarantee that university personnel possess a favorable disposition towards innovation and foster their excitement for it. In the digital revolution of higher education, it is essential to analyze the motivation, creativity, and exploratory tendencies of university personnel. We must implement a human-centric strategy, focusing on individual characteristics such as personality traits, interests, and hobbies; thoroughly considering their research inclinations; fostering their innovative mindset and philosophy to navigate digital transformation; and assigning them to suitable roles to ensure an optimal alignment between individuals and positions, thereby enabling them to fully actualize their personal value (Colak & Altinkurt, 2022).

The innovation self-efficacy of university personnel favorably affects their intentions and behaviors related to innovation. Augmenting positive feedback is essential to bolster university personnel's perception of their innovation self-efficacy. Organizations must acknowledge the emotional states of university personnel, honor, promote, and appreciate their technical competencies and professional capabilities, and react favorably to their endeavors and contributions to enhance their morale and self-assurance. Moreover, the training and enhancement of university personnel's innovative knowledge and professional and technical skills should be intensified to augment their knowledge base, refine their knowledge systems, update their knowledge frameworks, and bolster their innovative capacities, thus improving their sense of innovation self-efficacy.

Perceived organizational support of university personnel positively influences their innovative intentions. It is essential to establish suitable tasks and evaluation mechanisms to foster innovation among university personnel. This necessitates the integration of evaluation cycles with innovation cycles, considering the demographic attributes of university personnel and the trends of innovation. This necessitates concentrating on the comprehensive innovation process, eschewing a results-driven strategy that prioritizes only innovative outputs. This enables the assessment system to effectively serve as a guiding force and stimulate university staff's passion for innovation. Moreover, organizational leaders ought to acknowledge the emotional sentiments of university personnel and

use more supportive and advocacy-oriented communication strategies, eschewing coercive tactics such as mandates and intimidation.

Challenging pressure can influence the connection between innovation intention and innovation behavior. To optimize the management of challenging pressure, universities must concentrate on mitigating the uneasiness linked to job demands during the digital transition, therefore diminishing its detrimental impact on employees' innovation behavior. This can be accomplished by creating communication channels, coordinating consulting activities, gathering employee feedback, prioritizing psychological counseling, and executing pressure and emotional management strategies to assist employees in adjusting to alterations in their work routines (Yi et al., 2024).

7. Constraints

This study examined the correlation between challenging pressure, innovation intention, and innovation behavior. Despite its innovations and advancements, it nevertheless possesses specific faults and limits.

7.1. Scope of Research and Selection of Samples

The sample data for this paper was acquired from universities in Guangdong Province, China, due to objective restrictions such as time and budget during the research procedure. This constrained the sample size and coverage, suggesting that the research may be enhanced by including more samples to improve its representativeness. At present, there is a paucity of research on micro-level innovation. The investigation of employee innovation behavior could be broadened to encompass additional sample groups to better examine the generalizability of the results.

7.2. Survey Methodologies

This study employed a one-time questionnaire collection methodology. This type of cross-sectional data is more appropriate for scenarios lacking a logical chronological relationship between events. Additional sample data from various time intervals may be incorporated to detect any emerging alterations. Moreover, this study delineates a specific sequence in which innovation intention catalyzes innovation behavior via the mechanism of challenging pressure. Consequently, future investigations may endeavor to perform more comprehensive studies across various temporal contexts. Should conditions allow, one may select a control group and an experimental group to systematically document the subjects' innovation intentions and innovation behaviors daily, thereby dynamically monitoring fluctuations in various metrics and investigating potential temporal disparities in the influence of comprehensive innovation intentions on innovation behavior, thus augmenting the credibility of the research findings.

7.3. Research Methodologies and Instruments

The innovation behavior model for university personnel provided in this study, derived from a literature review, may be perceived as simplistic or lacking scientific rigor; thus, further in-depth research is required to enhance and develop the Theory of Planned Behavior. Although challenging pressure can elucidate the intricate connection between innovation intention and innovation behavior, this method concentrates exclusively on the nature of pressure and highlights the importance of pressure management, neglecting the influence of pressure intensity on employees. Moderating variables may be incorporated to further examine this effect. Moreover, the questionnaire items in this paper pertain to a foreign translation scale. The ambiguity of this measure due to cultural differences in translation and its appropriateness for Chinese universities necessitates further exploration in future research. Moreover, subsequent study may focus on creating research instruments tailored to the Chinese environment or applicable across many contexts to enhance the specificity of the research.

Declarations

Author Contributions. Xinjian Zhang and Khunanan Sukpasjaroen: conceptualization, formal analysis, methodology, visualization, writing—review and editing. Xinjian Zhang: investigation, data curation, validation, writing—original draft. Aroonroj Boonkrong and Rerkchai Fooprateepsiri: resource supervision. All authors have read and approved the published version of the article.

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Data Availability Statement. The datasets generated and/or analyzed during the current study are available, but re-strictions apply to the availability of these data, which were used under license for the current study, and thus cannot be publicly accessed. However, the data can be provided by the authors upon reasonable request, provided that permission is obtained from the third party.

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