

How Digital Competence, Self-Efficacy, and Perceived Organizational Support Shape Innovative Work Behavior: A Social Cognitive Approach

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Abstract

In global digital transformation, R&D companies face unprecedented pressure to innovate. Guided by Social Cognitive Theory, this study explores the complex interactions among digital competence, self-efficacy, perceived organizational support, and innovative work behaviors among employees in Chinese R&D companies. Using a quantitative approach, data were collected from 405 employees and analyzed through structural equation modeling (SEM). The findings reveal that digital competence significantly enhances self-efficacy and perceived organizational support, directly contributing to employees' innovative work behaviors. Furthermore, self-efficacy and perceived organizational support independently mediate partially in this relationship, highlighting the interplay between individual competence, psychological dispositions, and organizational climate in driving innovation. This study extends prior research by offering novel insights into the critical role of digital competence in shaping innovation within R&D environments, particularly in industries undergoing rapid digital transformation. From a practical perspective, the findings suggest that organizations can foster innovation by implementing targeted training programs to enhance employees' digital competence, boosting their self-efficacy, and strengthening organizational support mechanisms such as mentorship programs and incentive structures. By integrating these elements, R&D firms can build a more resilient and innovation-driven workforce in the digital era.

Keywords: digital competence; self-efficacy; perceived organizational support; innovative work behavior; China, social cognitive theory

Introduction

The digital transformation of industry has fundamentally reshaped how organizations innovate and compete. For R&D companies, employee digital competence has emerged as a critical driver of innovation capacity (Hausman & Johnston, 2014). While previous research has established the importance of digital skills in workplace innovation, a significant gap exists in understanding how digital competence interacts with psychological and organizational factors to foster innovative work behavior (Cetindamar Kozanoglu & Abedin, 2021).

This study addresses this gap by examining the complex interplay between digital competence, self-efficacy, and perceived organizational support in driving innovative work behavior. While existing literature has largely focused on these factors in isolation, their combined effects remain understudied, particularly in R&D settings. Understanding these relationships is crucial as organizations invest heavily in digital transformation while struggling to translate technological capabilities into sustained innovation performance (Wu et al., 2022).

Digital competence encompasses not just technical proficiency, but the ability to leverage digital tools for problem-solving, collaboration, and innovation (Spante et al., 2018). Self-efficacy, grounded in Social Cognitive Theory, reflects an individual's belief in their capacity to perform and innovate (Bandura & Wessels, 1997). Organizational support provides the essential context and resources that enable employees to apply their competencies toward innovation (Alpkan et al., 2010). By examining how these elements interact, this study offers theoretical insights into innovative behavior mechanisms and practical guidance for organizations seeking to enhance their innovation capabilities.

The R&D sector in China provides an ideal context for this investigation, as it represents a rapidly digitalizing environment where innovation is paramount to competitive success. However, the theoretical framework and findings have broader implications for understanding how organizations globally can better support and enable employee innovation in an increasingly digital workplace.

Research Objectives

The main objectives of this study are:

1. To explore the relationship between digital competence and employees' self-efficacy in R&D companies.
2. To investigate the connection between digital competence and organizational support.
3. To examine how self-efficacy and organizational support influence employees' innovative work behaviors.
4. To analyze the synergistic effects of core variables in driving innovation.
5. To provide evidence-based recommendations for how organizations can better leverage digital competence to enhance innovation performance.

Scope of Research

This research examines the relationships between digital competence, self-efficacy, perceived organizational support, and innovative work behavior in Chinese R&D companies. The following parameters define the scope of the study:

Research Context

This study focuses on R&D companies in Beijing, China, a choice that offers unique advantages for examining innovation dynamics in a digital context. As China's primary technology hub, Beijing hosts over 500 national-level R&D centers, leading the country in digital transformation initiatives. The city's competitive R&D landscape, characterized by intense innovation pressure and rapid digital adoption, is ideal for studying how digital competence influences innovative behavior. Additionally, Beijing's position as a nexus of international and domestic technology firms offers insights into innovation dynamics with local relevance and global implications.

The institutional environment of Beijing's R&D sector—marked by strong government support for digital transformation, substantial investment in technological infrastructure, and a highly skilled workforce—creates a distinctive context for observing the relationship between digital capabilities and innovation. This setting is particularly valuable for understanding how organizational support and individual self-efficacy mediate innovation in digitally intensive environments.

Time Frame

Data collection was conducted from April to July 2024, capturing a period of accelerated digital transformation in China's R&D sector. This timeframe coincides with the implementation of several national digital innovation initiatives, providing a rich context for studying digital competence and innovation behavior.

Research Population

The study surveyed 405 employees from R&D companies in Beijing, selected through a combination of convenience and snowball sampling methods. The sample represents diverse roles within R&D organizations, allowing for a comprehensive examination of how digital competence influences innovation across different organizational levels and functions.

Variables Under Investigation

The unique demands of digital transformation in R&D settings guided the selection of variables and theoretical framework. Social Cognitive Theory (SCT) was chosen as the theoretical foundation because it effectively captures the dynamic interplay between individual capabilities, psychological factors, and environmental influences that characterize innovation in digital environments. Specifically:

Digital competence (6-item scale): Selected to measure technical skills and the broader ability to leverage digital tools for innovation. This variable is crucial in the context of R&D companies where digital literacy increasingly underpins innovation capability.

Self-efficacy (6-item scale): Drawn from SCT, this variable was chosen for its proven role in explaining how individual beliefs influence behavior in technological contexts. It helps explain why similar levels of digital competence may lead to different innovation outcomes.

Perceived organizational support (8-item scale): Selected to capture the organizational context necessary for translating digital capabilities into innovative outcomes. This variable is particularly relevant in R&D settings where innovation often requires substantial organizational resources and support.

Innovative work behavior (6-item scale): Chosen to measure incremental and radical innovation activities, reflecting the range of innovation types in R&D environments.

Theoretical Framework

The research is guided by Social Cognitive Theory (SCT), which provides the theoretical foundation for understanding the relationships between the variables under study.

Literature Review

Social Cognitive Theory in Digital Innovation

Social Cognitive Theory (SCT) provides a robust framework for understanding how individual capabilities, psychological factors, and environmental conditions influence behavior in digitally transforming organizations. While traditional applications of SCT focused on general learning and performance, recent scholarship has demonstrated its relevance to digital innovation contexts. Khin and Ho (2020) found that SCT effectively explains how digital competencies influence innovative behavior through both direct effects and psychological mediators. This finding builds on earlier work by Ng and Lucianetti (2016), who established SCT's utility in explaining innovation behavior, but did not fully address the digital context. The theory's emphasis on reciprocal determinism – the mutual influence of personal, behavioral, and environmental factors – makes it especially suitable for examining how digital transformation reshapes innovation dynamics in modern organizations.

Digital Competence

Digital competence has evolved beyond basic technical literacy to encompass complex capabilities essential for innovation in contemporary work environments. Recent research by Huu (2023) identifies how artificial intelligence and big data analytics have fundamentally altered the nature of digital competence, requiring employees to develop new capabilities in areas such as algorithmic thinking and data-driven decision-making. This evolution is particularly evident in R&D settings, where digital tools increasingly mediate routine work and innovation processes.

Comparative studies across different cultural and organizational contexts reveal interesting patterns in how digital competence influences innovation. For instance, while European studies (Van Laar et al., 2020) emphasize individual digital creativity and problem-solving, research in Asian contexts (Zhang & Chen, 2024) highlights the importance of collective digital capabilities and knowledge sharing. These cultural variations suggest that digital competence manifests differently across contexts while maintaining its fundamental role in driving innovation.

Emerging research in remote work environments has added another dimension to our understanding of digital competence. Carvalho et al. (2023) remote workers with high digital competence showed greater innovative behavior, particularly in virtual collaboration and digital problem-solving. This finding suggests that digital competence becomes even more critical as organizations embrace hybrid and remote work models.

Self-efficacy

Self-efficacy is a core concept in Social Cognitive Theory, developed by Bandura and Wessels (1997). It refers to an individual's confidence or belief that they can complete a particular task or reach a certain goal. Self-efficacy affects individuals' behavior choices, persistence, effort, and mental state when facing challenges (Bandura & Wessels, 1997). Employees with high self-efficacy tend to be more willing to accept challenges, do not give up quickly in the face of difficulties, and are likelier to show positive and innovative behavior at work (Teng et al., 2020). Self-efficacy broadly impacts employees' job performance and behavior choices in the workplace. Research shows that employees with higher self-efficacy generally set higher goals and show greater motivation to achieve them (Cherian & Jacob, 2013). Confident in their abilities, they are likelier to explore new approaches, try new techniques, and show more creativity and initiative. Self-efficacy is also closely related to employees' adaptability, learning ability, and job satisfaction, which are important in promoting employees' innovative behavior (Demir, 2020).

There is a strong link between digital competence and self-efficacy. Employees with high digital competence tend to be more confident in their ability to do their jobs because they are adept at using digital tools to solve problems at work and are more comfortable with technical challenges (Tramontano et al., 2021). Maran et al. (2022) It has been shown that when employees master enough digital competence, they feel more competent for their current work tasks, which increases their sense of self-efficacy. Wolff et al. (2021) also found that after mastering digital technologies such as data analysis, programming, and project management tools, this proficiency made employees more efficient at completing tasks and increased their self-confidence. Employees' evaluation of their abilities improved significantly, and thus showed a stronger sense of self-efficacy. In addition, Oberländer et al. 2020), stated that by participating in digital competence training, employees are significantly more confident in completing complex tasks, which is directly reflected in higher self-efficacy. Therefore, the following hypothesis is proposed in this study:

H1: Employees' digital competence has a positive impact on self-efficacy.

Perceived Organizational Support

Perceived Organizational Support refers to the degree to which an employee perceives the care, recognition, and assistance given by the organization in their work (Eisenberger et al., 2020). Specifically, perceived organizational support reflects whether employees believe the organization values their contributions, cares about their welfare, and provides the necessary support when needed (Eisenberger et al., 2020). When employees feel supported by the organization, they return the favor with higher work engagement and greater loyalty (Nargotra & Sarangal, 2023). In the workplace, perceived organizational support profoundly impacts employee attitudes and behavior at work. Employees with high perceived organizational support typically show higher job satisfaction, more substantial organizational commitment, and more positive work behaviors (Maan et al., 2020). These employees believe that the organization will recognize and reward their efforts and contributions, so they are more willing to put more energy and resources into their work and show higher work performance (Astuty & Udin, 2020).

In the digital transformation process, there is a close interaction between digital capabilities and perceived organizational support. Brunetti et al. (2020) When organizations actively invest in advanced digital tools and provide systematic training, such initiatives significantly promote the upskilling of highly digitally capable employees. These employees are not only able to quickly master new technologies, but also feel the firm support of the organization in terms of technology and resources as a result (Zhang & Chen, 2024). This positive perception not only enhances their sense of belonging to the organization, but also enhances their identification with the organizational culture (Ridwan et al., 2020). Furthermore, Jun et al. (2022) found that employees with high digital ability are more inclined to actively explore and use the digital support system provided by the organization, which they regard as the organization's emphasis on their professional growth and innovation ability cultivation. This awareness not only motivates them to use organizational resources more effectively to improve work efficiency, but also inspires positive evaluations of the organization and higher job satisfaction (Andriyanti & Supartha, 2021). Therefore, the following hypothesis is proposed in this study:

H2: Employees' digital competence positively impacts perceived organizational support.

Innovative Work Behavior

Employee innovation behavior, as a key driving force for organizational innovation and sustainable development, has attracted extensive attention in both academic and practical circles in

recent years (Khodakarami & Zakaria, 2015). Employee innovation behavior is defined as the behavior in which employees take the initiative to propose new ideas, develop new plans, and put them into practice at work (De Jong & Den Hartog, 2008). It is not only the spark collision of creative thinking, but also the practice of transforming these ideas into actual results to optimize the organization's products, services, or work processes (Hill et al., 2014). With the deepening of digital transformation, the continuous innovation of innovative tools and means puts new requirements on employee innovative behavior. Digital technology not only improves the efficiency and accuracy of information processing, but also broadens the boundaries and possibilities of innovation (Opazo-Basáez et al., 2022). However, this also requires employees to be more digitally competent and information literate in order to take full advantage of these technological tools for innovative practices (Cetindamar Kozanoglu & Abedin, 2021).

Carvalho et al. (2023) Employees with higher digital competence can utilize IT tools more effectively and generate innovative ideas and solutions at work. This competence enhances employees' ability to handle complex information and data and facilitates the integration and recreation of knowledge, providing a solid foundation for innovative behavior. Further, Labanauskaitė et al. (2021) stated that highly digitally competent employees showed higher flexibility and adaptability in technological innovation. They responded quickly to market changes and proposed and implemented innovative solutions. Teng et al. (2020). It has been shown that employees with high self-efficacy are more inclined to set challenging goals and put in more effort to reach them when facing innovation tasks. They believed they could overcome the difficulties and obstacles encountered in the innovation process, making them more likely to generate innovative behaviors. In addition, Ng and Lucianetti (2016). Pointed out that Self-efficacy also indirectly contributes to generating innovative behaviors by influencing employees' cognitive processes and motivation levels. The study pointed out that when employees feel support from the organization, they will identify more with its values and goals and thus be more actively engaged in innovative activities. This support is reflected in the provision of material resources and includes emotional care, career development opportunities, and recognition and encouragement from leaders. Le and Lei (2019). Further, perceived organizational support stimulates employees' creativity and motivation to innovate, makes them more willing to develop new ideas and solutions, and strives to put them into practice. Therefore, the following hypothesis is proposed in this study:

H3: Employees' digital competence positively impacts innovative work behavior.

H4: Employees' self-efficacy has a positive impact on innovative work behavior.

H5: Employees' perceived organizational support positively impacts innovative work behavior.

Mediating role of self-efficacy and perceived organizational support

When exploring the influence mechanism of employees' digital competence on innovative work behavior, self-efficacy should not be ignored as an important mediating variable. Research shows that self-efficacy mediates the relationship between employees' digital competence and innovative work behavior. On the one hand, the enhancement of digital competence provides employees with more innovative opportunities and possibilities, making it easier for them to generate new ideas and solutions at work (Carvalho et al., 2023); on the other hand, the realization of these ideas and solutions requires employees to have sufficient self-efficacy to support their actions. Thus, digital competence indirectly contributes to innovative work behaviors by enhancing employees' self-efficacy (Santoso et al., 2019). In addition, self-efficacy influences employees' thinking patterns, emotional states, and action strategies during innovation. Employees with high self-efficacy are more inclined to adopt a positive thinking mode to face problems and believe that they can find practical solutions (Slåtten, 2014); at the same time, they are also more able to maintain a stable emotional state and avoid giving up quickly due to setbacks in the innovation process. This positive thinking mode and emotional state help employees better cope with various challenges and uncertainties in the innovation process, thus improving innovative behavior's success rate and quality (Wei et al., 2020). Therefore, the following hypothesis is proposed in this study:

H6: Employees' self-efficacy is an intermediary in the relationship between employees' digital competence and innovative work behavior.

Perceived organizational support is another key mediating variable in the in-depth analysis of how employee digital competence contributes to innovative work behaviors. It provides a positive psychological environment for employees to feel important, cared for, and supported by the organization. (Aggarwal-Gupta et al., 2010). This positive psychological environment is one of the important factors in motivating employees to innovate. When employees perceive that the organization values their contributions and is willing to provide them with the necessary resources and support, they are more willing to invest their time and energy in trying new ideas and approaches, which drives innovative work behaviors. (Chiang & Hsieh, 2012). Digital competence provides employees with the technological foundation and thinking tools to innovate, but technological competence alone is not enough to drive innovative behavior. At this point, perceived

organizational support is critical. Organizations help employees better utilize their digital competence and transform it into innovations by providing necessary support measures such as resources, training, motivation, and feedback. (Zhang & Chen, 2024). This support enhances employees' self-efficacy and provides them with more opportunities and platforms for innovation, promoting innovative work behaviors. (Akbari et al., 2021). Therefore, the following hypothesis is proposed in this study:

H7: Employees' perceived organizational support is an intermediary in the relationship between employees' digital competence and innovative work behavior.

Figure 1 below demonstrates the research model proposed in this study. The model reveals how employees' digital competence, self-efficacy, and perceived organizational support contribute to innovative work behaviors.

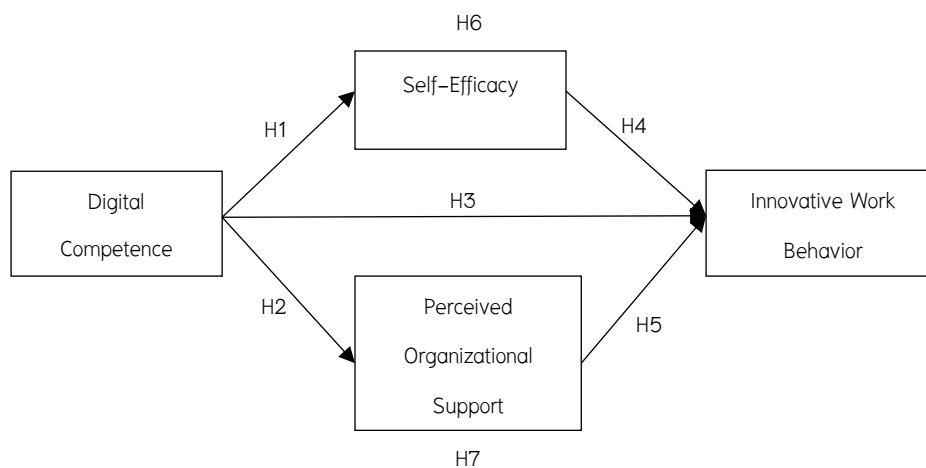


Figure 1 Research model

Research Methodology

Data collection and sampling

This study employed a quantitative research design using survey methodology to examine the relationships between digital competence, self-efficacy, perceived organizational support, and innovative work behavior among R&D employees in Beijing, China. The research design was guided by Social Cognitive Theory and aimed to test the hypothesized relationships through structural equation modeling (SEM).

The target population for this study consisted of employees working in R&D companies in Beijing, China. According to the Beijing Municipal Bureau of Statistics, the total population of R&D employees in Beijing's high-tech enterprises was approximately 89,000 as of 2024. This population was selected due to Beijing's status as China's primary technology hub, hosting over 500 national-level R&D centers. The required sample size was determined using the formula of Yamane (1967), which indicated a minimum requirement of 398 participants based on a 95% confidence level and a 5% margin of error. The final sample of 405 valid responses exceeded this requirement, ensuring adequate statistical power for the analyses.

A combination of convenience and snowball sampling methods was employed for data collection. While these non-probability sampling methods have inherent limitations, they were chosen for several practical reasons. First, R&D employees, particularly in high-tech companies, are often difficult to access through random sampling due to security and confidentiality concerns. Second, these methods allowed for efficient data collection within the study's time and budget constraints. Third, snowball sampling effectively leveraged professional networks within the R&D community, helping to reach qualified participants across different organizations. Several control measures were implemented to address potential limitations of these sampling methods. These included monitoring demographic distributions to ensure representation across age groups, education levels, and job roles; ensuring sampling from different districts in Beijing to avoid spatial clustering; including employees from state-owned and private R&D enterprises; and conducting wave analysis comparing early and late responses to assess non-response bias.

Measures

The questionnaire collected information about the study variables, including digital competence, self-efficacy, perceived organizational support, and innovative work behavior. The measurement method used was based on established scales and was adapted to the context of Chinese R&D companies. Drawing on the scale developed by Gümüş and Kukul (2023), a total of six items were used to assess participants' digital competence. The Self-Efficacy scale was adapted from Tramontano et al. (2021), including six items. The 8-item scale employed to measure Perceived Organizational Support was based on the work of Alshaabani et al. (2021). The Innovative Work Behavior scale, consisting of 6 items, was adapted from Akram et al. (2020). The questionnaire was written in English and translated into Chinese by a professional translator proficient in both languages and related fields. It was then back-translated into English by another independent translator to

verify the accuracy and fidelity of the translated version. (Thompson & Dooley, 2019). Participants were asked to rate their level of agreement or disagreement with a series of statements related to each variable using a 5-point Likert scale, ranging from 1 for strongly disagree to 5 for strongly agree.

Research Results

1. Preliminary Analysis

Participants Demographics

The study collected data from 405 R&D employees in Beijing, representing a diverse cross-section of the technology sector. Male participants comprised 53.3% of the sample (n = 216), while female participants comprised 46.7% (n = 189), reflecting a relatively balanced gender distribution. The age distribution revealed a predominantly young to middle-aged workforce, with 44.1% of participants aged 31–40, followed by 25.1% aged 21–30. This age structure aligns with the typical demographic profile of China's R&D sector, where younger professionals often drive innovation initiatives.

The participants' educational background demonstrated the high knowledge intensity of R&D work, with 82.8% holding at least a bachelor's degree. Notably, 26.7% possessed master's degrees, and 6.7% held doctoral degrees, indicating substantial human capital investment in the sector. The working experience distribution showed a healthy mix of newer and seasoned professionals, with 31.9% having 6–10 years of experience and 27.7% having 11–20 years, suggesting a balanced combination of fresh perspectives and established expertise.

Table 1 Participant's characteristics

Construct	Items	Frequency	Percentage
Age	21-30	102	25.1%
	31-40	179	44.1%
	41-50	100	24.7%
	51-60	24	5.9%
Gender	Female	189	46.7%
	Male	216	53.3%
Education	Vocational college	70	17.3%
	Bachelor degree	200	49.4%
	Master degree	108	26.7%
	Doctoral degree or above	27	6.7%
Working Years	0-5 Years	97	24.0%
	6-10 Years	129	31.9%
	11-20 Years	112	27.7%
	Over 20 Years	67	16.5%

Reliability and validity

As shown in Table 2 below, the reliability and validity of the measurement instruments were assessed in detail in this study. The Cronbach's Alpha (CA) coefficients were more significant than 0.7, indicating high internal consistency reliability for each variable. The Composite Reliability (CR) values were also all above 0.7, further validating the internal consistency of the scales. In addition, Average Variance Extracted (AVE) values were all greater than 0.5, indicating good convergent validity. These results indicate that the measurement instruments in the study have high reliability and validity and can accurately reflect the concepts and constructs measured. The specific values are shown in Table 2.

Table 2 Reliability and validity test

Variable	Cronbach's alpha	Composite reliability	AVE
DC	0.848	0.848	0.507
SE	0.839	0.84	0.512
POS	0.902	0.902	0.648
IWB	0.882	0.878	0.589

Note: DC=Digital Competence, SE= Self-efficacy, POS=Perceived organizational support, IWB=Innovative work behavior, AVE=Average variance extracted.

2. Hypothesis Testing

Correlation

Initial correlation analysis revealed significant positive relationships among all study variables. Digital competence showed moderate positive correlations with self-efficacy ($r = 0.212, p < 0.01$), perceived organizational support ($r = 0.251, p < 0.01$), and innovative work behavior ($r = 0.209, p < 0.01$). While modest in magnitude, these correlations suggest that employees with higher digital competence tend to exhibit greater self-efficacy and innovative behavior, and perceive more substantial organizational support.

Notably, self-efficacy demonstrated the strongest correlation with innovative work behavior ($r = 0.387, p < 0.01$), followed by perceived organizational support ($r = 0.364, p < 0.01$). The strength of these relationships suggests that psychological factors and organizational context play crucial roles in fostering innovative behavior, potentially more direct than technical competencies alone.

Table 3 Correlation between variables

	DC	SE	POS	IWB
DC	1			
SE	.212**	1		
POS	.251**	.424**	1	
IWB	.209**	.387**	.364**	1

Note: DC=Digital Competence, SE= Self-efficacy, POS=Perceived organizational support, IWB=Innovative work behavior, ** $p < 0.01$.

Hypothesis test

As shown in Figure 2, all the direct hypotheses proposed in this study are empirically supported. Especially, H1 assumes that employees' digital competences positively impact self-efficacy (path coefficient $\beta = 0.277***$), indicating that digital competences significantly enhance employees' self-efficacy. H2 assumes that employees' digital competences positively impact perceived organizational support (path coefficient $\beta = 0.304***$), showing that digital competences significantly positively impact perceived organizational support. H3 assumes that employees' digital competences positively impact innovative work behavior (path coefficient $\beta = 0.086*$); although the impact is small, it is still a significant positive relationship. H4 assumes that employees' self-efficacy

positively impacts innovative work behavior (path coefficient $\beta=0.324***$), showing that self-efficacy significantly promotes innovative work behavior. Finally, H5 assumes that employees' perceptions of organizational support positively impact innovative work behavior (path coefficient $\beta=0.255***$), indicating that perceived organizational support significantly enhances employees' innovative work behavior. These results indicate that digital competences, self-efficacy, and perceived organizational support have significantly promoted innovative work behavior, providing strong empirical support for further exploring how these factors affect employees' innovative behavior.

Model fit indexes

In this study, AMOS24.0 software was used to analyze the degree of fitting of the structural equation model. The results of model fit degree indexes are shown in Table 4, and all indexes meet the requirements of model fit degree. Specifically, the X^2/df ratio is less than 3, indicating a good fit of the model. Other fit indicators, including GFI (Goodness of Fit Index), AGFI (Adjusted Goodness of Fit Index), TLI (Tuck-Lewis Index), and CFI (Comparative Fit Index), are more significant than 0.9, indicating that the model has a good fit. In addition, the RMSEA (Root Mean Square Error of Approximation) value is lower than 0.08, indicating the model has a reasonable error approximation. In general, the results of these fitting indexes align with the fitting standards of structural equation models, indicating that the model has a good fit. Specific values are shown in Table 4.

Table 4 Model fit indexes result.

Indicators	X^2/df	GFI	AGFI	TLI	CFI	RMSEA
Value	2.048	0.92	0.9	0.945	0.952	0.05
Standard	<3	>0.9	>0.9	>0.9	>0.9	<0.08

Note: GFI=Goodness of Fit Index, AGFI=Adjusted Goodness of Fit Index, TLI=Tuck-Lewis Index, CFI=Comparative Fit Index, RMSEA=Root Mean Square Error of Approximation.

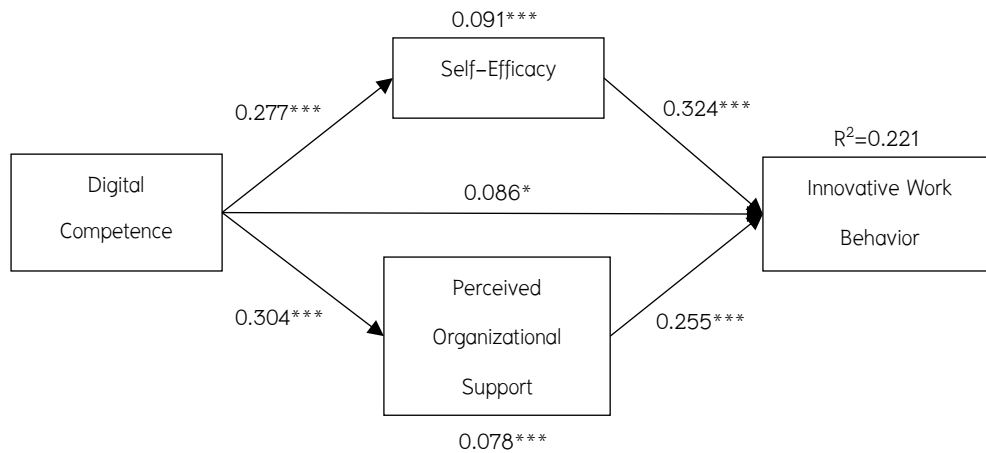


Figure 2 Research results

Mediation effect test

In this study, the bootstrapping method in AMOS was used to test the mediation effect; 5000 samples were set, and the significance of the mediation effect was evaluated based on a 95% confidence interval. The results are shown in Table 5, and all mediation hypotheses were supported. The mediation effect of H6 (employees' self-efficacy mediating between digital competences and innovative work behaviors) was significantly verified. The estimated value of the mediation effect was 0.091, the 95% confidence interval was [0.039, 0.158], and the p value was 0.000, indicating that self-efficacy significantly mediated between digital competences and innovative work behaviors. Similarly, the mediation effect of H7 (employees' perceived organizational support plays a mediating role between digital competences and innovative work behaviors) was also supported. The estimated value of the mediation effect was 0.078, the 95% confidence interval was [0.032, 0.142], and the p value was 0.001, indicating that perceived organizational support significantly mediated the relationship between digital competences and innovative work behaviors. The findings indicate that self-efficacy and perceived organizational support mediate the relationship between employees' digital competencies and innovative work behaviors.

Table 5. Mediation effect result

Hypothesis	Type of Effect	Estimate	Lower Bound	Upper Bound	Sig	Result
DC→SE→IWB	Indirect	0.091	0.039	0.158	0.000***	Accepted
DC→POS→IWB	Indirect	0.078	0.032	0.142	0.001***	Accepted

Note: DC=Digital Competence, SE= Self-efficacy, POS=Perceived organizational support, IWB=Innovative work behavior, ***p<0.001.

Discussion

This study investigated the complex relationships between digital competence, self-efficacy, perceived organizational support, and innovative work behavior in Chinese R&D companies. Through empirical analysis, our findings reveal both confirmatory and novel insights that extend our understanding of innovation dynamics in digitally transforming organizations, while also highlighting important theoretical and practical implications for fostering innovation in R&D settings.

The findings significantly extend Social Cognitive Theory (SCT) by illuminating how digital competence influences innovative behavior in R&D settings. While traditional applications of SCT have focused on general learning and performance outcomes, this study demonstrates how the theory can be adapted to explain innovation in digital contexts. The strong mediating effects of self-efficacy ($\beta = 0.091$, $p < 0.001$) and perceived organizational support ($\beta = 0.078$, $p < 0.001$) suggest that SCT's concept of reciprocal determinism needs to be reconceptualized for digital environments. Unlike previous studies that treated self-efficacy primarily as a general psychological resource (Newman et al., 2018), the current findings indicate that in digital contexts, self-efficacy acts as a crucial bridge between technical capabilities and innovative outcomes. This extends SCT by demonstrating how digital competence can enhance self-efficacy, which in turn facilitates innovative behavior—a relationship not previously explored in the traditional SCT framework.

The relationship between these findings and existing literature reveals important alignments and notable divergences. The positive relationship between digital competence and innovative behavior ($\beta = 0.086$, $p < 0.05$) supports findings from recent studies such as Carvalho et al. (2023) and Huu (2023). However, the relatively modest direct effect contradicts some earlier research suggesting stronger direct relationships. For instance, Labanauskaitė et al. (2021) reported more substantial direct effects of digital competence on innovation ($\beta = 0.31$) in European technology firms. This disparity might be attributed to cultural differences in how digital skills are leveraged for innovation, with Chinese organizations potentially placing greater emphasis on collective rather than individual innovation processes. While studies in Western contexts, such as Van Laar et al. (2020),

emphasize individual digital creativity and autonomy, the current results suggest that in Chinese R&D settings, organizational support – plays a more prominent role in facilitating innovation.

The findings also diverge from previous studies regarding the role of organizational support. While Bhatti et al. (2022) While the previous research found organizational support to be primarily a moderator of innovation relationships, the current results suggest it acts as a mediator, transforming digital competence into innovative outcomes. This difference might reflect the unique characteristics of Chinese R&D organizations, where hierarchical structures and collective orientation may enhance the importance of organizational support mechanisms. The strong mediating effect of self–efficacy aligns with recent meta–analytic findings. (Wei et al., 2020) However, it extends them by demonstrating how digital competence specifically enhances innovation–related self–efficacy. These results contradict studies suggesting that technical skills directly translate into innovative behavior. (Oberländer et al., 2020), highlighting instead the crucial role of psychological mechanisms.

These findings have important practical implications for R&D organizations seeking to enhance innovation capacity. Organizations should adopt a holistic approach to digital competence development beyond technical training to include self–efficacy building. This could be achieved through progressive skill–building exercises, allowing employees to experience success, peer mentoring programs providing role models for digital innovation, and recognition systems celebrating technical achievements and innovative applications. Organizations must also strengthen their support systems for digital innovation by establishing dedicated innovation labs, implementing flexible resource allocation systems, and creating clear pathways for employees to access technical and organizational support for innovative initiatives. Given the cultural context of Chinese R&D settings, organizations should balance individual and team–based innovation initiatives, incorporate collective decision–making processes in innovation management, and develop support systems that respect hierarchical structures while encouraging bottom–up innovation.

Conclusion

This study has advanced our understanding of the complex relationships between digital competence, self–efficacy, perceived organizational support, and innovative work behavior in the context of digital transformation through empirical analysis of 405 R&D company employees in China.

The findings reveal significant theoretical contributions, practical implications, and directions for future research that extend beyond the immediate context of Chinese R&D organizations.

The study makes important theoretical contributions by extending Social Cognitive Theory into the digital domain. By identifying digital competence as a crucial antecedent to both self-efficacy and innovative behavior, the research demonstrates how technical capabilities interact with psychological factors in digitally intensive environments. The mediating roles of self-efficacy and perceived organizational support reveal how digital competence influences innovation through multiple pathways, suggesting a more complex theoretical mechanism than previously understood in traditional frameworks.

For practitioners, the findings translate into several actionable recommendations. Organizations should implement comprehensive digital competence development programs that combine technical training with practical application opportunities. These programs should be supported by mentoring systems and progressive skill development approaches that enhance employee self-efficacy in digital innovation. Additionally, organizations need to create supportive institutional structures, including innovation laboratories, cross-departmental collaboration platforms, and flexible funding mechanisms for employee-initiated projects. The implementation of these recommendations should follow a phased approach aligned with organizational digital maturity and innovation capabilities.

The implications of this research extend beyond Chinese R&D companies to inform global digital transformation efforts. The strong mediating effects identified in the Chinese context suggest that collectivist cultures may require different approaches to fostering digital innovation compared to more individualistic Western settings. This highlights the importance of adapting innovation support systems to local cultural contexts while maintaining core elements of digital competence development.

Future research should adopt longitudinal designs to track how digital competence and innovative behavior co-evolve over time, particularly during periods of technological change. Cross-cultural studies comparing Asian, European, and American R&D organizations could reveal how cultural values influence the effectiveness of different support mechanisms. Additional investigation is needed regarding the roles of leadership styles, team dynamics, and organizational culture in digital innovation processes.

In conclusion, this research provides a foundation for understanding how organizations can effectively foster digital innovation by developing employee capabilities, enhancing self-efficacy, and providing appropriate organizational support. As digital transformation continues to reshape global business practices, these insights will become increasingly valuable for organizations seeking to build and maintain competitive advantage through innovation.

Suggestion

In terms of practical application, this study provides specific guidance for R&D companies on how to stimulate the innovative potential of their employees in the digital age. The results show that enterprises should prioritize digital capacity building for employees to ensure that employees can proficiently master and apply the latest digital tools and technologies. In addition, improving employees' self-efficacy is also key, because self-efficacy can increase employees' confidence in facing challenges, thus encouraging them to participate in innovation activities actively (Akbari et al., 2021). At the same time, enterprises should be committed to strengthening organizational support to create favorable conditions for employees' innovative activities by providing necessary resources, establishing incentive mechanisms, and creating an innovative atmosphere. These measures can not only improve the innovation ability of employees, but also enhance their sense of belonging to the organization and job satisfaction, thus further promoting the overall innovation ability of the company. Although this study has made meaningful findings, there are still some limitations. First, this study used cross-sectional data and could not fully reveal the causal relationship between the variables. Future research may consider adopting a longitudinal design to capture the dynamic relationship between these variables more accurately over time. Second, the sample was limited to R&D companies in China, which may limit the generalizability of the results. Future research can conduct similar studies in different countries and industries to verify the broad applicability of these findings. At the same time, future research can further explore the impact of digital competence on innovative behavior in different work environments and cultural contexts, especially considering the diverse challenges brought about by globalization. In addition, the study can also explore other factors that may affect employees' innovative behavior, such as leadership style, team dynamics, and external environmental pressure, to build a more comprehensive innovative behavior model.

New Knowledge

This study extends Social Cognitive Theory (SCT) by integrating digital competence as a key antecedent of innovative behavior and uncovering its complex pathways. While prior research has focused on direct links between technical capabilities and innovation (Oberländer et al., 2020; Van Laar et al., 2020), this study reveals that self-efficacy and perceived organizational support jointly mediate this relationship. By demonstrating these dual mediating effects, the research provides a more nuanced understanding of how digital competence translates into innovation in organizational settings.

Additionally, this study challenges previous assumptions by positioning perceived organizational support as a mediator rather than a moderator (Bhatti et al., 2022) and highlighting self-efficacy's critical role in enabling digital innovation. Methodologically, it contributes by refining measurement instruments for digital competence and validating them in an R&D setting in China, offering cross-cultural insights. These findings enhance SCT's applicability in digital environments and provide both theoretical and practical implications for fostering innovation.

References

- Aggarwal-Gupta, M., Vohra, N., & Bhatnagar, D. (2010). Perceived organizational support and Organizational commitment: the mediational influence of psychological well-being. *Journal of Business & Management*, 16(2). <https://doi.org/10.1504/JBM.2010.141182>
- Akbari, M., Bagheri, A., Imani, S., & Asadnezhad, M. (2021). Does entrepreneurial leadership encourage innovation work behavior? the mediating role of creative self-efficacy and support for innovation. *European Journal of Innovation Management*, 24(1), 1–22. <http://doi.org/10.1108/EJIM-10-2019-0283>
- Akram, T., Lei, S., Haider, M. J., & Hussain, S. T. (2020). The impact of organizational justice on employee innovative work behavior: mediating role of knowledge sharing. *Journal of Innovation & Knowledge*, 5(2), 117–129. <http://doi.org/10.1016/j.jik.2019.10.001>
- Alpkan, L., Bulut, C., Gunday, G., Ulusoy, G., & Kilic, K. (2010). Organizational support for intrapreneurship and its interaction with human capital to enhance innovative performance. *Management Decision*, 48(5), 732–755. <http://doi.org/10.1108/00251741011043902>

- Alshaabani, A., Naz, F., Magda, R., & Rudnák, I. (2021). Impact of perceived organizational support on OCB in the time of COVID-19 pandemic in Hungary: employee engagement and affective commitment as mediators. *Sustainability*, 13(14), 7800.
<http://doi.org.10.3390/su13147800>
- Andriyanti, N. P. V., & Supartha, I. W. G. (2021). Effect of perceived organizational support on organizational citizenship behavior with job satisfaction as mediating variables. *American Journal of Humanities and Social Sciences Research (AJHSSR)*, 5(1), 46–55.
<https://www.ajhssr.com/wp-content/uploads/2021/01/H215014655.pdf>
- Astuty, I., & Udin, U. (2020). The effect of perceived organizational support and transformational leadership on affective commitment and employee performance. *The Journal of Asian Finance, Economics and Business*, 7(10), 401–411.
<https://doi.org/10.13106/jafeb.2020.vol7.no10.401>
- Bandura, A., & Wessels, S. (1997). *Self-efficacy*: Cambridge University.
- Bhatti, S. H., Saleem, F., Murtaza, G., & Haq, T. U. (2022). Exploring the impact of green human resource management on environmental performance: the roles of perceived organizational support and innovative environmental behavior. *International Journal of Manpower*, 43(3), 742–762. <http://doi.org.10.1108/IJM-05-2020-0215>
- Brunetti, F., Matt, D. T., Bonfanti, A., De Longhi, A., Pedrini, G., & Orzes, G. (2020). Digital transformation challenges: strategies emerging from a multi-stakeholder approach. *The TQM Journal*, 32(4), 697–724. <http://doi.org.10.1108/TQM-12-2019-0309>
- Carvalho, L. P. d., Poletto, T., Ramos, C. C., Rodrigues, F. d. A., de Carvalho, V. D. H., & Nepomuceno, T. C. C. (2023). Predictors of digital competence of public university employees and the impact on innovative work behavior. *Administrative Sciences*, 13(5), 131.
<http://doi.org.10.3390/admsci13050131>
- Cetindamar Kozanoglu, D., & Abedin, B. (2021). Understanding the role of employees in digital transformation: conceptualization of digital literacy of employees as a multi-dimensional organizational affordance. *Journal of Enterprise Information Management*, 34(6), 1649–1672. <http://doi.org.10.1108/JEIM-01-2020-0010>
- Cherian, J., & Jacob, J. (2013). Impact of self efficacy on motivation and performance of employees. *International Journal of Business and Management*, 8(14), 80.
<http://doi.org.10.5539/ijbm.v8n14p80>

- Chiang, C.-F., & Hsieh, T.-S. (2012). The impacts of perceived organizational support and psychological empowerment on job performance: the mediating effects of organizational citizenship behavior. *International Journal of Hospitality Management*, 31(1), 180–190. <http://doi.org/10.1016/j.ijhm.2011.04.011>
- De Jong, J., & Den Hartog, D. N. (2008). Innovative work behavior: measurement and validation. *EIM Business and Policy Research*, 8(1), 1–27.
- Demir, S. (2020). The role of self-efficacy in job satisfaction, organizational commitment, motivation and job involvement. *Eurasian Journal of Educational Research*, 20(85), 205–224. <https://dergipark.org.tr/en/pub/ejer/issue/52308/686061>
- Eisenberger, R., Rhoades Shanock, L., & Wen, X. (2020). Perceived organizational support: why caring about employees counts. *Annual Review of Organizational Psychology and Organizational Behavior*, 7(1), 101–124. <https://doi.org/10.1146/annurev-orgpsych-012119-044917>
- Gümüş, M. M., & Kukul, V. (2023). Developing a digital competence scale for teachers: validity and reliability study. *Education and Information Technologies*, 28(3), 2747–2765. <http://doi.org/10.1007/s10639-022-11213-2>
- Hausman, A., & Johnston, W. J. (2014). The role of innovation in driving the economy: lessons from the global financial crisis. *Journal of Business Research*, 67(1), 2720–2726. <http://doi.org/10.1016/j.jbusres.2013.03.021>
- Hill, L. A., Brandeau, G., Truelove, E., & Lineback, K. (2014). *Collective genius: the art and practice of leading innovation*: Harvard Business Review.
- Huu, P. T. (2023). Impact of employee digital competence on the relationship between digital autonomy and innovative work behavior: a systematic review. *Artificial Intelligence Review*, 56(12), 14193–14222. <https://doi.org/10.1007/s10462-023-10492-6>
- Jun, W., Nasir, M. H., Yousaf, Z., Khattak, A., Yasir, M., Javed, A., & Shirazi, S. H. (2022). Innovation performance in digital economy: does digital platform capability, improvisation capability and organizational readiness really matter?. *European Journal of Innovation Management*, 25(5), 1309–1327. <http://doi.org/10.1108/EJIM-10-2020-0422>
- Khin, S., & Ho, T. C. F. (2020). Digital technology, digital capability and organizational performance. *International Journal of Innovation Science*, 11(2), 177–195. <http://doi.org/10.1108/IJIS-08-2018-0083>

- Khodakarami, P., & Zakaria, Z. (2015). The relationship between innovative behavior and sustainable development. *European Journal of Business and Management*, 7(23), 160–169.
<https://core.ac.uk/download/pdf/234626739.pdf>
- Labanauskaitė, D., Župerkienė, E., Kumpf, A., Šimanskienė, L., & Koller, S.–M. (2021). Development of digital and entrepreneurial competences for the future labour market needs. *Entrepreneurship and Sustainability Issues*, 8(3), 565–581.
[http://doi.org.10.9770/jesi.2021.8.3\(35\)](http://doi.org.10.9770/jesi.2021.8.3(35))
- Le, P. B., & Lei, H. (2019). Determinants of innovation capability: the roles of transformational leadership, knowledge sharing and perceived organizational support. *Journal of Knowledge Management*, 23(3), 527–547. <http://doi.org.10.1108/JKM-09-2018-0568>
- Maan, A. T., Abid, G., Butt, T. H., Ashfaq, F., & Ahmed, S. (2020). Perceived organizational support and job satisfaction: a moderated mediation model of proactive personality and psychological empowerment. *Future Business Journal*, 6(1), 21.
<http://doi.org.10.1186/s43093-020-00027-8>
- Maran, T. K., Liegl, S., Davila, A., Moder, S., Kraus, S., & Mahto, R. V. (2022). Who fits into the digital workplace? mapping digital self-efficacy and agility onto psychological traits. *Technological Forecasting and Social Change*, 175, 121352.
<https://doi.org/10.1016/j.techfore.2021.121352>
- Nargotra, M., & Sarangal, R. K. (2023). Perceived organizational support and intention to stay: the mediating effect of employee engagement. *FII Business Review*, 12(3), 317–327.
<http://doi.org.10.1177/23197145211042521>
- Newman, A., Tse, H. H. M., Schwarz, G., & Nielsen, I. (2018). The effects of employees' creative self-efficacy on innovative behavior: the role of entrepreneurial leadership. *Journal of Business Research*, 89, 1–9. <https://doi.org/10.1016/j.jbusres.2018.04.001>
- Ng, T. W. H., & Lucianetti, L. (2016). Within-individual increases in innovative behavior and creative, persuasion, and change self-efficacy over time: A social-cognitive theory perspective. *Journal of Applied Psychology*, 101(1), 14–34. <http://doi.org.10.1037/apl0000029>
- Oberländer, M., Beinicke, A., & Bipp, T. (2020). Digital competencies: a review of the literature and applications in the workplace. *Computers & Education*, 146, 103752.
<https://doi.org/10.1016/j.compedu.2019.103752>

- Opazo-Basáez, M., Vendrell-Herrero, F., & Bustinza, O. F. (2022). Digital service innovation: a paradigm shift in technological innovation. *Journal of Service Management*, 33(1), 97–120. <http://doi.org.10.1108/JOSM-11-2020-0427>
- Ridwan, M., Mulyani, S. R., & Ali, H. (2020). Improving employee performance through perceived organizational support, organizational commitment and organizational citizenship behavior. *Systematic Reviews in Pharmacy*, 11(12).
- Santoso, H., Elidjen, E., Abdinagoro, S., & Arief, M. (2019). The role of creative self-efficacy, transformational leadership, and digital literacy in supporting performance through innovative work behavior: Evidence from telecommunications industry. *Management Science Letters*, 9(13), 2305–2314. <http://doi.org.10.5267/j.msl.2019.7.024>
- Slåtten, T. (2014). Determinants and effects of employee's creative self-efficacy on innovative activities. *International Journal of Quality and Service Sciences*, 6(4), 326–347. <http://doi.org.10.1108/IJQSS-03-2013-0013>
- Spante, M., Hashemi, S. S., Lundin, M., & Algers, A. (2018). Digital competence and digital literacy in higher education research: Systematic review of concept use. *Cogent Education*, 5(1), 1519143. <http://doi.org.10.1080/2331186X.2018.1519143>
- Teng, C.-C., Hu, C.-M., & Chang, J.-H. (2020). Triggering creative self-efficacy to increase employee innovation behavior in the hospitality workplace. *The Journal of Creative Behavior*, 54(4), 912–925. <http://doi.org.10.1002/jocb.419>
- Thompson, G., & Dooley, K. (2019). Ensuring translation fidelity in multilingual research. In *The routledge handbook of research methods in applied linguistics* (pp. 63–75): Routledge.
- Tramontano, C., Grant, C., & Clarke, C. (2021). Development and validation of the e-work self-efficacy scale to assess digital competencies in remote working. *Computers in Human Behavior Reports*, 4, 100129. <http://doi.org.10.1016/j.chbr.2021.100129>
- Van Laar, E., Van Deursen, A. J. A. M., Van Dijk, J. A. G. M., & De Haan, J. (2020). Determinants of 21st-century skills and 21st-century digital skills for workers: A systematic literature review. *Sage Open*, 10(1). <http://doi.org.10.1177/2158244019900176>
- Wei, J., Chen, Y., Zhang, Y., & Zhang, J. (2020). How does entrepreneurial self-efficacy influence innovation behavior? Exploring the mechanism of job satisfaction and Zhongyong thinking. *Frontiers in Psychology*, 11. <http://doi.org.10.3389/fpsyg.2020.00708>

- Wolff, C., Mikhieieva, O., & Nuseibah, A. (2021). Competences and the digital transformation. In *Paper presented at the Project Management and Engineering Research: AEIPRO 2019*.
- Wu, J., Gong, X., & Liu, Y. (2022). Research on the influence mechanism of employees' innovation behavior in the context of digital transformation. *Frontiers in Psychology, 13*.
<http://doi.org.10.3389/fpsyg.2022.1090961>
- Yamane, T. (1967). *Statistics: an introductory analysis* (2nd ed.). Harper and Row.
- Zhang, J., & Chen, Z. (2024). Exploring human resource management digital transformation in the digital age. *Journal of the Knowledge Economy, 15*(1), 1482–1498.
<http://doi.org.10.1007/s13132-023-01214-y>