The Impact of Digital Transformation on Enterprise Innovation Resilience

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Abstract. In this new phase of development, where the digital economy and uncertainty intertwine, enterprise innovation resilience (EIR) has become a key strategic asset for weathering external shocks and sustaining its capacity for continuous innovation. Based on data from A-share listed companies from 2011 to 2024, this study employs a two-way fixed-effects model to systematically examine the impact and mechanisms of digital transformation (DIG) on EIR. Research has found that DIG significantly enhances EIR. DIG drives the development and strengthening of EIR through three key pathways: optimizing the efficiency of resource allocation, enhancing an organization's ability to respond dynamically, and improving the capabilities for intelligent risk early warning and remediation. The findings of this study contribute to the theoretical understanding of EIR in the context of the digital economy, providing empirical evidence and decision-making guidance for governments to formulate tailored digital support policies and for enterprises to enhance their risk-resilience and sustained innovation capabilities through DIG.

Keywords: Digital Transformation, Enterprise Innovation Resilience, Resource Allocation, Organizational Collaboration, Risk Management.

1 Introduction

In this new phase of development, where the digital revolution intersects with global technological competition, enterprise innovation resilience (EIR) is increasingly becoming a key measure of its core competitiveness. EIR refers to a company's strategic capacity to maintain the continuity of its innovation activities in the face of external shocks, technological changes, or market fluctuations, while achieving self-repair and a leap in capabilities. At present, China is at a critical juncture in its transition from a major manufacturing nation to a manufacturing powerhouse. The 2025 Central Economic Work Conference explicitly called for "strengthening the role of enterprises as the main drivers of innovation," with the aim of establishing a strategic pathway from scientific and technological strength to the strength of enterprises, industries, and the economy. However, the high investment, long timeframes, and high risks inherent in innovation activities mean that drastic changes in the external environment can easily

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disrupt a company's innovation chain. Given this, how to strengthen EIR amid uncertainty and ensure that innovation activities continue to function in adverse conditions has become a critical practical issue affecting corporate survival and industrial security.

In tandem with EIR, digital transformation (DIG)—as a core strategic focus in the digital economy era—is profoundly reshaping the underlying logic and operational mechanisms of corporate innovation activities. The report to the 20th National Congress of the Communist Party of China also explicitly called for "promoting the deep integration of the digital economy and the real economy," providing fundamental guidance for enterprises' DIG. The *Implementation Guidelines for the Digital Transformation of Manufacturing Enterprises*, jointly issued by the Ministry of Industry and Information Technology and two other departments, further stipulates that enterprises should follow a closed-loop management approach of "planning—implementation—evaluation—optimization" to advance their DIG in a phased manner, moving from specific initiatives to a broader scope.

DIG provides a new source of momentum for fostering and strengthening EIR by reshaping resource allocation, optimizing collaborative efficiency, and unlocking the value of data. However, the underlying logic and mechanisms linking these two aspects have not yet been systematically elucidated. This paper aims to conduct an in-depth examination of the impact of DIG on EIR and its transmission pathways, with the goal of providing theoretical foundations and empirical support to guide enterprises in leveraging digital strategies to enhance their risk-resilience and sustain their innovation capabilities.

2 Literature Review

Existing studies have examined the mechanisms through which DIG drives EIR from perspectives such as digital technology, resource allocation, and organizational capabilities. Li Chuntao et al.[1] have demonstrated that fintech drives corporate innovation by alleviating financing constraints, thereby providing a financial perspective on how digitalization empowers innovation; Zhang Jichang and Long Jing[2] found, based on data from high-tech enterprises, that DIG enhances innovation performance and strengthens EIR by improving innovation capacity, absorptive capacity, and adaptability; Wang Cai[3] further noted that DIG influences innovation performance through dynamic capabilities, thereby providing organizational and institutional support for the development of EIR. Together, these studies have established a core framework for the relationship between DIG and EIR.

Research on DIG has yielded systematic findings, focusing on transformation mechanisms, economic effects, and practical pathways. Through bibliometric analysis, Kashif Nadeem et al.[4] systematically reveal the close link between digital transformation and sustainable development, as well as future research trends.; Zhao Chenyu et al.[5] found that DIG can improve total factor productivity, with mechanisms including the optimization of innovation capabilities and human capital structure; Li Qi et al.[6] confirmed that DIG improves performance through supply chain integration and is positively moderated by entrepreneurship; Huang Dayu et al.[7] utilized text analysis

to demonstrate that DIG enhances corporate value and factor allocation efficiency, systematically elucidating the intrinsic mechanisms and practical value of DIG.

Research on the factors influencing corporate innovation provides a solid theoretical foundation for studies on EIR. Sarah van Duijn et al.[8] indicates that scientifically planning digital transformation and managing key factors are central to enhancing a company's innovative resilience; Wu Weiwei and Zhang Tianyi[9], also based on signaling theory, revealed that R&D and non-R&D subsidies have asymmetric effects on the innovation output of start-ups; Wang Yonggui and Wang Linlin[10] classified the digital strategies of traditional enterprises, providing strategic guidance for companies to achieve sustained innovation through digitalization; Sarah van Duijn et al.[11] have pointed out that digital transformation must take into account socio-political complexities in order to build robust innovation resilience within organizations.

In summary, while existing literature has extensively explored DIG, EIR, and their influencing factors, there remains a relative scarcity of studies that directly examine the impact of DIG on EIR. This paper focuses on the core theme of how DIG affects EIR. Based on a review of theoretical mechanisms and research hypotheses, we employ OLS regression to conduct empirical tests. By systematically identifying the effects and underlying logic of DIG on EIR, this study enriches the body of research on EIR in the context of the digital economy and provides empirical evidence to inform corporate practice and policy-making.

3 Theoretical Analysis and Research Hypotheses

From the perspective of resource allocation, DIG breaks down information barriers, enhances the efficiency and precision of the flow of innovation factors, alleviates financing constraints and resource misallocation in innovation activities, and provides a stable resource foundation for sustained innovation [12]. From the perspective of organizational capabilities, digitalization promotes flatter organizational structures and agile decision-making, enhancing enterprises' ability to respond rapidly to technological changes and market fluctuations while reducing the risk of disruptions to the innovation chain caused by external shocks. DIG drives the evolution of organizational structures toward networked and flatter models, thereby improving enterprises' responsiveness to market changes and technological disruptions [13]. Accordingly, this paper proposes the following core research hypothesis:

H: DIG has a significant positive impact on EIR.

4 Empirical Analysis

4.1 Empirical model

To empirically examine the impact of DIG on EIR, this paper establishes the following two-way fixed-effects model:

$$EIR_{it} = \alpha + \beta DIG_{it} + Year_t + Firm_i + \varepsilon_{it} \quad (1)$$

In this model, EIR_{it} represents the level of EIR of firm i in year t. DIG_{it} is the core explanatory variable for the degree of DIG. The coefficient β measures the extent to which DIG influences EIR. Additionally, $Year_t$ is the year-specific fixed effect, $Firm_i$ is the firm-specific fixed effect, and ε_{it} is the random error term.

4.2 Relevant variables

Dependent variable. The level of enterprise innovation resilience (EIR) is measured using the method proposed by Lu Zhengwen et al.[14]. Key explanatory variables. The degree of enterprise digital transformation (DIG) is measured using the method proposed by Zhang Yongkun et al.[15].

4.3 Data sources

Data from A-share listed companies on the Shanghai and Shenzhen stock exchanges from 2011 to 2024 were selected as the study sample. Additionally, the data on the degree of DIG and levels of EIR used in this study are primarily sourced from the CSMAR database, with supplementary data drawn from the annual reports and publicly disclosed information of the respective listed companies. Descriptive statistics are presented in Table 1.

Table 1. Descriptive Statistics.

Variable	N	mean	sd	min	p50	max
EIR	20,857	3.6650	20.8068	-65.1983	-0.1115	251.5847
DIG	29,789	-3.4854	1.8675	-9.0990	-3.4500	0.0000

5 Results of the Benchmark Regression

The benchmark results regarding the impact of DIG on EIR are shown in Table 2. As can be seen from the three models in Table 2, the coefficient for DIG is significantly positive. This indicates that DIG can effectively enhance EIR, thereby confirming research hypothesis H.

Table 2. Results of the Benchmark Regression.

Variable	(1) EIR	(2) EIR	(3) EIR
DIG	1.1460***	0.5673***	0.5061***
	(12.8173)	(3.1620)	(2.7215)
_cons	7.0573***	5.0641***	4.8538***
	(16.8678)	(7.6458)	(7.1652)

Individual fixed effects	NO	YES	YES
Time-fixed effect	NO	NO	YES
N	13906	13712	13712
r^2	0.0102	0.1543	0.1621

Note: Figures in parentheses are robust standard errors. * indicates $p < 0.10$, ** indicates $p < 0.05$, and *** indicates $p < 0.01$.

6 Conclusions and Policy Recommendations

The results indicate that DIG has a significant positive impact on EIR. This study has significant policy implications: The government should accelerate the development of new digital infrastructure, such as 5G and the Industrial Internet, to reduce the costs of enterprise transformation. It should encourage enterprises to integrate technologies like big data and artificial intelligence into the entire innovation process, break down barriers to digital application, and promote the deep integration of digitalization with innovation activities. By leveraging digital technology, we can build a solid foundation to support enterprises' ability to withstand risks through innovation. Second, precisely unblock the transmission channels through which digital technology empowers EIR.

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