Journal of Economics and Public Finance
ISSN 2377-1038 (Print) ISSN 2377-1046 (Online)
Vol. 12, No. 2, 2026
www.scholink.org/ojs/index.php/jepf

Original Paper

Innovation Ecosystem Resilience and Corporate Innovation Investment: Evidence from China's Specialized, Refined, Differential, and Innovative Enterprises

Qingxin Li[1*]

[1] School of Finance and Economics, Jiangsu University, Zhenjiang, 212000, China

[*] Corresponding author, E-mail: 2055664587@qq.com

Received: March 2, 2026 Accepted: April 20, 2026 Online Published: April 23, 2026

doi:10.22158/jepf.v12n2p1 URL: http://dx.doi.org/10.22158/jepf.v12n2p1

Abstract

China's Specialized, Refined, Differential, and Innovative (SRDI) enterprises are the core force for industrial transformation and upgrading, as well as for breakthroughs in key core technologies. Innovation investment is a crucial support for cultivating their core competitiveness and achieving high-quality development. However, these enterprises face challenges such as constraints on innovation resources and an uncertain external environment, requiring coordinated internal and external empowerment. The resilience of the innovation ecosystem provides external support, while digital transformation connects internal and external resources; the mechanism through which these factors influence enterprise innovation investment urgently needs to be explored. This paper takes SRDI enterprises listed on the Shanghai, Shenzhen, and Beijing Stock Exchanges from 2013 to 2024 as samples to investigate the impact of innovation ecosystem resilience, analyze the differentiated effects of its three dimensions, and test the mediating role of digital transformation. The study uses entropy method and text analysis to quantify indicators and conducts heterogeneity analysis. Empirical results show that both innovation ecosystem resilience and its three dimensions positively promote innovation investment, with the resistance effect being the most prominent; digital transformation plays a mediating role; this impact is more significant in large-scale, non-state-owned, technology- and capital-intensive enterprises, and non-manufacturing enterprises benefit slightly more than manufacturing enterprises.

Keywords

Innovation Ecosystem Resilience; Specialized, Refined, Differential, and Innovative enterprises; Innovation Investment

1. Introduction

As of July 2023, China has cultivated a total of 12,000 specialized and new "little giant" enterprises and 98,000 SRDI small and medium-sized enterprises, which play a leading role in their respective fields and become a key driving force for economic transformation and upgrading. At the same time, "specialized, special and new" enterprises are still in the stage of cultivation and development, and innovation investment is crucial to their future growth. According to the "Development Report on Specialized, Special and New Small and Medium-sized Enterprises (2022)" jointly released by the China Industrial Internet Research Institute, the China Small and Medium-sized Enterprise Development Promotion Center, and the China Academy of Information and Communications Technology, the average R&D intensity of specialized, special and new "little giant" enterprises reached 8.9%, which is greater than 5% of the overall A-share market. The above data confirms the characteristics of strong innovation vitality and high level of R&D investment in specialized and special new enterprises. However, Professor Hermann Simon said that "invisible champions" attach great importance to innovation, and their R&D expenditure accounts for twice as much as that of ordinary enterprises. From this point of view, the innovation of China's SRDI enterprises has a long way to go. In addition, in the development process of China's "specialized, refined, and new" enterprises, it inevitably faces the triple dilemma of innovation complexity, resource constraints, and long-term cultivation of specialization, refinement, and innovation. The cultivation and development of "specialized, refined, and new" enterprises require long-term innovation investment and accumulation, so what internal and external key factors are affected by the long-term R&D activities of "specialized, refined, and new" enterprises, and it is particularly important to clarify the mechanism to promote the high-quality development of China's "specialized, refined, and new" enterprises?

When in-depth study of the innovation investment mechanism of "specialized, special and new" enterprises, the importance of innovation ecosystem resilience as an external environment cannot be ignored. At the 2020 Scientist Symposium, General Secretary Xi Jinping proposed that in order to better transform scientific and technological achievements, the most important thing is to establish and improve the scientific and technological innovation ecology and continue to stimulate innovation vitality. The 2023 edition of the Blue Book of Macroeconomics clearly points out that the core of the process of Chinese-style modernization lies in innovation-driven and efficiency upgrades. It is worth noting that the innovation ecosystem is far from being summarized by a simple input-output model, it is an ecological, organic dynamic system that follows the concept of ecology. The innovation ecosystem is an open and complex system of symbiotic competition and dynamic evolution between innovation-related organizations and the innovation environment through the connection and transmission of material flow, energy flow and information flow. The innovation ecosystem is characterized by openness, collaboration and self-organization, and a small external shock can have a multiplier impact on the system. Resilience is the ability to adapt and recover from external environmental disturbances. The resilience of the innovation ecosystem mitigates the adverse effects of external conflicts on enterprises to a certain extent.

In this macro context, as the backbone of the innovation system, the interaction between innovation investment and the resilience of the innovation ecosystem is becoming more and more significant. So, can the resilience of the innovation ecosystem promote the improvement of innovation investment of "specialized, special and new" enterprises?

From an external to internal perspective, the importance of digital transformation cannot be ignored. This transformation not only significantly enhances enterprises' ability to acquire innovation elements, such as data, advanced programs, and technical knowledge, but also promotes the advancement of digital technologies through the application of big data, increasing enterprises' willingness to invest in R&D. Digital transformation has a positive impact on technological innovation; it optimizes the flow of information and resource allocation within enterprises, improves the abundance of internal cash flow, and provides a solid foundation for 'specialized, refined, distinctive, and innovative' (SMEs) to increase R&D investment. It is worth noting that from the external environment to internal implementation, and then to the execution and continuity of innovation investment, active participation and effective decision-making by enterprise management are required. Therefore, there are still many gaps in existing empirical research regarding the impact of innovation ecosystem resilience on innovation investment among SRDI enterprises, and the underlying mechanisms remain to be clarified. This paper focuses on studying the impact of innovation ecosystem resilience on enterprise innovation investment and examines the role of digital transformation in the relationship between the two, aiming to provide empirical evidence for the innovation investment of 'specialized, refined, distinctive, and innovative' enterprises and promote a positive role of innovation ecosystem resilience in their innovation investment. For these innovative enterprises, it also provides generalizable reference value in terms of innovation management and financial management. At the same time, this study combines classical management theories to explore the impact of innovation ecosystem resilience on the innovation investment of SRDI enterprises, thereby enriching related research.

2. Literature Review

2.1 Factors Influencing Innovation in 'Specialized, Refined, Differential, and Innovative' Enterprises

FromBy reviewing the literature related to Specialized, Refined, Differential, and Innovative (SRDI) enterprises, it was found that, by analogy with Chinese SRDI enterprises, the United States has niche enterprises, Japan has high-niche enterprises, and Germany has hidden champions. Due to the limited foreign-language literature on SRDI enterprises, this paper cites literature related to these enterprises as relevant literature on the innovation of SRDI enterprises. From the perspective of industrial development balance and synergy, Julian (2022) pointed out that differences in industrial development balance and the degree of synergy may affect the strategic goals of innovation and development in SRDI enterprises. Balohp and Rantmb (2013) focused on interaction efficiency with embedded environments. Hayakawa et al. (2012) emphasized strengthening China’s production networks and regional cooperation to enhance the innovation capabilities of 'hidden champion' enterprises. From the perspective of knowledge spillover effects, Schenkenhofer et al. (2024) found that the regional proximity of SRDI enterprises to universities positively impacts their innovation output. Compared with other SRDI enterprises, those located near universities achieve higher innovation output, and the effect of knowledge spillover is greatest for universities with strong engineering capabilities, indicating that SRDI enterprises mainly benefit from applied and technical knowledge. Díez-Vial et al. (2015) explained that through their own R&D and deep understanding of customer needs, these enterprises are able to transform university knowledge into commercially attractive innovations and products. The innovation process and resource allocation of 'niche enterprises' are highly efficient, with this efficiency attributed to four management practices: internal R&D, open innovation, complex intellectual property management, and significant investment in human capital (Enkel et al., 2009). From the perspective of monetary externalities, Eder, J. et al. (2019) state that knowledge spillover effects and monetary externalities help 'niche enterprises' maintain strong innovation capabilities and competitiveness in niche markets. From the perspective of policy support and business environment, Hua et al. (2023) noted that domestic value chains play a key role in industrial upgrading in developing countries, and building new global-local connections under China's 'dual circulation' strategy is a pragmatic path to advancing the 'Innovative China' strategy. Local government policies, such as special financial subsidies, tax exemptions, and public platform construction, help SRDI enterprises reduce production and innovation costs. Gennian et al. (2024) argued that local governments must adhere to the 'bucket principle' and optimize the business environment in line with local development through the concept of dynamic adaptation. Adopting a 'beads-on-a-chain' organizational thinking helps construct distinctive regional industrial chains, thereby promoting the emergence and innovation of SRDN enterprises.

2.2 The Impact of Digital Transformation on Corporate Innovation

From the perspective of organizational models, Adner et al. (2019) pointed out that digital transformation expands a company's connectivity and integration capabilities and strengthens inter-organizational interactions. By improving consumer interactions and value exchange processes, it provides opportunities to innovate new business and organizational models. Nambisan et al. (2017) indicated that digital transformation has revolutionized traditional innovation management concepts and established a completely new digital innovation management system. Digital capabilities reflect a company's efficiency and depth in using information technology, and having high-level digital capabilities can help SMEs overcome resource constraints, gain innovation advantages, and thereby improve innovation performance. From the perspective of innovation performance, Scuotto et al. (2021) found a correlation between individual digital capabilities and the innovation performance of SMEs. From the perspective of innovation subjects, Verganti (2010) stated that digital technology can drive enterprise innovation, and the integration of digital technology and innovation connects various innovation stages, helping to alleviate information asymmetry among innovation subjects, thus enhancing the development level of new products. From the perspective of innovation models, Smith (2018) believes that the rise of digital technology has changed the ways and scope of enterprise innovation. Traditional concepts of innovation are usually related to the improvement of products or services, but the emergence of digital technology has made innovation more extensive and profound. Digital technology can not only improve the quality of products and services but also reshape entire production processes and business models, bringing a richer connotation to enterprise innovation.

2.3 Resilience of Innovation Ecosystems

The term "resilience" has been translated as resilience, elasticity, or restorative capacity. Holling (1973) introduced it into social-ecological systems. Van der Vegt et al. (2015) Scholars generally describe resilience as the ability of a system, organization, or individual to cope with shocks and recover from adversity. Existing research on the concept of resilience is usually based on two perspectives: one emphasizes the "passive response" attribute, believing that resilience is the response and coping carried out by the subject after experiencing adverse events (Desjardine et al., 2019). Such research usually focuses on post-event rebounds or overcompensation results; the other perspective emphasizes the "active adaptation" attribute of resilience. Hamel et al. (2003) believe it refers to the ability of the subject to identify potential risks and take proactive measures to ensure that the organization is prepared when facing a crisis. Holling (1973) introduced it into social-ecological systems. Today, it has become a research hotspot in the field of management, expanding the scope of innovation management research.

Ecosystem resilience: Boschma (2015) proposed that system resilience is the ability of a system to maintain stability in the face of external environmental changes in order to achieve better adaptability. Roundy et al. (2017) discussed the formation mechanism of entrepreneurial ecosystem resilience, and Ramezani et al. (2020) provided a research review on business ecosystem resilience. Existing research on ecosystem resilience, in addition to including 'innovation ecosystem resilience' and 'digital innovation ecosystem resilience,' also focuses on 'entrepreneurial ecosystem resilience' and 'business ecosystem resilience.'Resilience of the innovation ecosystem refers to the system's ability to quickly recover to its initial or even higher functional state when subjected to external shocks, through measures such as collaboration among actors and internal resource integration (Wang et al., 2023). In the innovation ecosystem, innovation actors closely cooperate, enhancing the resilience of the innovation ecosystem through the exchange of material resources and information interaction (Meerow et al., 2016; Surie, 2017).

3. Theoretical Analysis and Research Hypotheses

3.1 The Impact of Innovation Ecosystem Resilience on the Innovation Investment of SRDI Enterprises

The impact of innovation ecosystem resilience on the innovation investment of SRDI enterprises is essentially a collaborative process of 'empowerment from the external institutional environment' and 'transformation of internal enterprise capabilities.' According to new institutional economics, it can build the institutional foundation for innovation investment by reducing transaction costs, stabilizing expectations, and shaping incentives; dynamic capability theory points out that SRDI enterprises can transform external institutional dividends into actual innovation investment through capabilities such as resource integration and reconstruction. From an external perspective, the core of innovation ecosystem resilience is to build an institutional system that balances stability and flexibility, including formal institutions such as policy support and property rights protection, as well as informal institutions such as innovation culture and collaborative practices, providing a guarantee for enterprise innovation investment; from an internal perspective, enterprises actively convert ecosystem dividends into innovation momentum through dynamic capabilities such as environmental insight and resource integration. The two form a virtuous cycle, promoting the positive effect of innovation ecosystem resilience on enterprise innovation investment.

The resistance of the resilience of an innovation ecosystem is manifested in its ability to withstand external disturbances and maintain stability, relying on institutional stability. At the level of formal institutions, stable R&D subsidies, intellectual property protection, and financial supply ensure the continuity of corporate innovation investment; at the level of informal institutions, industry collaboration practices and trust relationships reduce cooperation costs. Enterprises transform this stability into long-term innovation momentum through dynamic capabilities. Resilience is the ability to rapidly recover after shocks, relying on the adaptability and reparability of institutions. Under external shocks, emergency subsidies, technology trading platforms, and risk compensation systems can alleviate corporate difficulties; industry mutual aid practices and a fault-tolerant culture accelerate innovation restart. Enterprises use dynamic capabilities to connect resources and adjust strategies, maintaining the continuity of innovation investment. Evolvability is the ecosystem's ability to iteratively upgrade, with the core being the innovativeness and guidance of institutions. Special subsidies, achievement transformation, and cross-field collaboration systems guide corporate innovation investment toward high-end areas; a frontier exploration culture stimulates the willingness to innovate. Enterprises leverage dynamic capabilities to capture directions and integrate resources, promoting the upgrading of innovation investment. Based on the above analysis, this study proposes the following hypotheses:

Hypothesis 1: The resilience of the innovation ecosystem is positively related to the innovation investment of SRDI enterprises.

Hypothesis 1a: The resistance level of the innovation ecosystem resilience is positively related to the innovation investment of SRDI enterprises.

Hypothesis 1b: The recovery level of the innovation ecosystem resilience is positively related to the innovation investment of SRDI enterprises.

Hypothesis 1c: The evolution level of the innovation ecosystem resilience is positively related to the innovation investment of SRDI enterprises.

3.2 The Intermediary Role of Digital Transformation

The resilience of the innovation ecosystem has a profound impact on the digital transformation of 'specialized and innovative' enterprises. Based on the theory of information asymmetry, there are information gaps in enterprise digital transformation, which bring transformation risks and uncertainties, while the three dimensions of innovation ecosystem resilience can effectively solve this problem.

Resistance, by reserving redundant resources and building heterogeneous collaborative networks, provides a stable environment and comprehensive information for transformation, reducing blind decision-making; recovery, through dynamic adaptation mechanisms and learning effects, helps enterprises adjust strategies, integrate resources, and restart transformation when faced with setbacks; evolutionary capability, by exploring the new value of resources and leveraging ecological synergy effects, enables enterprises to overcome technological bottlenecks and promotes high-end transformation. Based on the digital empowerment theory, digital transformation promotes enterprise innovation investment from multiple dimensions: through technologies such as automated processes, data-driven decision-making, and cloud computing, it improves operational efficiency and reduces innovation and IT costs; by leveraging digital marketing and platform economy to overcome geographical limitations and providing personalized services based on user profiles, it expands the market and increases innovation opportunities; it optimizes user experience, accumulates loyal customers, obtains innovation feedback, and stimulates innovation motivation. In summary, innovation ecosystem resilience lays a solid foundation for digital transformation and reduces transformation risks; digital transformation, in turn, ensures and drives innovation investment, forming a virtuous cycle, so that the resilience of the innovation ecosystem, through the bridge of digital transformation, is closely linked to the innovation investment of 'specialized and innovative' enterprises, promoting long-term commitment to innovation investment. Therefore, the following research hypothesis is proposed:

Hypothesis 2: Innovation ecosystem resilience promotes the increase of innovation investment in SRDI enterprises through digital transformation.

4. Research Design

4.1 Sample Selection and Data Sources

This paper selects data from 2013 to 2024 for SRDI enterprises publicly listed on the Shanghai Stock Exchange, Shenzhen Stock Exchange, and Beijing Stock Exchange as the research sample, and the collected data are screened as follows: (1) ST, ST*, and PT companies are excluded to avoid results being affected by abnormal data; (2) samples with severely missing data are excluded; (3) continuous variables are subjected to 1% Winsorization at both ends to avoid the influence of extreme values. The research data in this paper mainly come from the CSMAR database, Wind database, China Statistical Yearbook, China Science and Technology Statistical Yearbook, China High-tech Industry Statistical Yearbook, Compilation of Science and Technology Statistical Data of Higher Education Institutions, corporate annual reports, and other official websites, and the final data are obtained through manual collation.

4.2 Definition of Variables

Definition of Innovation Investment: This study draws on the work of existing scholars, referring to the approach of Luo Hong and Qin Jidong (2019), as well as Ma Jun and Xiao Weicheng (2023), measuring the size of a company's innovation investment by the proportion of R&D investment to total assets (R&D). The proportion of R&D investment to operating revenue is also selected for robustness testing.

Innovation Ecosystem Resilience： Liang Lin et al. (2020) constructed a national-level new area innovation ecosystem resilience monitoring index system composed of four dimensions: diversity, evolvability, mobility, and buffering capacity. Zhao Yubo et al. (2022) identified diversity, evolvability, mobility, buffering capacity, and network characteristics as the basic features of digital economy industry innovation ecosystem resilience. This study combines the connotation of innovation ecosystem resilience, reflecting innovation ecosystem resilience through the levels of resistance, recovery, and evolution. Based on the analysis of the characteristics and indicators of innovation ecosystem resilience, and following the principles of objectivity, systematization, feasibility, and data availability, while referring to a series of relevant research literature on the construction and measurement of innovation ecosystem indicator systems, the monitoring indicator system for innovation ecosystem resilience was ultimately determined. An evaluation indicator system for innovation ecosystem resilience was constructed, summarizing three primary indicators—resistance level, recovery level, and evolution level—and 12 secondary indicators, all of which are positive indicators. The entropy method was used to determine the weights of each indicator to make the results more objective. The main data sources are the 'China Statistical Yearbook,' 'China Science and Technology Statistical Yearbook,' 'China High-Tech Industry Statistical Yearbook,' and the 'Compilation of Science and Technology Statistics in Higher Education Institutions.' To ensure data completeness, missing values were supplemented using the interpolation method. The specific indicators are shown in Table 1:

Table 1. Measurement Indicator System for the Resilience of Regional Innovation Ecosystems

Level 1 Indicator	Level 2 Indicator	Level 3 indicator	Indicator Attributes
Resistance level	Economic resources	Per capita year-end balance of deposits in financial institutions	Positive indicator
		Per capita year-end balance of loans from financial institutions	Positive indicator
		Per capita GDP	Positive indicator
	Social and environmental resources	Number of public library books per 10,000 people	Positive indicator
	Knowledge resources	Number of science museums per million people	Positive indicator
		Number of scientific publications per 10,000 people	Positive indicator
		The proportion of educational fiscal expenditure in total fiscal expenditure	Positive indicator
Level of	Corporate diversity	Number of high-tech enterprises	Positive indicator
	College diversity	Number of ordinary higher education	Positive indicator

resilience		institutions	
	Diversity of research institutions	Number of research institutions	Positive indicator
	Talent flow	Number of college students per 100,000 people	Positive indicator
	Capital flow	Enterprise support for industry-university-research R&D funding	Positive indicator
		Government funding support for industry-university-research R&D	Positive indicator
	Technical style	Amount of Technology Contracts Flowing into the Technology Market	Positive indicator
		Amount of Technology Outflow in the Technology Market Contract	Positive indicator
	Information flow	Number of Internet broadband accesses	Positive indicator
Evolutionary power level	Research and development investment	Industry-University-Research R&D personnel	Positive indicator
		Industry-University-Research Funding	Positive indicator
	Transformation of output results	Sales revenue of new products in high-tech industries	Positive indicator
		Number of new product development projects in high-tech industries	Positive indicator
		Technology market transaction volume	Positive indicator

Definition of Digital Transformation: This paper draws on the approach of scholars such as Wu Fei et al. (2021), using text analysis. Through Python web scraping, the annual reports of SRDI listed companies on the Shanghai Stock Exchange, Shenzhen Stock Exchange, and Beijing Stock Exchange were collected and organized. All text content was then extracted using the Java PDFBox library, which served as a data pool for subsequent feature word selection.

In summary, the variable definitions used in this study are shown in Table 2:

Table 2. Variable Definitions

Variable type	Variable Name	Variable symbol	Variable Definition
Dependent variable	Innovation Investment	RD	R&D Investment / Total Assets
explanatory variable	Innovation Ecosystem Resilience	IER	Construct an evaluation index system from three dimensions: resistance, resilience, and evolvability based on the entropy method
	Resistance level	Sta_IER	Constructing an Evaluation Index System Based on the Entropy Method
	Resilience level	Lie_IER	Constructing an Evaluation Index System Based on the Entropy Method
	Evolutionary power level	Evo_IER	Constructing an Evaluation Index System Based on the Entropy Method
Mediator variable	Digital transformation	DIG	Based on obtaining the frequency counts of 75 terms related to corporate digital transformation, the degree of implementing 'digital transformation' is measured using the natural logarithm of keyword occurrence frequency.
Control variable	Return on Assets	ROA	Net Profit / Total Assets at End of Period
	Debt-to-asset ratio	Adra	Total Liabilities / Total Assets
	Two positions combined into one	Duality	If the chairman and the general manager are the same person, then it is 1; otherwise, it is 0.
	Equity Concentration	Share	The largest shareholder's shareholding ratio
	Management Compensation	Remuner	The annual report of directors, supervisors, and senior executives discloses salaries using logarithms
	Tobin's Q	TobinQ	Enterprise Market Value / Asset Replacement Cost
	Proportion of independent directors	Ind	Number of Independent Directors / Number of Directors
	Price-to-book ratio	Val	Book Value / Market Capitalization
	Financial expense ratio	Fin	Financial Expenses / Operating Income
	Year	Year	Year dummy variable
	Individual	Id	Individual virtual variable

4.3 Model Construction

To test Hypothesis 1, regarding the impact of innovation ecosystem resilience on the innovation investment of SRDI enterprises, this paper constructs the following regression model:

$$RD_{i,t} = \beta_0 + \beta_1 IER_{i,t} + \beta_2 controls_{i,t} + \delta_i + \delta_t + \varepsilon_{i,t} \quad (4.1)$$

$$RD_{i,t} = \beta_0 + \beta_1 \, Sta\_IER_{i,t} + \beta_2 controls_{i,t} + \delta_i + \delta_t + \varepsilon_{i,t} \quad (4.2)$$

$$RD_{i,t} = \beta_0 + \beta_1 Lie\_IER_{i,t} + \beta_2 controls_{i,t} + \delta_i + \delta_t + \varepsilon_{i,t} \quad (4.3)$$

$$RD_{i,t} = \beta_0 + \beta_1 \, Evo\_IER_{i,t} + \beta_2 controls_{i,t} + \delta_i + \delta_t + \varepsilon_{i,t} \quad (4.4)$$

To test Hypothesis 2, regarding the mediating role of digital transformation, this paper constructs regression models (4.5), (4.6), and (4.7):

$$DIG_{i,t} = \beta_0 + \beta_1 \, IER_{i,t} + \beta_2 controls_{i,t} + \delta_i + \delta_t + \varepsilon_{i,t} \quad (4.5)$$

$$RD_{i,t} = \beta_0 + \beta_1 \, DIG_{i,t} + \beta_2 controls_{i,t} + \delta_i + \delta_t + \varepsilon_{i,t} \quad (4.6)$$

$$RD_{i,t} = \beta_0 + \beta_1 \, IER_{i,t} + \beta_2 \, DIG_{i,t} + \beta_3 controls_{i,t} + \delta_i + \delta_t + \varepsilon_{i,t} \quad (4.7)$$

5. Empirical Analysis

5.1 Descriptive Statistics

Table3 shows that there are 6,677 sample observations. Continuous variables are Winsorized at the 1% and 99% quantiles to avoid the influence of extreme values. The explained variable, corporate innovation input (RD), exhibits significant individual differences; among the core explanatory variables, innovation ecosystem resilience, digital transformation, and CEO composite functional background all show notable differentiation characteristics. The distribution of control variables conforms to the patterns of SRDI listed companies, and the numerical distribution of each variable is reasonable, providing a solid data foundation for subsequent empirical analysis.

Table 3. Descriptive Statistical Results of Variables

Variable	N	Mean	p50	SD	Min	Max
G	6677	0.0370	0.0280	0.0450	0.001	1.824
IER	6677	0.322	0.258	0.225	0.002	0.897
DIG	6677	1.791	1.609	1.525	0	6.248
Mult	6677	2.117	2	0.871	1	5
ROA	6677	0.0430	0.0460	0.106	-3.200	1.408
Adra	6677	0.326	0.299	0.186	0.0110	2.849
Share	6677	30.69	28.98	13.81	1.920	87.31
Duality	6677	0.412	0	0.492	0	1
Remuner	6677	15.68	15.68	0.643	11.78	18.98
TobinQ	6677	2.343	1.877	1.550	0.767	22.56
Ind	6677	38.19	37.50	5.533	0	75
Val	6677	0.529	0.531	0.224	0	1.303

5.2 Correlation Analysis

Table 4. Benchmark Regression Results

	RD	**IER**	**DIG**	**ROA**	**Adra**	**Share**	**Duality**	**Remuner**	**TobinQ**	**Ind**	**Val**
RD	1										
IER	0.101***	1									
DIG	0.176***	0.184***	1								
ROA	-0.088***	-0.098***	-0.053***	1							
Adra	-0.068***	0.042***	0.00700	-0.354***	1						
Share	-0.081***	-0.062***	-0.152***	0.165***	-0.068***	1					
Duality	0.101***	0.066***	0.038***	0.021*	-0.059***	0.054***	1				
Remuner	0.227***	0.283***	0.177***	0.036***	-0.0100	-0.076***	0.036***	1			
TobinQ	0.183***	-0.057***	0.061***	0.049***	-0.145***	-0.00300	0.043***	0.0180	1		
Ind	-0.028**	0.027**	0.035***	-0.00100	0.00100	0.051***	0.088***	-0.120***	-0.0100	1	
Val	-0.179***	0.085***	-0.073***	-0.047***	0.174***	0.0150	-0.030**	0.043***	-0.655***	0.016	1

5.3 Benchmark Regression Analysis

This paper constructs a two-way fixed effects panel model to examine the impact of innovation ecosystem resilience and its dimensions on the innovation investment of SRDI enterprises. The model controls for individual and time fixed effects to mitigate interference. The baseline regression shows that the regression coefficient of innovation ecosystem resilience is 0.010, significant at the 1% level and positive, confirming Hypothesis 1. In the dimension-specific tests, the coefficients for resistance, recovery, and evolution are 0.015 (significant at 1%), 0.009 (significant at 1%), and 0.006 (significant at 5%), respectively, all positively affecting innovation investment, confirming Hypotheses 1a, 1b, and 1c, with the resistance effect being the most prominent. The regressions of control variables meet expectations. The adjusted R^2 of each model is about 0.490, indicating a good fit and providing reliable support for the empirical analysis.

Table 5. Benchmark Regression Results

	(1)	**(2)**	**(3)**	**(4)**
	RD	**RD**	**RD**	**RD**
IER	0.010***			
	(3.47)			
Sta_IER		0.015***		
		(4.59)		
Lie_IER			0.009***	
			(3.23)	
Evo_IER				0.006**

				(2.25)
ROA	-0.054**	-0.054**	-0.054**	-0.054**
	(-2.24)	(-2.25)	(-2.23)	(-2.24)
Adra	-0.013***	-0.014***	-0.013***	-0.013***
	(-3.38)	(-3.44)	(-3.31)	(-3.39)
Share	-0.000***	-0.000***	-0.000***	-0.000***
	(-6.31)	(-5.97)	(-6.25)	(-6.37)
Duality	0.006***	0.006***	0.006***	0.006***
	(6.42)	(6.33)	(6.40)	(6.54)
Remuner	0.013***	0.013***	0.013***	0.013***
	(9.77)	(9.31)	(9.71)	(9.88)
TobinQ	0.003***	0.002***	0.003***	0.003***
	(4.18)	(4.09)	(4.16)	(4.15)
Ind	0.000	-0.000	0.000	0.000
	(0.07)	(-0.21)	(0.13)	(0.10)
Val	-0.027***	-0.027***	-0.027***	-0.027***
	(-7.23)	(-7.24)	(-7.28)	(-7.27)
Observations	6,677	6,677	6,677	6,677
Adj.R2	0.491	0.492	0.491	0.490
id	YES	YES	YES	YES
time	YES	YES	YES	YES

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.4 Replacing the Dependent Variable

To test the robustness of the baseline regression, this paper replaces the dependent variable with the proportion of R&D investment to operating revenue and reconstructs the two-way fixed effects model for regression. The results show that the regression coefficients of the innovation ecosystem resilience and its dimensions are all significantly positive at the 1% level, consistent in sign with the baseline regression, with differences only in magnitude due to different units, and the increase in the resilience coefficient is the most obvious. The results of the control variables are basically consistent, the model R^2 reaches 0.826, indicating improved fit, confirming the robustness of the baseline regression results.

Table 6. Replacing the Dependent Variable

	(1)	(2)	(3)	(4)
	RD	**RD**	**RD**	**RD**
IER	0.330***			
	(6.01)			
Sta_IER		0.184***		
		(2.65)		
Lie_IER			0.534***	
			(8.86)	
Evo_IER				0.185***
				(3.69)
ROA	-1.796***	-1.814***	-1.775***	-1.806***
	(-7.92)	(-7.88)	(-7.87)	(-7.90)
Adra	-1.615***	-1.618***	-1.598***	-1.618***
	(-21.87)	(-21.83)	(-21.75)	(-21.84)
Share	-0.010***	-0.009***	-0.009***	-0.010***
	(-12.26)	(-11.88)	(-12.15)	(-12.34)
Duality	0.177***	0.181***	0.172***	0.181***
	(8.92)	(9.11)	(8.74)	(9.13)
Remuner	0.189***	0.188***	0.185***	0.196***
	(8.58)	(8.38)	(8.37)	(8.97)
TobinQ	0.021**	0.019**	0.022**	0.020**
	(2.39)	(2.12)	(2.47)	(2.28)
Ind	-0.001	-0.001	-0.000	-0.000
	(-0.29)	(-0.43)	(-0.17)	(-0.24)
Val	-0.713***	-0.720***	-0.712***	-0.718***
	(-11.02)	(-11.11)	(-11.01)	(-11.06)
Observations	6,677	6,677	6,677	6,677
R-squared	0.826	0.825	0.827	0.826
id	YES	YES	YES	YES
time	YES	YES	YES	YES

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.5 Lagged Explanatory Variable by One Period

To mitigate the issues of reverse causality endogeneity and the lag of innovation input, this paper re-ran the regression with the core explanatory variable, the resilience of the innovation ecosystem, and its dimensions lagged by one period. The results show that the regression coefficients of the core explanatory variables lagged by one period are all significantly positive at the 1% level, with signs consistent with the baseline regression and only slight numerical adjustments, while the lag effect of resilience is more pronounced. The results of the control variables are basically consistent, and the model's adjusted R^2 is between 0.488 and 0.492, indicating good fit, further confirming the reliability of the baseline regression results and that ecological resilience has a long-term impact on innovation input.

Table 7. Lag Treatment of Explanatory Variables

	(1)	**(2)**	**(3)**	**(4)**
	RD	**RD**	**RD**	**RD**
L.IER	0.011***			
	(3.99)			
L.Sta_IER		0.014***		
		(3.98)		
L.Lie_IER			0.011***	
			(3.78)	
L.Evo_IER				0.008***
				(2.85)
ROA	-0.052*	-0.053*	-0.052*	-0.052*
	(-1.89)	(-1.91)	(-1.88)	(-1.90)
Adra	-0.011***	-0.012***	-0.011**	-0.011***
	(-2.60)	(-2.69)	(-2.53)	(-2.62)
Share	-0.000***	-0.000***	-0.000***	-0.000***
	(-5.21)	(-4.90)	(-5.15)	(-5.30)
Duality	0.006***	0.006***	0.006***	0.006***
	(5.92)	(5.87)	(5.90)	(6.04)
Remuner	0.013***	0.013***	0.013***	0.013***
	(8.83)	(8.36)	(8.78)	(8.95)
TobinQ	0.003***	0.003***	0.003***	0.003***
	(3.77)	(3.70)	(3.76)	(3.74)
Ind	0.000	0.000	0.000	0.000
	(0.33)	(0.10)	(0.39)	(0.36)
Val	-0.028***	-0.028***	-0.028***	-0.028***
	(-6.62)	(-6.63)	(-6.68)	(-6.65)
Observations	6,677	6,677	6,677	6,677
Adj.R2	0.492	0.489	0.489	0.488

id	YES	YES	YES	YES
time	YES	YES	YES	YES

Standard errors in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

5.6 Mediation Effect

This paper uses the stepwise regression method to examine the mediating role of digital transformation between the resilience of the innovation ecosystem and the innovation investment of SRDI enterprises. The baseline regression has confirmed the significant impact of the core explanatory variables on the explained variables. The regression results show that the regression coefficient of innovation ecosystem resilience on digital transformation is 0.010 (significant at 1%), verifying the second condition; the regression coefficient of digital transformation on innovation investment is 3.863 (significant at 5%), providing a basis for mediation; when both are included in the model, the coefficients of digital transformation and innovation ecosystem resilience are both significantly positive, and the latter's coefficient decreases by more than 20% compared with the baseline regression, verifying the third condition. In summary, digital transformation plays a partial mediating role, hypothesis 2 is confirmed, and a corresponding transmission path exists.

Table 8. Regression Results of the Mediation Mechanism Test

	(1)	**(2)**	**(3)**
	DIG	**RD**	**RD**
IER	0.010***		0.008***
	(6.37)		(2.87)
DIG		3.863**	0.003***
		(2.58)	(7.49)
ROA	-0.044	-0.063	-0.053**
	(-1.63)	(-0.28)	(-2.19)
Adra	0.001	0.087	-0.013***
	(0.09)	(0.80)	(-3.40)
Share	0.000	-0.014***	-0.000***
	(0.54)	(-10.40)	(-5.35)
Duality	0.023***	0.061	0.006***
	(5.00)	(1.61)	(6.28)
Remuner	0.024***	0.190***	0.013***
	(5.96)	(5.31)	(8.97)
TobinQ	-0.007***	-0.012	0.003***

	(-3.80)	(-0.80)	(4.18)
Ind	0.000	0.012***	-0.000
	(0.42)	(3.80)	(-0.33)
Val	-0.028**	-0.722***	-0.024***
	(-2.13)	(-6.72)	(-6.42)
Observations	6,677	6,677	6,677
Adj.R2	0.786	0.622	0.496
id	YES	YES	YES
time	YES	YES	YES

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

6. Further Analysis

6.1 Heterogeneity of Enterprise Scale

This paper uses the median of enterprises' year-end total assets as the standard to divide the sample into small-scale and large-scale enterprises, examining the impact of innovation ecosystem resilience on their innovation investments. The regression shows that for large-scale enterprises, the regression coefficient of ecosystem resilience is 0.013 (significant at 1%), while for small-scale enterprises, the coefficient is 0.003 and does not pass the significance test. The reason is that the scaled resource supply of ecosystem resilience aligns with the large-scale innovation demand of large enterprises, producing a significant enabling effect; however, it is difficult to match the dispersed and precise innovation needs of small-scale enterprises, so it cannot provide effective support.

Table 9. Regression Results of Enterprise Scale Heterogeneity

	(1)	**(2)**
	Small-scale enterprise	**Large-scale enterprise**
	RD	**RD**
IER	0.003	0.013***
	(0.51)	(4.60)
ROA	-0.116**	-0.013
	(-2.45)	(-1.56)
Adra	-0.006	-0.008***
	(-0.80)	(-2.64)
Share	-0.000**	-0.000***
	(-2.52)	(-6.94)
Duality	0.006***	0.006***

	(3.34)	(5.75)
Remuner	0.022***	0.008***
	(9.40)	(5.32)
TobinQ	0.002***	0.004***
	(2.67)	(3.07)
Ind	-0.000	0.000
	(-0.02)	(0.64)
Val	-0.018***	-0.023***
	(-3.14)	(-4.64)
Observations	3,339	3,338
Adj.R2	0.459	0.608
id	YES	YES
time	YES	YES

Standard errors in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

6.2 Heterogeneity of Enterprise Property Rights

This study classifies the sample into state-owned enterprises and non-state-owned enterprises according to the nature of the actual controller, and examines the impact of innovation ecosystem resilience on their innovation investment. The regression shows that, in non-state-owned enterprises, the regression coefficient of ecosystem resilience is 0.012 (significant at 1%); in state-owned enterprises, the coefficient is -0.007, which did not pass the significance test. The reason is that the market-oriented incentives and flexible governance of the ecosystem are highly compatible with non-state-owned enterprises, producing significant empowering effects, whereas they conflict with the administrative governance structure and diverse decision-making objectives of state-owned enterprises, making it difficult to exert their effect.

Table 10. Regression Results of Enterprises with Heterogeneous Property Rights

	(1) **state-owned enterprise** **RD**	**(2)** **Non-state-owned enterprise** **RD**
IER	-0.007	0.012***
	(-0.42)	(4.98)
ROA	0.007	-0.058**
	(0.22)	(-2.25)
Adra	0.017	-0.016***
	(1.54)	(-4.20)

Share	-0.000	-0.000***
	(-0.54)	(-6.46)
Duality	-0.005	0.006***
	(-1.60)	(6.69)
Remuner	-0.002	0.014***
	(-0.61)	(10.23)
TobinQ	-0.001	0.003***
	(-0.67)	(4.54)
Ind	-0.000	0.000
	(-0.78)	(0.56)
Val	-0.031***	-0.026***
	(-2.67)	(-6.61)
Observations	738	5,939
Adj.R2	0.165	0.579
id	YES	YES
time	YES	YES

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

6.3 Heterogeneity of Factor Intensity

This study divides the sample into technology-intensive, capital-intensive, and labor-intensive enterprises according to industry factor intensity, and examines the impact of innovation ecosystem resilience separately. The regression shows that the IER coefficient for technology-intensive enterprises is 0.012 (significant at 1%), for capital-intensive enterprises is 0.008 (significant at 5%), and for labor-intensive enterprises is -0.002 and not statistically significant. The reason is that ecosystem resilience focuses on high-end factor allocation such as technology and capital, which aligns with the core factor needs of the first two types of enterprises, making the empowerment effect significant; however, its empowerment of labor factors is insufficient, failing to meet the needs of labor-intensive enterprises and thus unable to exert a promoting effect.

Table 11. Regression Results of Factor Intensity Heterogeneity

	(1) technology-intensive RD	(2) Capital-intensive RD	(3) Labor-intensive RD
IER	0.012***	0.008**	-0.002
	(4.19)	(2.20)	(-0.18)
ROA	-0.090**	0.054***	0.003
	(-2.56)	(2.99)	(0.57)
Adra	-0.013**	0.003	-0.002
	(-2.44)	(0.53)	(-0.29)
Share	-0.000***	-0.000*	-0.000**
	(-3.42)	(-1.67)	(-2.17)
Duality	0.008***	-0.001	-0.001
	(6.92)	(-0.84)	(-0.46)
Remuner	0.019***	-0.001	0.000
	(10.94)	(-0.33)	(0.19)
TobinQ	0.002***	0.001*	-0.000
	(3.38)	(1.90)	(-0.11)
Ind	0.000	-0.000	-0.000
	(1.26)	(-1.06)	(-0.78)
Val	-0.034***	-0.005	-0.015**
	(-7.03)	(-1.27)	(-2.32)
Observations	4,438	1,041	1,159
R-squared	0.613	0.629	0.158
id	YES	YES	YES
time	YES	YES	YES

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

7. Conclusions

This paper focuses on SRDI enterprises listed on the Shanghai, Shenzhen, and Beijing stock exchanges from 2013 to 2024, selecting 6,677 observational samples. It constructs the analytical logic of 'external ecological environment–enterprise transformation behavior–innovation investment decisions' to explore the impact of innovation ecosystem resilience on enterprise innovation investment, and to examine the mediating role of digital transformation and the heterogeneity of enterprise characteristics. The study employs a two-way fixed effects model for benchmark regression, stepwise regression for mediation testing, combined with robustness and endogeneity tests, and then conducts grouped regression to analyze heterogeneity, reaching the following conclusions.

First, innovation ecosystem resilience significantly promotes innovation investment in 'specialized and innovative' enterprises. Its three dimensions—resistance, recovery, and evolution—play positive roles, with the effect of resistance being the most prominent. This conclusion has been verified as reliable. Resistance provides a stable environment and resource support, recovery ensures continuity of innovation investment, and evolution guides diversified innovation. Highly resilient ecosystems can also alleviate constraints on enterprise innovation resources. Second, digital transformation plays a partial mediating role, forming the transmission path of 'innovation ecosystem resilience digital transformation innovation investment of SRDI enterprises'. A high-resilience ecosystem can reduce information asymmetry during transformation and lower costs, promoting enterprise digital transformation. Digital transformation, in turn, optimizes resource allocation and improves efficiency, enhancing innovation investment, with the two synergistically achieving indirect empowerment. Third, this positive effect exhibits significant heterogeneity: it is significant for large-scale, non-state-owned, and technology- and capital-intensive enterprises, but not significant for small-scale, state-owned, and labor-intensive enterprises. The differences stem from variations in enterprise resource integration capabilities, market orientation, and core element demands, leading to different levels of adaptability to ecosystem resilience.

References

Abrokwah-Larbi, K., & Awuku-Larbi, Y. (2023). The Impact of Artificial Intelligence in Marketing on the Performance of Business Organizations: Evidence From SMEs in an Emerging Economy. *Journal of Entrepreneurship in Emerging Economies*, *16*, 1090-1117. https://doi.org/10.1108/JEEE-07-2022-0207

Balohp. (2013). Innovation behaviour of hidden champions. In P. Mckiernan, & D. Purg (Eds.), *Hidden champions in CEE and Turkey* (pp. 53-67). Berlin: Springer. https://doi.org/10.1007/978-3-642-40504-4_5

Boschma, R. (2015). Towards an Evolutionary Perspective on Regional Resilience. *Regional Studies*, *49*(5), 733-751. https://doi.org/10.1080/00343404.2014.959481

Bughin, J., & Van Zeebroeck, N. (2017). The best response to digital disruption. *Ulb Institutional Repository*, *58*(4), 80-86. https://doi.org/10.5465/AMBPP.2017.15155abstract

Camelo-Ordaz, C., Hernández-Lara, A. B., & Valle-Cabrera R. (2005). The relationship between top management teams and innovative capacity in companies. *Journal of Management Development*. https://doi.org/10.1108/02621710510613726

Crossland, C., Zyung, J., Hiller, N. J., et al. (2014). CEO career variety: Effects on firm-level strategic and social novelty. *Academy of Management Journal*, *57*(3), 652-674. https://doi.org/10.5465/amj.2012.0469

Custódio, C., Ferreira, M. A., & Matos, P. (2013). Gener-alists Versus Specialists: Lifetime Work Experience and Chief Executive Officer Pay. *Journal of Financial Economics*, *108*(2), 471-492. https://doi.org/10.1016/j.jfineco.2013.01.001

Custódio, C., Ferreira, M. A., & Matos, P. (2019). Do general managerial skills spur innovation?. *Management Science*, *65*(2), 459-476. https://doi.org/10.1287/mnsc.2017.2828

Czarnitzki, D., & Delanote, J. (2013). Young innovative companies: the new high-growth firms. *Industrial and Corporate Change*, *22*(5), 1315-1340. https://doi.org/10.1093/icc/dts039

Desjardine, M., Bansal, P., & Yang, Y. (2019). Bouncing Back: Building Resilience through Social and Environmental Practices in the Context of the 2008 Global Financial Crisis. *Journal of Management*, *45*(4), 1434-1460. https://doi.org/10.1177/0149206317708854

Díez-Vial, I., & Fernández-Olmos, M. (2015) Knowledge spillovers in science and technology parks: how can firms benefit most? *The Journal of Technology Transfer*, *40*, 70-84. https://doi.org/10.1007/s10961-013-9329-4

Eder, J., & Trippl, M. (2019). Innovation in the periphery: Compensation and exploitation strategies. *Growth Change*, *4*, 1511-1531. https://doi.org/10.1111/grow.12328

Eraydin, A., & Taşan-Kok, T. (2012). *Resilience thinking in urban planning*. New York, USA: Springer. https://doi.org/10.1007/978-94-007-5476-8

Ettlie, E. J. (1998). R&D and Global Manufacturing Performance. *Management Science*, *1998*(44), 1-11. https://doi.org/10.1287/mnsc.44.1.1

Gennian Tang, Luqian Wang, Tao Zheng, & Weie Wu. (2024). What types of business environment fosters the emergence of more specialized and sophisticated “little giant” enterprises?—An empirical study based on the TOE framework and configuration adaptation theory. *Managerial and Decision Economics*, 2024, 1195-1737. https://doi.org/10.1002/mde.4063

Hambrickdc. (2007). Upper echelons theory: an update. *The Academy of Management Review*, *32*(2), 334-343. https://doi.org/10.5465/amr.2007.24345254

Hamel, G., & Välikangas, L. (2015). The Quest for Resilience. *Harvard Business Review*, *81*(9), 52-63.

Hayakawa, K., Tomohiro, M., & Fukunari, K. (2012). Globalization and Productivity: A Survey of Firm-Level Analysis. *Economic Surveys*, *26*, 332-350. https://doi.org/10.1111/j.1467-6419.2010.00653.x

Helfat, C. E., & Martin, J. A. (2015). Dynamic managerial capabilities: Review and assessment of managerial impact on strategic change. *Journal of Management*, *41*(5), 1281-1312. https://doi.org/10.1177/0149206314561301

Helfat, Constance E., & Miguel A. Campo-Rembado. (2016). Integrative Capabilities, Vertical Integration, and Innovation over Successive Technology Lifecycles. *Organization Science*, *27*(2), 249-264. https://doi.org/10.1287/orsc.2015.1045

Hu, C., & Liu, Y. (2015). Valuing diversity: CEOs' career experiences and corporate investment. *Journal of Corporate Finance*, *30*, 11-31. https://doi.org/10.1016/j.jcorpfin.2014.08.001

Jodha, K. S., Kaur, N., Salazar, S. M. S., et al. (2022). Relationship between fracture toughness and fractal dimensional increment in two types of dental glass- ceramics with different fracture surface roughness. *Dental Materials*, *38*(12), 1977-1988. https://doi.org/10.1016/j.dental.2022.11.011

Julian Schenkenhofer. (2022). Hidden champions: A review of the literature & future research avenuesc. *Management Review Quarterly*, *2022*, 01-66. https://doi.org/10.1007/s11301-021-00253-6

Kapoor, Rahul. (2013). Persistence of Integration in the Face of Specialization: How Firms Navigated the Winds of Disintegration and Shaped the Architecture of the Semiconductor Industry. *Organization Science*, *24*(4), 1195-1213. https://doi.org/10.1287/orsc.1120.0802

Karaevli, A., & Hall, D. T. T. (2006). How career variety promotes the adaptability of managers: A theoretical model. *Journal of Vocational behavior*, *69*(3), 359-373. https://doi.org/10.1016/j.jvb.2006.05.009

Li Jian, Gong Jing, Zhang Xiu, et al. (2024). The Impact of Scientific Collaboration on Exploratory Innovation of the "Little Giant" Firms. *Science & Technology Progress and Policy*, *41*(22), 129-139.

Liang Lin, Zhao Yubo, & Liu Bing. (2020). Research on Monitoring And Early Warning of the Resilience of the Innovation Ecosystem in the China's National New Districts. *China Soft Science*, *2020*(07), 92-111.

Luo Hong, Qin Jidong. (2019). Research on the Influence of State-Owned Equity Participation on Family Firms' Innovation Investment. *China Industrial Economics*, *2019*(07), 174-192.

Ma Jun, & Xiao Weicheng. (2023). Family Business Organization Identity Deviation and Innovation Input: Analysis Based on Organizational Identity Theory. *Accounting Research*, *2023*(12), 117-133.

Marquisc, Tilcsik A. (2013). Imprinting: toward amul-ti level theory. *Academy of Management Annals*, *7*(1), 195-245. https://doi.org/10.5465/19416520.2013.766076

Massis, De, David Audretsch Alfredo, Lorraine Uhlaner, & Nadine Kammerlander. (2018). Innovation with Limited Resources: Management Lessons from the German Mittelstand. *Journal of Product Innovation Management*, *35*(1), 125-146. https://doi.org/10.1111/jpim.12373

Meerow, S., Newell, J. P., & Stults, M. (2016). Defining urban resilience: a review. *Landscape and Urban Planning*, *147*(2), 38-49. https://doi.org/10.1016/j.landurbplan.2015.11.011

Merrett, R. (2015). *Adoption of new technology top priority in digital business transformation: Gartner*.

Michel, J. G., & Hambrick, D. C. (1992). Diversification posture and top management team characteristics. *Academy of Management journal*, *35*(1), 9-37. https://doi.org/10.2307/256471

Nambisan, S., Lyytinen, K. J., Majchrzak, A., et al. (2017). Digital Innovation Management: Reinventing Innovation Management Research in a Digital World. *MIS Quarterly*, *41*, 223-238. https://doi.org/10.25300/MISQ/2017/41:1.03

Oztemel, E. (2020). Understanding Digital Transformation. *Antonio Sartal Rodríguez*, *2020*, 1-30. https://doi.org/10.1201/9780429055621-1

Prahalad, C. K., & Hamel, G. (1994). Strategy as a field of study: Why search for a new paradigm?. *Strategic Management Journal*, *15*(S2), 05-16. https://doi.org/10.1002/smj.4250151002

Ramezani, J., & Camarinha-Matos, L. (2020). Approaches for Resilience and Antifragility in Collaborative Business Ecosystems. *Technological Forecasting and Social Change*, *151*, 119846. https://doi.org/10.1016/j.techfore.2019.119846

Rantmb. (2013). Hidden champions of Slovenia. In P. Mckiernan, & D. Purg (Eds.), *Hidden champions in CEE and Turkey* (pp. 357-81). Berlin: Springer. https://doi.org/10.1007/978-3-642-40504-4_21

Roundy, T. P., Brockman, K. B., & Bradshaw, M. (2017). The Resilience of Entrepreneurial Ecosystems. *Journal of Business Venturing Insights*, *8*, 99-104. https://doi.org/10.1016/j.jbvi.2017.08.002

Santhosh, A., Unnikrishnan, R., Shibu, S., Meenakshi, K. M., & Joseph, G. (2023). AI Impact on Job Automation. *International Journal of Engineering Technology and Management Sciences*, *7*, 410-425. https://doi.org/10.46647/ijetms.2023.v07i04.055

Schenkenhofer, Julian et al. (2024). University knowledge spillovers and innovation of hidden champions: evidence from Italy. *R&D Management*, *2024*, 1467-9310.

Scuotto, V., Nicotra, M., Giudice, M. D., et al. (2021). A microfoundational perspective on SMEs' growth in the digital transformation era. *Journal of Business Research*, *129*(10), 382-392. https://doi.org/10.1016/j.jbusres.2021.01.045

Smith, S. S. (2018). Digitization and financial reporting-how technology innovation may drive the shift toward continuous accounting. *Accounting and Finance Research*, *7*(3), 240-250. https://doi.org/10.5430/afr.v7n3p240

Stirling, A. (2007). A general framework for analysing diversity in science, technology and society. *Journal of the Royal Society Interface*, *4*(15), 707-719. https://doi.org/10.1098/rsif.2007.0213

Surie, G. (2017). Creating the innovation ecosystem for renewable energy via social entrepreneurship: insights from India. *Technological Forecasting and Social Change*, *121*(5), 184-195. https://doi.org/10.1016/j.techfore.2017.03.006

Teece, D. J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable)enterprise performance. *Strategic Management Journal*, *28*(13), 1319-1350. https://doi.org/10.1002/smj.640

Teece, D. J. (2012). Dynamic Capabilities: Routines versus Entrepreneurial Action. *Journal of Management Studies*, *49*(8), 1395-1401. https://doi.org/10.1111/j.1467-6486.2012.01080.x

Van der Vegt, G. S., Essens, P., Wahlström, M., & George, G. (2015). Managing Risk and Resilience. *Academy of Management Journal*, *2015*(58), 971-980. https://doi.org/10.5465/amj.2015.4004

Verganti, R. (2010). Design as brokering of languages: Innovation strategies in Italian firms. *Design management journal*, *14*(3), 34-42. https://doi.org/10.1111/j.1948-7169.2003.tb00050.x

Wang, F., Wong, W. K., Wang, Z, et al. (2023). Emerging pathways to sustainable economic development: an interdisciplinary exploration of resource efficiency, technologic al innovation, and ecosystem resilience in resource- rich regions. *Resources Policy*, *85*, 103747. https://doi.org/10.1016/j.resourpol.2023.103747

Wu Fei, Hu Huizhi, Lin Huiyan, & Ren Xiaoyi. (2021). Enterprise Digital Transformation and Capital Market Performance: Empirical Evidence from Stock Liquidity. *Journal of Management World*, *37*(07), 130-144+10.

Xie, Zhou, Zong, et al. (2020). Gender diversity in R&D teams and innovation efficiency: Role of the innovation context. *Research Policy*, *49*(1), 103885. https://doi.org/10.1016/j.respol.2019.103885

Xin, L., & Bian, W. (2022). Can Reducing Knowledge Network Sharing Degree Improve Innovation Performance of Specialized and Special New Enterprises? The Role of Financial Constraints. *American Journal of Industrial and Business Management*, *12*, 1517-1551. https://doi.org/10.4236/ajibm.2022.1210084

Zhu Huasheng, Liu Ruobin, & Chen Bo. (2023). The Rise of Specialized and Innovative Little Giant Enterprises under China's 'Dual Circulation' Development Pattern: An Analysis of Spatial Patterns and Determinants. *Land*, *12*(1), 259. https://doi.org/10.3390/land12010259