Bridging scientists with breakthrough innovation in enterprises

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Abstract. It is an inherent requirement for the high quality development of Chinese science and technology industry to promote the breakthrough innovation of enterprises and eliminate the threat of "bottleneck" technology. This paper focuses on the key minority human capital that promotes radical innovation in enterprises -- the bridging scientist founder, and demonstrates the mechanism of the bridging scientist founder that promotes the digital transformation of enterprises and then improves the systematic innovation ability. This paper constructs a data set of the founder's personal information to carry out an empirical study on the listed companies of specialized and ultra-new little Giants. The results show that the breakthrough innovation ability of enterprises is stronger when there is a bridge scientist founder; Bridging Scientist Founders further promote radical innovation by driving the digital transformation of enterprises.

Keyword: Bridging scientist; Founder; Digital transformation; Specialization and innovation; Radical innovation

1 INTRODUCTION

After the occurrence of the China-US trade friction, the development of China's technology-driven industries has faced increasing sanctions and constraints on "chokehold" technologies. This has led to more and more Chinese companies focusing on breakthrough innovation and rethinking how to achieve an innovative path that breaks through technology blockades. [1]This article investigates the relationship between bridging scientist-founders and breakthrough innovation from the perspective of enterprise digital transformation. Specifically, using the 2007-2021 sample of China's A-share "specialized and innovative" small and medium-sized listed companies, it explores the specific impact of bridging scientist-founders on breakthrough innovation in enterprises and its underlying transmission mechanism1. Furthermore, it examines the mediating effect of enterprise digital transformation in bridging scientist-founders and breakthrough innovation, aiming to complement the existing theoretical framework and empirical foundation for enterprise breakthrough innovation.

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2 THEORETICAL ANALYSIS AND RESEARCH HYPOTHESES

2.1 Bridging scientist-founders and breakthrough innovation in enterprises

Firstly, bridging scientist-founders can provide a substantial knowledge foundation for breakthrough innovation in enterprises.[2]Secondly, bridging scientist-founders can assist in formulating breakthrough innovation strategies that meet potential market demands. Lastly, bridging scientist-founders possess dual social capital from academia and industry, which benefits enterprises in cost-effective recruitment of technical personnel and provides multiple financing channels. Therefore, the following hypothesis is proposed: H1: Bridging scientist-founders have a positive impact on breakthrough innovation in enterprises.

2.2 Bridging scientist-founders and enterprise digital transformation

On the one hand, based on the resource-based theory, from the perspectives of internal resource acquisition and external resource acquisition, bridging scientist-founders, with their dual professional experiences, gain access to abundant academic, industry, and external government resources, which positively contribute to enterprise digital transformation. [3] On the other hand, based on the imprinting theory, the dual professional imprints of bridging scientist-founders strengthen their cognitive understanding of enterprise digital transformation andfacilitate the execution of digital transformation strategies. Therefore, the following hypothesis is proposed: H2: Bridging scientist-founders have a positive impact on enterprise digital transformation.

2.3 The mediating role of digital transformation

Digital transformation refers to the comprehensive transformation of enterprise products and services, business management processes, and organizational structures through the utilization of technologies such as big data, artificial intelligence, blockchain, and cloud computing. It aims to enable innovation, value chain, and supply chain through digital technology empowerment. In this process, digital technologies play a central role. [4]Firstly, a higher degree of digital transformation in enterprises can enhance transparency, leading to reduced financing costs. Secondly, digital transformation facilitates multi-party collaboration. In summary, digital transformation promotes breakthrough innovation in enterprises by alleviating financing constraints and fostering multi-party collaboration. Therefore, the following hypothesis is proposed: H3: Digital transformation mediates the relationship between bridging scientist-founders and breakthrough innovation.

3 RESEARCH DESIGN

3.1 Sample Selection and Data Sources

This study selects specialized and innovative "small giant" enterprises listed on the Shanghai and Shenzhen Stock Exchanges from 2007 to 2021 as the research sample. As of August 2022, a total of four batches of specialized and innovative small giant enterprises have been announced in China, with 632 listed companies among them.

3.2 Variable Selection

1.Dependent Variable: Breakthrough Innovation (Patent)

Following the study by Huang et al. (2022), this research uses the number of patent applications filed by the company as a measure of breakthrough innovation.

2.Key Independent Variable: Bridging Scientist-Founders (Scientist_bri)

Following the approach in the study by Kaiser et al. (2018), this research considers individuals who have research experience in universities or public research institutions, hold a doctoral degree, or have received academic research training as having academic research work experience. [5]Similarly, individuals who have engaged in technical research and development in private enterprises or have received technology awards at the provincial level or above are considered to have industry research work experience. [6]A binary variable is used to represent bridging scientist-founders, where a value of 1 is assigned if the company founder has both academic research work experience and industry research work experience, and 0 otherwise.

3.Mediating Variable: Enterprise Digital Transformation (DCG1)

Following the study by Wu et al. (2021), a Python web scraping technique is used to extract the frequency of occurrence of 76 digital-related terms in the dimensions of artificial intelligence, big data, cloud computing, blockchain, and digital technology application from the company's annual reports. [7]These frequencies are aggregated, logged, and used as an overall measure of digital transformation.

4.Control Variables

Following the studies by Wu et al. (2021) and Su et al. (2022), control variables such as firm size (Size), leverage ratio (Lev), firm age (Age), return on assets (Roa), and firm growth (Growth) are selected. As show in table 1.

Table 1. Correlation Analysis

Variables	1	2	3	4	5	6	7	8
1.Patent	1							
2.DCG1	0.280***	1						

3.scientist~i	0.312***	0.348***	1					
4.Lev	0.151***	0.105***	-0.0190	1				
5.Age	0.0170	0.079***	-0.137***	0.123***	1			
6.Roa	-0.075***	-0.067**	-0.0180	-0.364***	-0.0120	1		
7.Sales	0.0360	0.077***	0.100***	0.049*	-0.0170	-0.090***	1	
8.size	0.222***	0.069***	0.102***	0.435***	0.167***	-0.098***	0.00400	1

4 REGRESSION ANALYSIS

Since this study primarily examines the impact of bridging scientist-founders on breakthrough innovation in enterprises, the explanatory variable does not vary over time. Therefore, a random effects model is selected for the regression analysis.Firstly, the direct effect is examined. The first column in Table 2 illustrates the relationship between bridging scientist-founders and breakthrough innovation. The regression results in the first column show a significant positive correlation between bridging scientist-founders (scientist_bri) and breakthrough innovation (Patent) at a 1% confidence level, supporting the hypothesis H1.Secondly, the mediating effect is examined. Following the approach by Baron et al. (1986), this study employs the "three-step method" to analyze whether enterprise digital transformation mediates the relationship between bridging scientist-founders and breakthrough innovation. The results are presented in Table 2. Firstly, the first column shows (1) that bridging scientist-founders have a significant positive effect on breakthrough innovation. Secondly, from the second column(2), it can be observed that hypothesis H2 is supported. Finally, from the third column(3), it can be seen that hypothesis H3 is supported.

Table 2. Regression Results of Bridging Scientist-Founders and Breakthrough Innovation

	(1)	(2)	(3)
Variables	Patent	DCG1	Patent
Scientist_bri	0.701***	0.967***	0.631***
	(0.132)	(0.186)	(0.134)
Lev	-0.071	0.164	
	(0.233)	(0.226)	
Age	-0.006	0.001	-0.006
	(0.013)	(0.018)	(0.013)

Roa	-0.335	0.111	-0.298
	(0.427)	(0.399)	(0.411)
Growth	0.015	-0.001	0.014
	(0.028)	(0.026)	(0.028)
Size	0.248***	-0.018	0.244***
	(0.053)	(0.051)	(0.050)
DCG1			0.075***
			(0.028)
	-4.569***	-0.024	-4.459***
	(1.251)	(1.243)	(1.211)
	1400	1400	1400
R^2	0.134	0.195	0.156

4.1 Robustness Test

To address endogeneity concerns(1), a robustness test (3)is conducted by shifting the measurement of breakthrough innovation, which is the number of patent applications, to the subsequent year. This means(2) that the patent applications filed in year t+1 are used to measure the breakthrough innovation in year t. As show in table 3.

Table 3. Robustness Test Regression Results

	(1)	(2)	(3)
Variables	F.Patent	DCG2	F.Patent
scientist_bri	0.669***	0.584***	0.638***
	(0.139)	(0.159)	(0.138)
Lev	-0.169	0.399**	
	(0.255)	(0.166)	
Age	-0.010	-0.006	-0.009
	(0.013)	(0.015)	(0.013)
Roa	-0.376	0.087	-0.290
	(0.447)	(0.289)	(0.429)
Sales	-0.011	-0.010	-0.012
	(0.029)	(0.019)	(0.029)
Size	0.136**	0.080**	0.120**
	(0.057)	(0.038)	(0.054)
DCG2			0.062
			(0.039)
_cons	-2.078	-1.014	-1.846
	(1.436)	(0.922)	(1.386)

5 CONCLUSION

The research findings indicate that: Bridging scientist-founders can provide enterprises with a substantial knowledge base and valuable social capital from both academia and

industry. They contribute to the development of breakthrough innovation strategies that meet market demands, thereby fostering breakthrough innovation in enterprises. Bridging scientist-founders can further enhance breakthrough innovation by driving enterprise digital transformation. Digital transformation becomes an accelerator for enterprises to achieve breakthrough innovation.

REFERENCES

1. Haeussler C.Assmus A.Bridging the gap between invention and innovation:increasing success rates in publicly and industry-funded clinical trials[J].Research Policy,2021.50(2):104155.
2. Roche M,Cont A,Rothaermel F,et al.Diferent founders,diferent venture outcomes.A comparative analvsis of academic and non-academic startups[J].Research Policy,2020,49(10).104062.
3. Macher,J.T.&B. Hahn D,Minola T,Eddleston K A.How do scientists contribute to the perormance of innovative star-ups?An imprinting perspective on open innovation[J].Journal of Management Studies.2019.56(5):895-928.
4. Fabiano G,Marcelusi A,Favato G.R versus D,from knowledge creation to value appropriation:0wnership of patents filed by European biotechnology founders[J].Technovation,2021,108:10232
5. Yordanova Z B.Lean startup method hampers breakthrough innovations and company's innovativeness[J].International Journal of Innovation & Technology Management,2018,15(2):1850012.1-1850012.18.
6. Kaaremo. y. A.-G. Nvstrom, Emeroing technolov as a platform for market shaping and innovationl. joural of Business Research. 2021. 124 458-468
7. Haessler, P.,F. Giones, A. Brem. The who and howof commercializing technologies :A technology-focused review[J].Technovation,2023,121:102637.