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Entrepreneurial ability and technological innovation: Evidence from publicly listed companies in an emerging economy

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ABSTRACT

This study's purpose is to explore the moderating effect of ownership on the relationship between entrepreneurial ability and technological innovation. Using 788 publicly listed companies, we applied a multivariate regression analysis to explore this underlying relationship, and found that the Chinese concept of guanxi ability, social responsibility ability, and strategic leadership ability have significantly positive effects on technological innovation. Additionally, as the proportion of state-owned shares increases, guanxi, social responsibility, and strategic leadership abilities become more conducive to technological innovation. The underlying mechanisms of these abilities on technological innovation are discussed.

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1. Introduction

The entrepreneur to some extent determines an enterprise's fortune, a type of special, scarce, and irreplaceable social resource (Nunes, 2016). Prior research indicated that the entrepreneur also has an effect on technological innovation. Schumpeter (1934) considered entrepreneurship to be the motivating force of the "new combination," and indicated that entrepreneur's effect involves replacing the old mode of production with a new one, realizing the sustainable revolutionary change in the economic structure. Hambrick and Mason (1984) suggested the TMT (Top Management Team) theory, according to which the TMT's demography will affect organizational performance, in terms of the age, term of office, education, and professional experience, and in turn, technological innovation. Rostow (2001) believed that a necessary condition for an increase in economic productivity is that entrepreneurs of one or several rapidly growing businesses invest profits in new productivity approaches, and that entrepreneurs are those who are prepared to innovate. Mao and Chen (2003) established three definitions of an entrepreneur, one of which is that an entrepreneur combines production factors or modes in a new way. The entrepreneur's management activities, such as cultivating a management team, building organizational structure, and constructing an enterprise system, will affect cost control, quality advantage, flexibility, and technological innovation, which are sources of organizational efficiency (He and Li, 2005).

According to Jiao et al. (2010), an entrepreneur's ability consists of conceptual ability (Zheng, 2006), guanxi ability (Park and Luo, 2001; He and Li, 2005), leadership (Williams, 1983; Li et al., 2003), and entrepreneurial ability (Covin and Slevin, 1989; Alvareza and Busenitzb, 2001). Jiao et al. (2014) believed that entrepreneurial alertness, uncertainty tolerance, and risk preference are significantly and positively correlated with technological innovation. Moreover, entrepreneurial alertness and interpersonal guanxi have a positive correlation with technologically innovative performance. In this study, entrepreneurial ability has been classified into four sub-indexes, which are entrepreneurial human capital, guanxi ability, social responsibility ability, and strategic leadership ability; we will examine their respective effects on enterprises' technological innovation.

Furthermore, some scholars indicate that the relationship between entrepreneurial ability and technological innovation may differ with ownership systems; specifically, the ownership will affect the strength of the relationship. Entrepreneurs in listed companies with different ownerships exhibit significant differences. Xu et al. (2006) observed that Chinese state-owned companies face more managerial entrenchment risks; for state-owned and non-state-owned listed companies, significant differences exist in the agency problem. Further, Chen et al. (2010) research indicated that the underinvestment of non-state-owned companies in research is one of the largest challenges for technological innovation.

Based on the above, it can be observed that entrepreneurial ability will affect technological innovation, and that ownership has a moderating effect on the relationship between entrepreneurial ability and

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technological innovation. In this research, we will explore ownership's effects on the relationship between entrepreneurial ability and technological innovation.

2. Theory and hypotheses

As a scarce resource, the entrepreneur's effective allocation is an effective way to achieve enterprise development and promote economic growth. Zahra et al. (2000) considered that successful innovation in an enterprise requires strong support from the entrepreneur. Coles et al. (2001) believed that with more office time, the CEO's ability to manage enterprise innovation would be affected to a greater extent. Guo and Li (2006) believed that if entrepreneurs could fully exploit their talents, they would tend to support enterprise innovation activities. Borch and Madsen (2007) posited four types of entrepreneurial abilities that are favorable to enterprises assuming a superior position: internal and external allocation and integration ability, resource acquisition ability, network ability, and strategic path alignment ability. Empirical research found that all of these entrepreneur abilities positively correlate with enterprise innovation strategy, which promotes internal innovation and the enterprise's sustainable growth (Dingler and Enkel, 2016).

An enterprise's competitive advantage, with trends in global integration, is derived from interactive effects of stakeholders, such as suppliers, customers, and aligned partners (Jiao et al., 2013). An entrepreneur's guanxi is a significant source of enterprise innovation; therefore, to obtain external information, an enterprise must persistently scan the environment. Further, other measures should be considered, such as obtaining potential customers' information to turn them into customers, taking the initiative to connect with customers to understand their needs, participating in trade seminars or product exhibitions to understand market quotation information, assembling middle and senior-level leadership meetings, or consulting with senior experts or consultants to pool industry knowledge (Hambrick, 1982).

Therefore, the enterprise can recognize and obtain external knowledge useful for operation through dynamic proactive interaction with the stakeholder network (Zahra and George, 2002; Jiao et al., 2015). Obtaining external knowledge is a significant intelligence source inside the enterprise, which demonstrates the entrepreneur's recognition ability. If the enterprise obtains more external knowledge in a given time, it will have more opportunities and promote inside innovation behavior, which will create and supply more innovative products and services. Zollo and Winter's (2002) research found that, based on guanxi and relationships with stakeholders, the entrepreneur can promote technologically innovative behavior by scanning feasible external opportunities. We propose the following hypothesis, based on the prior analysis:

Hypothesis 1. Entrepreneurial ability has a significantly positive effect on technological innovation.

However, the Chinese economy is a typical transitional economy, an important characteristic of which is the diversity of ownership (Peng and Luo, 2000). Ownership, as a primary motivator of an enterprise management system, has a significant effect on enterprises' organizational strategy and behavior. Compared with other countries globally, China's special social and political environment has nurtured diversified forms of organizational ownership; thus, the effect that ownership diversification exerts on an enterprise must be considered (Walsh et al., 2009). Freeman (1995) was the first to suggest a national innovation system; he thought that Japan's success originated with this system, which includes interaction between the government, industry, and enterprise. Jensen (2010) concluded, based on data research, that control mechanisms will affect the allocation efficiency of research and development resources due to the agency problem.

Moreover, Hitt et al. (1996) considered that differences among enterprises' internal control mechanisms will lead to different innovation choices. Lee and O'Neill (2003) found that under different governance mechanisms, the relationship between ownership structure and the investment in research and development exhibits different characteristics. Guo and Liu (2004) maintained that ownership structure determines whether an enterprise possesses independent property rights and decision-making power; additionally, the incentive structure of entrepreneurial human capital and the financing structure of technological innovation will be affected. Therefore, based on the Chinese special institutional background, entrepreneur ability's effect on technological innovation differs with ownership systems.

Finally, Pryke (1972) believed that state-owned companies operate with better technological efficiency than private companies; moreover, regarding allocation efficiency, no obvious low allocation efficiency exists in state-owned companies. Technological innovation requires adequate capital, and a steady cash flow can support enterprises' technological innovation, while a lack of internal financing may limit technological innovation efforts (Helfat, 1997). State-owned companies tend to more easily obtain government funds and bank loans, which can be more conducive to technological innovation. We propose the following hypothesis based on the prior analysis:

Hypothesis 2. Ownership will moderate the positive impact of entrepreneurial ability on technological innovation.

Integrating the preceding discussion, this research's framework is displayed in Fig. 1.

3. Research method

3.1. Data collection

The sample evaluated in this research includes listed companies from the Shanghai and Shenzhen main boards and growth enterprise markets. However, the sample excluded newly listed companies in 2011 because they had been in operation for less than a full fiscal year; additionally, companies with a CEO who had been in office for less than a year were rejected. Entrepreneurial ability has been classified into four sub-indexes: entrepreneurial human capital, and the guanxi, social responsibility, and strategic leadership abilities. Research data were obtained from the China Corporate Governance Index database from Beijing Normal University, China (Gao et al., 2012). The samples of data loss and data exception were rejected to maintain research consistency; thus, 788 valid samples were obtained.

3.2. Measurement

Enterprises' technological innovation (Thchinno) is measured by the number of patents as per the corporate annual report.

The entrepreneur in this research is signified as the CEO, including the chairman of the board who acts as part-time CEO. This is because the CEO pursues the chairman's strategic goal with his own wisdom and talent, and is authorized by the board of directors. Although the CEO pursues the maximization of personal benefits, this is aligned with the maximization of the company's value, while the chairman of the board is only the “spokesman” or “congregant” of the board of directors, and is not the leader of the other directors or the general manager. The chairman of the board is authorized, which is subject to the responsibility of the board of directors, with the responsibility to organize, coordinate, and represent, and does not generally make individual decisions. Meanwhile, the board of directors authorizes the general, and not the chairman, manager to conduct enterprise management. Over a significant duration, we have severely misunderstood the chairman of the board's status and responsibility; we believe the chairman of the board is the corporate juridical person, who leads the board of

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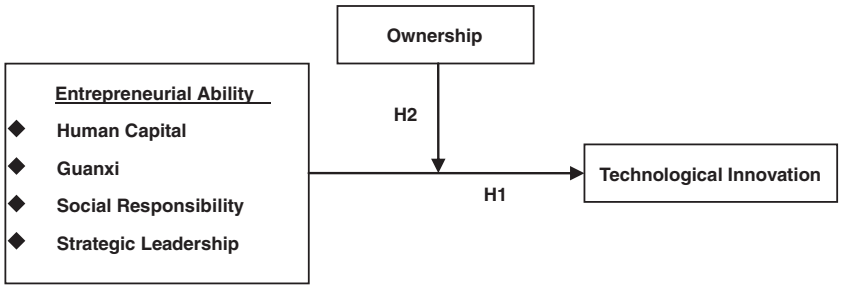

Fig. 1. The research framework of this research.

directors, the general manager, and the corporation's leader. The chairman of the board, considering the above, cannot be a good agent for the principal, namely, the shareholders.

Entrepreneurial ability is a combination of many types of abilities, rather than a single ability index. First, human capital is the basis of entrepreneurial ability, and can be measured by education, work experience, and the duration of work history. Second, the entrepreneur's strategic leadership plays a significant role in enterprise development, especially in a complicated environment that determines an enterprise's long-term development. Moreover, it has been found that an enterprise's fortune is closely associated with an entrepreneur's guanxi. Many foreign researchers found the top manager's government background to be a corporate attribute similarly as corporate ownership structure and corporation diversification effect on corporate value; therefore, guanxi is an important dimension of entrepreneurial ability. Meanwhile, the financial crisis again warned people that an enterprise's sustainable development be based on the construction of social responsibility for all stakeholders, in addition to financial responsibility.

The entrepreneurial ability index (EAI^{BNU}) is evaluated based on the preceding discussion using four sub-indexes, including entrepreneurial human capital (EH), guanxi ability (EN), social responsibility ability (ER), and strategic leadership ability (ES).

Regarding ownership, we classify the company as either an absolute state-owned holding company; state-owned, strong relative holding company; state-owned, weak relative holding company; state-owned share company; or non-state-owned company. We define the five types of ownership as follows:

A. Absolute state-owned holding company: The lower limit proposition of state-owned shares is 50% (excluding 50%).
B. State-owned, strong relative holding company: The state shareholder is the first majority shareholder, and the upper limit proposition of the state-owned share is 50% (including 50%), while the lower upper limit proposition is 30% (excluding 30%).
C. State-owned, weak relative holding company: The state shareholder is the first majority shareholder, and the proposition of the state-owned share is less than 30% (including 30%).
D. The state-owned share company: There is a state shareholder in the company who does not meet the criteria of A, B, C.
E. Non-state-owned company: all others.

Control variables in the regression model include gender, major, a combination of director and general manager (Dual), and industry.

3.3. Descriptive statistics

Table 2 displays different variables' descriptive statistics; it can be observed that the average value of entrepreneurial ability is 35.52, the maximum is 61.59, the minimum is 15.19, and the standard deviation is 7.872. The average value of entrepreneurial human capital is 33.25, the maximum is 92.12, the minimum is 7.288, and the standard deviation is 13.89. The average value of entrepreneurial guanxi ability is 13.54, the maximum is 56.11, the minimum is 0, and the standard deviation is 11.31. The average value of entrepreneurial social responsibility ability is 67.38, the maximum is 100, the minimum is 14.29, and the standard deviation is 14.81. The average value of entrepreneurial strategic leadership ability is 27.92, the maximum is 82.19, the minimum is 1.808, and the standard deviation is 13.51. The measurement index is illustrated in Table 1.

We studied the regression variable using a correlation analysis, and Table 3 presents the Pearson correlation coefficient matrix. It has been demonstrated that a positive correlation exists between entrepreneurial ability and enterprise technological innovation; additionally, there is a positive correlation between ownership and technological innovation, which preliminarily illustrates that this is consistent with expectations.

4. Regression analysis

4.1 Entrepreneur ability, ownership and technological innovation

Table 4 indicates the multiple regression results of entrepreneurial ability, ownership, and technological innovation. Controlling the effects of the entrepreneur's gender and major, the combination of the chairman of the board and the general manager (Dual), and enterprise's industry, the entrepreneurial ability index, which is significant at the 1% significance level, is positively correlated with technological innovation. The results indicate that listed companies with a higher entrepreneurial ability index have more developed technological innovation; thus, Hypothesis 1 is supported.

Additionally, to test the effect ownership exerts on the relationship between entrepreneurial ability and technological innovation, this section places ownership, interaction term of the entrepreneurial ability index, and ownership in the regression equation. Table 4 states that the regression coefficient of the entrepreneurial ability index and ownership's interaction term is 2.820, which is significant at the 1% level. This result indicates that the higher the degree of nationalization, the higher the effect entrepreneurial ability exerts on technological innovation. Specifically, the greater the share of state-owned shares in the enterprise's ownership structure, the greater the effect of entrepreneurial ability on the output of technological innovation; thus, Hypothesis 2 is supported.

To further verify ownership's moderating effect on the relationship between entrepreneurial ability and technological innovation, we conduct a regression using two groups: state-owned and non-state-owned companies; the regression results can be viewed in Table 5. It can be observed from this table that in the state-owned company group, the entire model is more significant, and the dependent variable's explanatory power is greater in comparison to the non-state-owned company group. Further, R^2 increases from 0.0624 to 0.1174, and the estimated regression coefficient significantly increases, which indicates that in state-owned companies, entrepreneurial ability is more conducive to the development of technological innovation. The results provide further support for Hypothesis 2.

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Table 1
The measurement index system of entrepreneur ability.

First level	Second level	Measurement
Human capital	1. Entrepreneur (CEO) education degree	High school, junior high school, primary school and unavailable (0) Vocational school (0.35) Undergraduate education (0.7) Master and doctor (1)
	2. Entrepreneur working time	0–10 years (0) 10–20 years (0.35) 20–30 years (0.7) More than 30 years (1)
	3. Job hopping times	0 (0) 1–2 (0.5) 3 (1)
	4. Whether the entrepreneur undertakes the position of independent director in other corporations	Yes (1); no (0)
	5. Have you studied abroad (more than half a year)?	Yes (1); no (0)
	6. Have you worked abroad (more than half year)?	Yes (1); no (0)
	7. The channel of the recruitment of the CEO	Talent market (1); internal promotion (0)
Guanxi ability	8. Did a government officer visit the enterprise in 2011?	Yes (1); no (0)
	9. In 2011, did the CEO escort the government officer on a visit abroad?	Yes (1); no (0)
	10. Are you the Party representative?	For the whole nation (1) For the province(0.7) The others (0.35) No (0)
	11. Are you the representative of the National People's congress?	For the whole nation (1) For the province (0.7) The others (0.35) No (0)
	12. Are you the representative of the Chinese People's Political Consultative Conference?	For the whole nation (1) For the province (0.7) The others (0.35) No (0)
	13. Have you held an office in the army?	Yes (1); no (0)
	14. Have you won a title of honor when working as CEO?	Of nationwide level (1) Of provincial and ministerial level (0.5) The others (0)
	15. Have you held an office in a trade association?	Of nationwide level (1) Of provincial and ministerial level (0.5) The others (0)
	16. Have you held an office in government?	In central committee (1) Of the provincial and ministerial level (0.7) Of prefecture level (0.35) No (0)
Social responsibility ability	17. Did you donate to an endowment fund in 2011?	Yes (1); no (0)
	18. Do you take a part-time job in a nonprofit organization such as assistant?	Yes (1); no (0)
	19. Have you been denounced by the securities supervision committee in 2011?	Yes (−1); no (0)
	20. Has the enterprise received complaints about the quality of the product?	Yes (−1); no (0)
	21. Is the income growth rate of the employee beyond the profits ratio of the corporation?	Yes (1); no (0)
	22. Is there a dividend?	Yes (1); no (0)
	23. Is there a lawsuit against the corporation for a loan?	Yes (−1); no (0)
Strategic leadership ability	24. Contribution of top manager	Standardized
	25. Do you want overseas expansion?	Yes (1); no (0)
	26. The employee number of enterprise	Standardized
	27. Total assets of enterprise	Standardized
	28. The status of the enterprise in the industry	Standardized by industry (22)
	29. Brand recognition	Of the whole nation (1) Of the province or the industry (0.5) The others (0)
	30. Does the enterprise possess a whole ERP system?	Yes (1); no (0)

Table 2
Descriptive statistics.

Variables	Sample size	Average value	Standard deviation	Minimum	Maximum
EAI[BNU]	788	35.52	7.872	15.19	61.59
EH	788	33.25	13.89	7.288	92.12
EN	788	13.54	11.31	0	56.11
ER	788	67.38	14.81	14.29	100
ES	788	27.92	13.51	1.808	82.19
Techinno	788	27.49	169.37	0	3732
Ownership	788	2.517	1.503	1	5
Gender	788	0.946	0.259	0	1
Dual	788	0.285	0.451	0	1
Major	788	0.645	0.478	0	1

4.2 Entrepreneurial ability, ownership, and technological innovation (sub-item ability indexes)

Entrepreneurial ability has been further classified into four sub-indexes: entrepreneurial human capital and guanxi, social responsibility, and strategic leadership abilities. We will examine their respective effects on enterprises' technological innovation.

Table 6 displays the regression results of technological innovation on the sub-indexes of entrepreneur ability, namely, the multiple regression results of technological innovation on entrepreneur human capital and guanxi, social responsibility, and strategic leadership abilities. Controlling the effect of the entrepreneur's gender and major, the combination of the chairman of the board and the general manager (dual), and the

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Table 3
Correlation analysis.

	Techinno	EAI^{BNU}	EH	EN	ER	ES	Ownership	Gender	Dual
Techinno	1.000								
EAI^{BNU}	0.145***	1.000							
EH	−0.025	0.448***	1.000						
EN	0.086**	0.596***	0.004	1					
ER	0.059*	0.684***	0.048	0.251***	1				
ES	0.227***	0.621***	−0.041	0.274***	0.238***	1			
Ownership	0.128***	−0.102***	−0.074**	−0.007	−0.164***	0.024	1		
Gender	−0.032	−0.066*	−0.010	−0.052	−0.051	−0.043	−0.096***	1	
Dual	−0.046	0.151***	0.066*	0.238***	0.094***	0.019	−0.319***	−0.068*	1
Major	0.048	0.026	−0.043	0.033	0.018	0.057	0.084***	−0.101***	0.016

[a] *** means it is significant at the 1% significance level; ** means it is significant at the 5% significance level; * means it is significant at the 10% significance level.

enterprise's industry, the relationship between the human capital index and technological innovation is not significant. This indicates that the effect of entrepreneurial human capital on technological innovation is limited. Additionally, the guanxi, social responsibility, and strategic leadership abilities positively correlate to technological innovation at least at the 5% significance level. The results indicate that with a higher guanxi, social responsibility, and strategic leadership ability indexes, more technological innovation occurs. This is primarily because with high guanxi ability, entrepreneurs can obtain government funds more easily, which may further encourage the development of technological innovation. Moreover, if the entrepreneur's sense of social responsibility is strong, the entrepreneur will continue to enhance products' quality to supply consumers with more high quality products and, as a result, enhance the technological innovation level. Meanwhile, entreprenuers with high strategic leadership ability will promote technological innovation. Finally, regarding the entrepreneurial human capital and guanxi, social responsibility, and strategic leadership abilities in the model, the guanxi and social responsibility abilities are no longer significant. However, only strategic leadership ability still significantly affects technological innovation, which indicates that, from a certain perspective, the guanxi and social responsibility abilities focus on the strategic leadership ability, which is reflected in the entrepreneur's decision-making activities.

Furthermore, to test the effect ownership exerts on the relationship of each type of ability with technological innovation, we include ownership, and the interaction terms between each ability's sub-index in the entrepreneurial ability index and ownership in the regression equation. Table 7 shows that the regression coefficient of the interaction terms of guanxi, social responsibility, and strategic leadership abilities with ownership are positive and significant at the 1% level. This result means that the higher the degree of the enterprise's nationalization, the stronger the effect that the guanxi, social responsibility, and strategic leadership abilities exert on technological innovation. Specifically, the greater the proportion of state-owned shares in an enterprise's ownership structure, the greater the effect that guanxi, social responsibility, and strategic leadership abilities exert on the output of technological innovation activities. Finally, when entrepreneurial human capital and these three abilities have been included in the model, the interaction terms of guanxi and social responsibility abilities and ownership are no longer significant. However, the interaction terms of strategic leadership ability and ownership still have a significant effect on technological innovation, which indicates that, from a certain perspective. The guanxi and social

Table 4
Entrepreneur ability, ownership and technological innovation.

Variables	Dependent variable: technological innovation			
	Regression coefficient	t-Value	Regression coefficient	t-Value
EAI^{BNU}	3.289***	4.28	−3.630**	−2.41
Ownership			19.549***	−3.92
EAI^{BNU} × Ownership			2.820***	5.74
Gender	−14.687	−0.63	−11.980	−0.52
Dual	−26.799**	−2.00	−8.036	−0.58
Major	15.246	1.22	15.189	1.24
Constant	−10.659	−0.18	313.165***	3.200
Industry Effect	YES			
N	788		788	
R^2	0.0282		0.1271	
F	5.69		4.10	

[a] *** means it is significant at the 1% significance level; ** means it is significant at the 5% significance level; * means it is significant at the 10% significance level.

Table 5
The regression results of state-owned company group and non-state-owned company group.

Variables	Dependent variable: technological innovation			
	State-owned company		Non-state-own company	
	Regression coefficient	t-Value	Regression coefficient	t-Value
EAI^{BNU}	9.338***	4.24	−0.637***	−2.82
Gender	−68.70	−0.82	−2.354	−0.38
Dual	−55.417**	−1.00	−2.926	−0.82
Major	27.197	0.72	12.506***	3.54
Constant	−145.9	−0.65	−22.855	−1.14
Industry Effect	YES			
N	262		526	
R2	0.1174		0.0624	
F	2.76		1.99	

[a] *** means it is significant at the 1% significance level; ** means it is significant at the 5% significance level; * means it is significant at the 10% significance level.

Table 6
Entrepreneur ability and technological innovation—subitem ability indexes.

Variables	Dependent variable: technological innovation				
EH	−0.181				−0.076
	(−0.411)				(−0.176)
EN		1.565***			0.553
		(2.840)			(0.967)
ER			0.982**		0.285
			(2.372)		(0.669)
ES				2.872***	2.668***
				(6.540)	(5.716)
Gender	−16.517	−13.476	−13.647	−10.138	−8.910
	(−0.693)	(−0.568)	(−0.574)	(−0.437)	(−0.383)
Dual	−7.965	−17.490	−10.597	−6.727	−10.689
	(−0.567)	(−1.220)	(−0.756)	(−0.493)	(−0.758)
Major	13.044	12.623	12.736	8.794	8.609
	(1.020)	(0.993)	(1.000)	(0.706)	(0.690)
_cons	278.564***	279.490***	223.527***	182.161**	178.658**
	(3.823)	(3.916)	(3.002)	(2.560)	(2.382)
Industry Effect	Yes	Yes	Yes	Yes	Yes
N	788	788	788	788	788
R^2	0.0483	0.0580	0.0550	0.0986	0.1007
F	1.546	1.877	1.775	3.336	3.035

[a] T statistics in parentheses. *** means it is significant at the 1% significance level; ** means it is significant at the 5% significance level; * means it is significant at the 10% significance level.

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Table 7
Entrepreneur ability, ownership and technological innovation-sub-item ability indexes.

	Dependent variable: technological innovation				
EH	0.598				0.513
	(0.713)				(0.651)
Ownership	35.308***	3.659	−33.379	−33.356***	−39.434*
	(2.696)	(0.397)	(−1.573)	(−3.139)	(−1.753)
EH × Ownership	−0.304				−0.236
	(−1.055)				(−0.872)
EN		−2.235**			−0.347
		(−2.069)			(−0.319)
EN × Ownership		1.477***			0.109
		(3.889)			(0.273)
ER			−1.010		−0.074
			(−1.228)		(−0.091)
ER × Ownership			0.895***		0.262
			(3.125)		(0.907)
ES				−2.825***	−2.715***
				(−3.333)	(−3.061)
ES × Ownership				2.041***	1.938***
				(7.785)	(6.812)
Gender	−11.714	−13.024	−11.818	−9.082	−8.194
	(−0.493)	(−0.556)	(−0.502)	(−0.408)	(−0.367)
Dual	0.256	−4.240	−2.778	−1.312	−0.567
	(0.018)	(−0.293)	(−0.198)	(−0.099)	(−0.041)
Major	12.176	13.465	12.649	12.866	12.336
	(0.956)	(1.073)	(1.006)	(1.078)	(1.030)
_cons	109.214	182.245**	232.853**	196.193**	184.089*
	(1.203)	(2.186)	(2.235)	(2.383)	(1.736)
Industry Effect	YES	YES	YES	YES	YES
N	788	788	788	788	788
R^2	0.0612	0.0856	0.0818	0.177	0.181
F	1.834	2.634	2.508	6.055	5.049

[a] T statistics in parentheses. *** means it is significant at the 1% significance level; ** means it is significant at the 5% significance level; * means it is significant at the 10% significance level.

responsibility abilities focus on strategic leadership ability. Thus, only the interaction terms of strategic leadership ability and ownership still exert significant effects on technological innovation.

We conduct our regression with two groups, the state-owned and non-state-owned companies, to further verify ownership's moderating effect on the relationship between each ability's sub-index and technological innovation; the regression results can be observed in Tables 8 and 9. It can be observed from these tables that in the state-owned company group, the entire model is more significant, the explanatory power

Table 8
The regression results of state-owned company group-subitem ability indexes.

	Dependent variable: technological innovation				
EH	−0.461				−0.058
	(−0.348)				(−0.046)
EN		4.286**			0.086
		(2.539)			(0.046)
ER			3.123**		1.167
			(2.465)		(0.889)
ES				6.422***	6.062***
				(5.644)	(4.706)
Gender	−76.691	−67.326	−76.747	−62.499	−62.894
	(−0.879)	(−0.781)	(−0.890)	(−0.760)	(−0.761)
Dual	−27.611	−46.461	−36.844	−21.138	−23.961
	(−0.480)	(−0.821)	(−0.654)	(−0.394)	(−0.436)
Major	17.518	19.220	19.733	18.140	18.244
	(0.444)	(0.497)	(0.510)	(0.492)	(0.489)
_cons	403.326*	378.417*	238.440	156.568	111.533
	(1.779)	(1.696)	(1.027)	(0.722)	(0.494)
Industry Effect	YES	YES	YES	YES	YES
N	262	262	262	262	262
R^2	0.0511	0.0746	0.0732	0.1583	0.1612
F	1.117	1.672	1.639	3.902	3.153

[a] T statistics in parentheses. *** means it is significant at the 1% significance level; ** means it is significant at the 5% significance level; * means it is significant at the 10% significance level.

Table 9
The regression results of non-state-owned company—subitem ability indexes.

	Dependent variable: technological innovation				
EH	0.006				0.011
	(0.051)				(0.092)
EN		0.199			0.072
		(1.296)			(0.453)
ER			0.214*		0.128
			(1.851)		(1.069)
ES				0.446***	0.402***
				(3.330)	(2.882)
Gender	−3.744	−3.405	−3.108	−2.850	−2.403
	(−0.600)	(−0.546)	(−0.499)	(−0.461)	(−0.388)
Dual	−1.524	−2.806	−2.032	−1.373	−2.159
	(−0.426)	(−0.757)	(−0.568)	(−0.388)	(−0.585)
Major	13.018***	12.871***	12.853***	12.030***	11.985***
	(3.656)	(3.619)	(3.621)	(3.403)	(3.385)
_cons	−4.174	−3.054	−17.919	−16.396	−23.497
	(−0.215)	(−0.160)	(−0.877)	(−0.853)	(−1.125)
Industry Effect	YES	YES	YES	YES	YES
N	526	526	526	526	526
R^2	0.0478	0.0509	0.0542	0.0681	0.0711
F	1.500	1.603	1.711	2.185	1.931

[a] T statistics in parentheses. *** means it is significant at the 1% significance level; ** means it is significant at the 5% significance level; * means it is significant at the 10% significance level.

of the dependent variable is greater in comparison to the non-state-owned company group, and the estimated regression coefficient of each ability's index is significantly increased. This means that in state-owned companies, the guanxi, social responsibility, and strategic leadership abilities are more conducive to the development of technological innovation. The results provide further support for Hypothesis 2.

5. Conclusions

As a type of scarce resource, an entrepreneur's effective allocation is an effective way to achieve enterprise development and promote economic growth. This research found that entrepreneurial ability exhibits a positive correlation with technological innovation, which indicates that the listed company with a higher entrepreneurial ability index possesses greater technological innovation. With higher guanxi, social responsibility, and strategic leadership abilities, the enterprise's technological innovation is superior. This is primarily because with high guanxi ability, the entrepreneur can more easily obtain government funding, which may contribute to the development of technological innovation. Thus, the entrepreneur's guanxi ability is closely related to technological innovation. Additionally, guanxi contributes to the enterprise's competitive advantage, derived from interactions with such stakeholders as suppliers, customers, and aligned partners. Entrepreneurial guanxi allows the enterprise to obtain necessary information regarding opportunities for development.

After China conducted its reform and open policies, the economy greatly developed; however, with this development came new problems, such as an increasing wealth gap, resource wastage, environmental pollution, and trade friction. The public has increasingly realized the importance of social responsibility. Thus, the enterprise should emphasize social responsibility for all stakeholders, in addition to economic responsibility for the shareholders, in order to achieve the enterprise's sustainable development. Moreover, if entrepreneurs have a strong sense of social responsibility, they will continue to satisfy the consumer with high quality products and, as a result, enhance the level of technological innovation.

The entrepreneur's strategic leadership ability plays a key role in the enterprise's development, and especially in a modern, complicated environment. Entrepreneurial strategic leadership ability to some extent determines the enterprise's long-term growth. This ability affects the breadth and depth of strategic decision-making creativity, resources' allocation efficiency, and opportunity recognition. Specifically, in a highly

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uncertain environment, the enterprise is confronted with unstructured problems that cannot be solved by conventional methods; the entrepreneur should simultaneously recognize internal and external environments to make judgments. The entrepreneur's strategic leadership ability is especially important in this process.

Finally, the higher the degree of nationalization, the greater the effect that entrepreneurial ability exerts on technological innovation. Specifically, the greater the proportion of state-owned shares in an enterprise's ownership structure, the greater the effect that entrepreneurial ability exerts on the output derived from technological innovation. We also found that the greater the proportion of state-owned shares in the enterprise's ownership structure, the greater the effect that the guanxi, social responsibility, and strategic leadership abilities exert on the output of technological innovation activities.

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