



Research on Enterprise Innovation Behavior Based on the Regression Analysis Under Big Data Technology

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Abstract. This paper uses the 2016–2018 SME Board listed companies as sample, takes the senior executives' professional experience as an explanatory variable, and divides them into two dimensions: academic, overseas, to empirically test the impact of different professional experiences on corporate innovation investment. In the regression, the application level of big data technology is used as the moderating variable. The study found that: the professional experience of executives has a significant positive effect on the innovation investment of enterprises; the application of big data technology promotes the relationship between the professional experience and innovation investment of enterprises. The research has certain reference value for China's SME Board listed companies to improve the structure of the senior management team and enhance the innovation capabilities of enterprises.

Keywords: Career experience of senior management · Innovation investment · Big data technology

1 Introduction

In recent years, China has vigorously encouraged enterprise innovation. In the report of the 19th National Congress of China, innovation has been mentioned many times, pointing out that innovation is the first driving force for development. As the engine of sustainable development of a company, innovation has always played an important role in the development of the company. Innovation, as the foundation of enterprise survival and development, can promote the improvement of enterprise organization and management efficiency, so that enterprises can continuously improve efficiency and continuously adapt to the requirements of economic development. As a high-value human capital, senior management is the core of business operations. The mission of executives is to ensure that the company has good operating performance. Their personal characteristics, especially background characteristics, have an important impact on the company's strategic choices. For example, military experience makes executives' decision-making more radical and financial experience of senior executives can influence the true earnings management of companies, and the tenure of CEOs in companies can influence organizational strategic changes [1]. The upper echelon theory believes that, compared with

the personal characteristics of managers, the group characteristics of senior managers are more able to influence corporate behavior. A highly efficient management team can formulate good strategies and decisions for the company and bring better development to the company. With the advancement of science and technology, the application of big data technology has brought new opportunities for the company's innovation and development.

The current academic research on executive characteristics and corporate behavior can be divided into the following three categories: (1) Based on the Upper Echelons Theory, some scholars examine the impact of executive human capital characteristics on corporate behavior [2]. (2) Some scholars study the incentive effects of executive compensation and reputation on their behavior. (3) Others Explore the impact of executive overconfidence and risk appetite on corporate decision-making. The professional experience of the senior management team is less involved [3].

The innovations of this article are as follows: It studies the relationship between the professional experience of the senior management team and the innovative behavior of the enterprise, and add the level of big data technology application as a moderating variable. This article enriches the research on the human capital theory and the upper echelon theory.

2 Theoretical Analysis and Research Hypothesis

2.1 Professional Experience of Senior Executives and Investment in Enterprise Innovation

Upper Echelons Theory believes that the characteristics of executives will affect their own value and the basis of self-cognition, thereby affecting the strategic and business decisions of the company. Compared with personal characteristics, the characteristics of the senior management team can affect corporate behavioral decisions. The new human capital theory believes that people's cognitive and non-cognitive abilities are formed in multiple stages, and that abilities can be cultivated not only by genetic inheritance, but also by nurture [4]. Therefore, the professional experience of executives will affect their business decision-making preferences. Some studies believe that a good academic training and academic atmosphere can improve the theoretical accomplishment of executives and cultivate their innovative thinking [5]. Executives with academic experience generally have higher moral standards and sense of responsibility, are more alert to market trends, and have a higher acceptance of innovative ideas [6]. Some scholars believe that executives with overseas experience pay more attention to the protection of technological innovation achievements and tend to make innovative decisions in management. Overseas experience can make senior executives more international in their thinking and management concepts, enabling them to grasp the future market development direction and be more inclined to innovation in formulating corporate development strategies. Based on the above summary and analysis, the following hypotheses are proposed:

H1a: When other conditions remain unchanged, the senior executives' academic experience has a positive effect on corporate innovation investment.

H1b: When other conditions remain unchanged, the senior executives' overseas experience has a positive effect on corporate innovation investment.

2.2 The Role of Corporate Big Data Technology in the Relationship Between Executive's Career Experience and Innovation Investment

The Theory of Regulation Orientation believes that individuals will change their thoughts and reactions according to self-regulation to achieve specific goals. The technological level of an enterprise reflects the innovation ability of the enterprise and affects the innovation ability of the enterprise. Therefore, the enterprise's big data technology level will affect the enterprise's innovation activities and innovation investment behavior. When the level of corporate big data technology is relatively high, executives are more inclined to increase the company's investment in innovation in order to obtain better innovation performance. Therefore, the level of big data technology of company has a moderating effect on the relationship between the professional experience of senior managers and the company's investment in innovation. Based on the above analysis, this article proposes the following hypotheses:

H2a: The level of corporate big data technology has a moderating effect on the relationship between the academic experience of executives and the investment in innovation of the enterprise.

H2b: The level of corporate big data technology has a moderating effect on the relationship between the overseas experience of executives and the investment in innovation of the enterprise.

3 Research Design

3.1 Sample Selection

This article selects the SME Board listed companies from 2016 to 2018 as a sample. The senior executives' career experience data and sample companies are all from the CSMAR database. The missing data is cross-checked and supplemented by querying websites such as Sina Finance and Baidu search engine. In order to avoid the bias caused by the elimination of samples, the largest available sample is used for all regressions. Screen the initial research samples according to the following conditions:

- (1) Excluding financial and insurance companies;
- (2) Eliminate ST and delisted companies;
- (3) Eliminate samples with missing other variables and failing to meet the standards
- (4) Perform 1% Winsorize processing on each continuous variable of the model to avoid the influence of extreme outliers. After the above-mentioned data screening and deletion of missing samples, a 1989 annual sample was finally obtained. All data analysis uses stata15.

3.2 Related Variables and Definitions

The explained variable. Based on the research results of previous scholars, this paper uses innovation input (RD) to measure the innovation capability of enterprises. Since operating income fluctuates greatly and is easily affected by the market, the ratio of innovation input to total assets is used to measure enterprise innovation input.

Table 1. SENIOR EXECUTIVES' PROFESSIONAL EXPERIENCE AND CORPORATE INNOVATION INDICATORS

	Variable name	Variable label	Description
Explained variable	Enterprise R&D investment	RD	R&D investment/total assets
Explanatory variables	senior executives with academic experience	Academic	The number of executives with academic background/ total number of executive team
	senior executives with overseas experience	Ocaper	The number of executives with overseas background/total number of executive team
Control variable	Company Size	SIZE	The natural logarithm of the company's total assets
	Equity ratio	DER	Total liabilities/total owners' equity
	Equity concentration	FSP	The largest shareholder's shareholding ratio
	Return on Assets	ROA	Net profit/total assets
	Cash flow position	CASH	Net cash flow from operating activities per share
	Corporation value	Tobinq	Measured by Tobin's Q
	Industry variables	IND	Industry dummy variables
	Annual variable	YEAR	Annual dummy variable
Moderating Variable	The level of big data technology	TECH	The company uses big data technology as 1, otherwise it is 0

The *Explaining variables*. This article draws on the practice of Zhou Kaitang and others, and defines the senior management team as the senior management personnel, including CFO, CEO, etc., who directly participate in business decision-making in addition to the members of the board of directors and the board of supervisors.

- (1) Academic experience: This article measures the academic experience of senior executives as the proportion of academic executives to the total number of executives in the company.
- (2) Overseas experience: This article measures the overseas experience of senior executives based on the proportion of the number of returned executives to the total number of executives in the company.
- (3) Moderating variables: The moderating variable is the level of big data technology.

Control variables. Combined with the existing research, the control variables selected in this article: company size, corporate value, equity ratio, cash flow status, return on assets, equity concentration, etc., and add industry and annual dummy variables. The definition of each variable is shown in Table 1 shows:

3.3 Model Construction

In order to analyze the relationship between the senior management’s professional experience and the innovation investment of enterprise, as well as the moderating effect of the level of big data technology, a stepwise multiple regression analysis model was constructed. Since there are two independent variables in this paper, EC is used to replace the model in the setting of the model. In order to verify the hypothesis, the following regression model is used:

$$RD = \beta_0 + \beta_1 EC + \beta_2 Controls + \varepsilon \tag{1}$$

$$RD = \beta_0 + \beta_1 EC + \beta_2 EC \times TECH + \beta_3 TECH + \beta_4 Controls + \varepsilon \tag{2}$$

4 Empirical Analysis

4.1 Descriptive Analysis of Variables

Before performing multiple regression analysis, you need to perform the following simple descriptive statistics on each variable of the sample. The specific results are shown in Table 2:

Table 2 shows the descriptive statistics of overall variables. In terms of innovation input, the average innovation input of enterprises during the operation period is 2.31%,

Table 2. SUMMARY STATISTICS

	Obs	Mean	SD	Min	Median	Max
RD	1989	0.023	0.017	0.001	0.020	0.097
Acdemic	1989	0.139	0.152	0.000	0.118	1.000
Ocaper	1989	0.078	0.135	0.000	0.000	1.000
TECH	1989	0.014	0.116	0	1	1989
CASH	1989	0.349	0.568	-1.371	0.267	2.554
FSP	1989	0.315	0.133	0.088	0.297	0.692
Tobinq	1989	2.095	1.117	0.925	1.769	7.112
SIZE	1989	22.130	0.930	19.199	22.106	26.019
DER	1989	0.778	0.676	0.078	0.575	3.843
ROA	1989	0.039	0.057	-0.224	0.037	0.188

Table 3. CORRELATION MATRIX

	RD	Academic	Ocaper	TECH
RD	1			
Academic	0.088***	1		
Ocaper	0.141***	0.040*	1	
TECH	0.277***	0.049**	0.017	1

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

and the minimum and maximum are about 0 and 9.66%, respectively. This shows that the SME Board listed companies are due to industry and market competition. Affected by many factors, the difference in innovation investment is quite large, with a median of about 2%, which is lower than the sample average, indicating that most SME Board listed companies have relatively low investment in innovation. In terms of the proportion of senior executives with academic experience, the minimum is 0 and the maximum is 1. The median and average are both 11.8% and 13.9%, indicating that executives with academic experience in the selected sample companies account for approximately 14%. In terms of the proportion of executives with overseas backgrounds, the average is about 8%, indicating that executives with overseas backgrounds in the selected sample companies account for about 8% of the executive team. The maximum of TECH is 1, the minimum is 0, and the average is 1.4%, indicating that big data technology level of each sample company is quite different. The control variables all meet the standard of general sampling inspection.

4.2 Correlation Test of Variables

From Table 3, we can see the Pearson correlation coefficient results of innovation input RD and each explanatory variable. The correlation coefficients between the explanatory variables are all less than 0.3, indicating that the correlation between the variables is weak, and there is no serious multicollinearity. The correlation test results of the main independent variables are shown in Table 3:

4.3 Multiple Regression Analysis Test

As shown in Table 4, model (1) analyzes the impact of senior executives’ professional experience on corporate innovation investment after controlling for other variables that affect corporate innovation investment. The regression coefficient between the proportion of senior executives with academic experience and corporate innovation investment is significantly positive at the 5% level. It shows that for China’s SME Board listed companies, the proportion of senior executives with academic experience has a significant positive impact on corporate innovation investment. Hypothesis 1a has been verified; The regression coefficient between the proportion of senior executives with overseas experience and corporate innovation investment is significantly positive at the 1% level, which indicates that the proportion of senior executives with overseas experience and

Table 4. THE MULTIPLE REGRESSION OF SENIOR MANAGEMENT’S PROFESSIONAL EXPERIENCE AND CORPORATE INNOVATION INVESTMENT

	(1)	(2)	(3)	(4)
Academic	0.006**		0.005**	
	(0.002)		(0.002)	
Ocaper		0.013***		0.012***
		(0.003)		(0.003)
AcademicTECH			0.035**	
			(0.017)	
OcaperTECH				0.061***
				(0.017)
TECH			0.029***	0.028***
			(0.003)	(0.003)
SIZE	0.001***	0.001**	0.001	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
DER	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
ROA	0.037***	0.038***	0.038***	0.033***
	(0.007)	(0.007)	(0.007)	(0.007)
CASH	0.001	0.000	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
FSP	-0.002	-0.002	-0.001	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)
Tobinq	0.003***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
_cons	-0.035***	-0.028**	-0.020*	-0.027**
	(0.011)	(0.011)	(0.011)	(0.011)
Obs.	1989	1989	1989	1989
R-squared	0.175	0.183	0.219	0.198

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

corporate innovation investment exist significant positive impact, hypothesis 1b has been verified. It provides the possibility to further analyze the moderating mechanism between them.

(3) (4) Report on the moderating effect of the level of big data technology on the professional experience of senior management and innovation investment of enterprise. The empirical results show that the regression coefficients of the interaction terms of the proportion of senior executives with academic experience and the proportion of senior

executives with overseas experience are significantly positive. It shows that the level of big data technology has played a role in promoting the relationship between corporate innovation investment and senior executives' professional experience. Hypothesis 2a and 2b are confirmed.

4.4 Robustness Test

(1) Expand the scope of sample research and include directors and supervisors into the senior management team to study its impact. (2) Excluding companies that have been issued with unqualified audit opinions. The results of regression analysis have not changed significantly, which are consistent with the conclusions of this article. Due to space limitations, we will not repeat them.

5 Conclusion

This article uses the 2016–2018 SME Board listed companies as a sample to study the impact of executives with different professional experiences on corporate innovation investment decisions. This paper conducts an empirical test on the relationship between the academic experience, overseas experience of senior managers and corporate innovation investment, and finds that the professional experience of senior managers has a significant positive impact on innovation investment. The level of big data technology of enterprise plays a moderating role between the career experience of senior managers and the investment in innovation. The article provides new evidence support for the recruitment and selection of high-level talents in the company, and improves the structure of the senior management team of the SME Board listed companies. It is conducive to further standardizing the corporate governance system, improving the enterprise's risk-bearing level and innovation capabilities, and promoting the sustainable development of the entire social economy.

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