

# Managerial Ability and Enterprise Innovation —An Empirical Analysis Based on Shanghai and Shenzhen A-Share Listed Companies

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## ABSTRACT

With innovation becoming an important activity, this article considers how to improve the level of innovation of enterprises. Through preliminary literature reading, it was found that improving the managerial ability had become an effective attempt to enhance enterprise innovation. Based on the resource-based theory and human capital theory, the hypothesis that managerial ability positively affects the company's innovation output and innovation input was proposed. This article selected 612 companies in the A-share listed companies in Shanghai and Shenzhen from 2010 to 2016 as the research object, and explored the influence mechanism between managerial ability and enterprise innovation through empirical research.

**Keywords:** Managerial ability, Innovation output, Innovation input.

## 1. INTRODUCTION

In recent years, with the deepening of the awareness of innovation, enterprises have increased their investment in pursuing product innovation and technological innovation. How to improve the performance level of enterprise innovation has become a new research theme. However, innovation behavior is a special kind of investment behavior, which includes new product development, new technology discovery, and new market exploration. The output has extremely high uncertainty and timeliness [1], which will bring enterprises great risk. Excellent managers will be able to control the overall direction of innovation projects, and bring higher innovation performance and profits to the enterprise. Therefore, what characteristics of managers can choose to promote the improvement of enterprise innovation performance has become an important research topic. For example, some scholars have found that riskier and more challenging innovative projects were favored by overconfident managers who believed that they are competent for projects with uncertainties and hoped that the success of the projects could prove their personal capabilities [2]. Overconfident managers tended to highly estimate their own ability to solve problems and operate enterprise development projects [3], overestimated the future benefits of the project, and underestimated the risk of project failure [4], which

made them more willing to choose innovation project to create higher economic benefits. So whether there is a correlation between managerial ability and the enterprise's innovative behavior and performance has become one of the purposes of this research. There are many researches on managerial ability and enterprise performance. In the research of managerial ability, scholars have conducted more research on the relationship between managerial ability and investment behavior, earnings quality, and company performance level [5], in terms of corporate innovation behavior and performance there is less research. In the research on measuring the innovation behavior and performance of enterprises, most scholars focused on the external competitive environment and policy environment factors, and less considered the factors of enterprises themselves.

The main core of the research in this paper is the influence of managerial ability on corporate innovation behavior and performance, involving the definition of two important concepts, one is the managerial ability, and the other is corporate innovation. First, the research results of managerial ability and enterprise innovation performance are sorted out, and the shortcomings of the current research on manager ability and enterprise innovation performance are summarized. On this basis, the research ideas of the article are put forward, and the

foundation for constructing theoretical models is laid. Second, we can select A-share listed companies in Shanghai and Shenzhen stock exchanges from 2010 to 2016 from databases such as CSMAR and the official websites of some companies in the sample, and use spss2.0 statistical software descriptive statistics, correlation analysis, and regression analysis are performed on the data, to study the relationship between the managerial ability and the innovation performance of the enterprise, and get the results, and then in-depth analysis of the results to draw conclusions.

## **2. LITERATURE REVIEW**

### ***2.1. Managerial Ability***

When mentioned in previous literature, managerial ability was often referred to as "managerial skills", "management quality" and "managerial talent" [6], and managers played an important role in the work of setting goals for corporate strategy, so they might be replaced by terms such as "CEO competence", but the most frequently used in the literature is still "managerial ability" [7], so this article collectively referred to the managerial ability. Based on resource-based theory, managerial ability was defined as the ability to deploy and control corporate resources. It usually manifested itself as knowledge, experience and skills. Highly capable managers rely on their own rich knowledge or professional experiences adjusted the strategic direction and improve performance of the enterprise; as far as the development of the enterprise was concerned, the managerial ability was defined by scholars as the ability to use economic resources to create economic profits for the enterprise [8]. Some scholars believed that managerial ability to use their own management skills was their ability, which could be used to improve efficiency and improve performance [9].

Reviewing the literature, managerial ability was mostly measured based on some proxy variables, which roughly boiled down to the characteristics of the managers themselves and the characteristics of the enterprise. The characteristics of managers were mainly reflected in the aspects of age, education level, work experience, manager's tenure, style, reputation, etc. Scholars have found that these elements have a certain degree of influence on corporate decision-making and performance [10]. In the past, managerial abilities were often measured by one or several characteristics. For example, some used managers' reputation to measure managerial ability, while reputation quantification was based on the number of media reports on managers or the length of CEO's tenure, promotion method, etc. [11]. Some of these indicators were not objective enough, such as the choice of media and the definition of the degree of attention, and others were difficult to use for all companies, especially the reports on

managers of small and medium-sized companies were rare [12]. They cannot provide a stable and extensive quantitative index for managerial ability, so they had been rarely adopted in recent years. The method of quantifying managerial ability from the level of enterprise characteristics was chosen by more scholars. Compared with manager characteristics, enterprise characteristics (total assets, scale, performance and efficiency) are easier to measure and calculate. For example, Rosen (1982) used total assets and company size, and Huang et al. (2011) used efficiency as a proxy variable to measure managerial ability. Some scholars have discovered the correlation between managerial ability and stock price, so that the rise or fall of stock price can be used to measure managerial ability [13].

The early indicators cannot reasonably represent the managerial ability and are not universally persuasive. With the continuous expansion of the research field of managerial ability, foreign scholars [8] proposed more persuasive conceptual interpretation and quantitative method, namely data envelopment analysis method, used to estimate the input and output of the enterprise after separating influencing factors (such as market share, assets, cash flow and operating cycle, etc.) other than the managerial ability. In view of the more comprehensive and accurate interpretation of this indicator and in recent years, most scholars have used this measurement method to conduct empirical research, so I decided use the DEA method to measure managerial ability.

### ***2.2. Innovation Input and Innovation Output***

Innovation includes not only technological innovation, but also business model innovation, as well as the process by which scholars express innovation as new products and services for the first commercial transformation [10]. As for the measurement of the benefits they bring (innovation performance), the existing literature positions them to describe the financial performance, economic and social benefits of the enterprise, such as the sales input-output ratio of new products, and the product innovation ratio. The measurement of enterprise innovation performance is divided into the following two factions, one is innovation input, and the other is innovation output.

Innovation input is considered R&D investment, which is specifically expressed in the number of assets and personnel invested in R&D. Early scholars found through empirical research that innovation investment has a direct impact on corporate performance. For example, foreign scholars studied the relationship between Australian corporate R&D investment and corporate performance and found a positive correlation between them, so R&D input was used as a measure of innovation performance [14]. The general view of comprehensive scholars can be drawn that the

innovation input of enterprises is the various resource investment that enterprises make in order to obtain economic benefits in innovation activities. Following the most common practice and taking the availability of data into account, this paper chooses R&D costs as be measured indicator, including direct costs and indirect costs. The focus of the research on output indicators lies in the impact of innovation output on corporate performance in corporate innovation projects. For example, some scholars have learned that the number of patent applications applied by companies has an impact on corporate performance [15]. Patents include not only invention patents, but also utility model patents and design patents. When quantifying the innovation performance of enterprises, scholars gradually use the number of patent applications for enterprises to measure the innovation output of enterprises [16]. Two other scholars use the number of patent applications to measure the innovation capability of enterprises [17].

### **3. RESEARCH HYPOTHESIS**

#### ***3.1. Managerial Competence and Enterprise Innovation Output Performance***

In the study of the relationship between managerial abilities and corporate innovation performance, based on resource-based theory, it can be found that corporate innovation was inseparable from the rational allocation of resources and required companies to choose different application methods for relatively scarce resources to create the best output. During the operation of a company with relatively strong managerial abilities, its managers had a better understanding of the business development status of the company, as well as a more thorough understanding of the industry environment. In most cases, they were good at using new technologies and discovering new ones and seizing new market opportunities. Capable managers were good at uniting teams to integrate internal and external resources. They not only gained insights into new opportunities and discoveries, but also identified certain risks that may exist in the market environment and make risk predictions. Therefore, companies with stronger managerial abilities could find the optimal solution in the process of resource allocation, while identifying market opportunities and avoiding risks, thereby promoting innovation.

Based on the human capital theory, the managerial ability was a scarce heterogeneous resource relative to the enterprise itself. The stronger the managerial ability, the stronger the competitive advantage of the enterprise can be shown. For enterprises, if they wanted to make new discoveries and breakthroughs, they should not only invest in material resources, but also absorb excellent human capital for continuous accumulation [18]. The managerial ability was human capital, and the

managerial abilities came from their past experience and knowledge level. They can have a strong grasp and prediction of market demand and the development direction of the enterprise [19]. Based on the above analysis, we put forward Hypothesis 1: A company's managerial ability positively affects the company's innovation output performance.

#### ***3.2. Managerial Competence and Enterprise Innovation Output Performance***

We found that managers often increase venture capital when supporting enterprise innovation activities. Such venture capital or investment in innovation could be added with the increase in the shareholding ratio of capable managers. And other scholars have found that when studying the relationship between managers' salary incentives and innovative behaviors, managers who were more sensitive to salary might increase R&D expenditure. Based on the theory of high-level echelon, scholars believed that when the top managers of enterprises made decisions that affect corporate strategy, they relied on their own cognitive foundation and scenario choices, which will make relatively personalized decisions [21]. The theory believed that the individual characteristics of managers, such as management style, background characteristics, etc., could affect the making of innovative decisions. Scholars have found that overconfident managers were more inclined to increase investment in innovation and choose high-risk innovative decisions. Competent managers were also more willing to carry out high-risk activities and more confident in their decisions and investment. So based on the above analysis, we put forward Hypothesis 2: The ability of a company's managers positively affects its investment in innovation.

### **4. SAMPLE SOURCE AND VARIABLE DESCRIPTION**

#### ***4.1. Sample Source***

We selected companies from 2010-2016 A-share listed companies in Shanghai and Shenzhen stock exchanges as the initial sample. In order to ensure the rigor of the sample, the selection of the sample was carried out. First, the sample of listed companies with 0 patent applications was excluded, whose complete information cannot be obtained. Secondly, the samples of ST and PT listed companies were excluded because most of them have financial problems, which weren't included in the scope of analysis. And sample companies in the financial and insurance industries were excluded, and finally samples with missing variable data were excluded. According to the above conditions, 612 samples were finally obtained.

**4.2. Variable Description**

**4.2.1. Explanatory Variable**

As one of the important research variables of this article, the measurement and calculation of managerial ability (MA) adopted the calculation method and process of Demerjian (2012) and other scholars [8], namely the DEA-Tobit two-stage model. This method was used to calculate the company's total output efficiency (Efficiency) under a certain level of resource constraints, and then the influence of corporate-level factors was removed, such as corporate size, company listing years, market share, etc. The final residual was the manager ability.

The company's output efficiency (Efficiency) in the first stage is calculated as follows:

$$\text{Efficiency} = \text{Sales} / (\alpha_1 \text{COGS} + \alpha_2 \text{SG\&A} + \alpha_3 \text{PPE} + \alpha_4 \text{Good will} + \alpha_5 \text{Intan} + \alpha_6 \text{R\&D}) + \varepsilon \tag{1}$$

In the second stage of the calculation of MA, the company's output efficiency (Efficiency) in the first

stage was used as the dependent variable, and the influencing factors at the enterprise level were used as independent variables to perform regression analysis to obtain the residual items in the results. So  $\varepsilon$  was MA. Drawing lessons from the above-mentioned scholars, the enterprise-level factors listed in this article included enterprise size (SIZE), listing age (AGE), free cash flow (FCF), market share (MS), business type (BHBI).

$$\text{Efficiency} = \beta_0 + \beta_1 \text{SIZE} + \beta_2 \text{AGE} + \beta_3 \text{FCF} + \beta_4 \text{MS} + \beta_5 \text{BHBI} + \text{year} + \varepsilon \tag{2}$$

**4.2.2. Explained Variable**

This article selected the number of patent applications as the explained variable and is recorded as Patent; the innovation input was measured by the company's R&D expenditure and recorded as R&D.

**4.2.3. Control Variables**

This article selected corporate size (SIZE), company listing years (AGE), corporate equity concentration

**Table 1.** Descriptive statistical results of research variables

Variable	MA	Patent	R&D	SIZE	AGE	SHRCR	GROWTH	LEV	ROE
Numbers	612	612	612	612	612	612	612	612	612
Mean	0.0021	3.9976	0.0357	22.558	2.0013	0.3498	0.2638	0.3921	0.0619
SD	0.1752	2.3865	0.0272	1.1466	0.8134	0.1566	0.3822	0.1877	0.0812

**Table 2.** Correlation statistical results of main research variables

Variable	MA	Patent	R&D	SIZE	AGE	SHRCR	GROWTH	LEV	ROE
MA	1								
Patent	.093**	1							
R&D	.245**	.179**	1						
SIZE	-0.031	-.506**	.005	1					
AGE	.075**	.159**	.012**	.037**	1				
SHRCR	-.208*	.063**	.163**	.144**	-.085**	1			
GROWTH	.014**	-.055*	-.007	-.041**	.069**	.018	1		
LEV	-.108**	-.147**	-.082*	-.012**	.113**	.003	.001	1	
ROE	.327*	.137**	.057	.061**	.130**	.091*	.198**	.024	1

**Table 3.** Regression analysis results of main research variables

Variable		MA	SIZE	AGE	SHRCR	GROWTH	LEV	ROE
Patent	coefficient	1.65	0.732	0.118	0.044	-0.104	-0.021	2.121
	sig.	0.006	0.005	0.007	0.197	0.046	0.591	0.008
R&D	coefficient	0.842	0.161	0.095	0.163	-0.092	-0.014	1.783
	sig.	0.002	0.008	0.007	0.047	0.127	0.591	0.036

(SHRCR), operating income growth rate (GROWTH), asset-liability ratio (LEV), and return on equity (ROE) as controls variable.

## 5 MODEL DESIGN AND REGRESSION ANALYSIS

### 5.1. Model Design

This paper proposes Hypothesis 1: The managerial ability of a company positively affects the innovation output performance of the enterprise, and Hypothesis 2: The managerial ability of an enterprise positively affects the innovation input. In order to verify these two hypotheses, the following model was designed:

$$Patenti,t = \alpha_0 + \alpha_1 MA_{i,t} + \alpha_2 SIZE_{i,t} + \alpha_3 AGE_{i,t} + \alpha_4 SHRCR_{i,t} + \alpha_5 GROWTH_{i,t} + \alpha_6 LEV_{i,t} + \alpha_7 ROE_{i,t} + \epsilon \quad (1)$$

$$R\&D_{i,t} = \beta_0 + \beta_1 MA_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 AGE_{i,t} + \beta_4 SHRCR_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 LEV_{i,t} + \beta_7 ROE_{i,t} + \epsilon \quad (2)$$

According to the above hypothesis analysis, if  $\alpha_1$  is positive and significant, hypothesis 1 is supported, and if  $\beta_1$  is positive and passes the significance test, hypothesis 2 is supported.

### 5.2. Descriptive Statistics

As shown in Table 1, the mean of MA was 0.0021; the standard deviation was 0.1752, indicating that there were significant differences in managerial ability among the selected sample of listed companies. This showed that my country's listed companies should strengthen management building. The average value of patent applications was 3.9976, the standard deviation was 2.3865. These data showed that my country's listed companies have a relatively high level of patent technology, but there are also significant differences. The mean of R&D was at an intensity of 0.0357. Although the overall level is not low, it is also necessary to improve the innovation performance of companies that are currently at a low level.

### 5.3. Relevance Statistics

After data analysis, I found that VIF was less than 4, which indicated that there was no multiple mutual linear problems. At the same time, this paper conducts Pearson correlation test between variables based on the hypothesis, and the specific results can be seen in Table 2.

It can be seen from the table that the correlation coefficient between the MA and Patent was 0.093, which was significantly correlated at the 1% level, in line with Hypothesis 1. The correlation coefficient between R&D and MA was 0.245, which was significantly correlated ( $p < 0.1$ ). Therefore, in the correlation analysis, it can be initially obtained that the

enterprise with the stronger the managerial ability, the higher the enterprise innovation output performance level, the more innovation investment. For getting more accurate and convincing results, I performed a further regression analysis.

### 5.4. Regression Analysis

From the first column of the Table 3, it found that the regression coefficient between MA and Patent was 1.650 ( $p < 0.1$ ). So hypothesis 1 can be supported. The second column was that the regression coefficient between MA and R&D was 0.842, which was significantly correlated at the 1% level, so Hypothesis 2 can be supported.

Looking at the control variables, the coefficient between SIZE and Patent was 0.732 ( $p < 0.1$ ). Therefore, expanding the size of the firm can have a positive effect on firm innovation. The coefficient between AGE and Patent was 0.118 ( $p < 0.05$ ). Therefore, the longer the company was established the more experience and results it can accumulate to promote corporate innovation. The coefficient between SHRCR and Patent was 0.044, which didn't pass the significance test, indicating that the relationship between them was not significant. The coefficient between GROWTH and Patent was -0.104 ( $p < 0.05$ ), which meant that the growth of corporate revenue didn't promote corporate innovation performance. The coefficient between LEV and Patent was -0.201, which also didn't pass the significance test, indicating that there is no significant connection between them. The coefficient between ROE and Patent was -0.201 ( $p < 0.1$ ), which showed that companies with high profitability could promote the growth of corporate innovation performance.

## 6. CONCLUSIONS

In the regression analysis, it can be seen that there was a significant positive relationship between the managerial ability and innovation output, and that the managerial ability positively affected corporate innovation input. From the results of the analysis of control variables, it can be found that the expansion of enterprise scale, the accumulation of enterprise experience, and the improvement of profitability can all promote the improvement of innovation performance. Returning to the impact of managerial abilities on corporate innovation performance and innovation investment, we can see that in the current society and industry requiring companies to quickly integrate into the pace of innovation, this article also proposed a direction for companies that wanted to know how could do a good job in innovation: Enhance managerial abilities. As the decision maker, direction planner, and market perceiver of an enterprise, managers can be said to be closely related to the development direction of

enterprise innovation. Managers were also scarce human resources. They should play an important role in the enterprise's resource allocation, coordinating and leading the planning and formulation of the entire enterprise strategy [22]. The stronger the managerial abilities, the better they can identify risks and opportunities in the rapidly changing market environment, avoid decisions that will cause losses, compare various innovative solutions, and select the best solution to lead the company into the correct innovation direction to continue development.

In the process of analysis, it is found that the current level of corporate managerial competence is not high. The state should promote enterprises to cultivate managerial competence and strengthen the construction of the entire management team. Establish a scientific manager training system, increase the company's investment in managerial training, extend training hours, and enrich training types, especially training courses in innovation. At the same time, managers are encouraged to continue their studies, and managers who have not obtained a high degree can provide them with opportunities to study abroad and encourage them to improve their own knowledge accumulation and skill level[23]. It is also possible to formulate a reasonable supervision mechanism to motivate the managers who have completed the training in terms of performance and salary, and regularly check the training effect, carry out various assessment activities, and consolidate the training knowledge.

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