

Neural Network Data Mining Application in Innovation Input and Output Performance of Listed Companies in Colleges based on Regulation of Governance Structure

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Abstract

This paper focuses on the research on the allocation of corporate innovation resources around board governance and executive incentive of Listed Companies in Colleges and Universities. Using the production function of Douglas's cloth, it studies the moderating effect of board governance and executive incentive of Listed Companies in Colleges and Universities on innovation resources input and innovation performance output of the company, and analyzes if the different governance mechanisms have a moderating effect on innovation resources input and innovation performance output of the company. The study found that the board of directors of Listed Companies in Colleges and Universities has no moderating effect on innovation resources input and innovation performance output of the company, but executive incentive does. This not only improves the existing governance structure and innovation performance logic analysis framework in theory, but also provides theoretical support for the improvement of the governance structure and mechanism and the level of innovation performance management of the listed companies in Colleges and universities.

Keywords: *Listed companies, board governance, executive incentive, innovation resources, moderating effect*

1. Introduction

With the help of university enterprise shareholder resources in driving close relationship between school and enterprise, the enterprise has obtained the necessary input of innovation resources, but innovation resources input and output to the allocation of resources management can produce good economic benefits. This resource allocation capability is achieved through the correct technology research and development decision-making, the correct management decisions of the board of directors and the executive management system is an important way to ensure the company to make the right decisions. Therefore, board governance and executive incentive affect the company's innovation performance through the management of innovation resources. In the era of knowledge economy, the investment of technology innovation can have a positive effect on the performance, which has been widely supported by the existing research [1-2]. As Johnson and Pazderka (1993) the fundamental purpose of R & D investment is to obtain the advantages of different competitors [3], so as to achieve the purpose of improving the performance of the company. But because of the information asymmetry, the intertemporal income development activities and other features make the existence of

serious agency problems, the governance structure of different companies have different innovation performance [4], therefore, it can be said that corporate governance has a moderating effect on innovation performance. Such as Chung and Shen (2009) empirical results show that, when the enterprise R&D investment, supervision mechanism operation of enterprises additional higher returns; when the enterprise capital investment, enterprise contract of mechanism of additional higher returns [5].

Based on this, this paper explores the listed companies in the acquisition process of configuration of innovation resources, its internal governance mechanism on innovation and utilization of resources, and through the research methods of empirical test based on regulation for R & D investment and innovation performance of the governance structure of the decision-making mechanism, and tries to find out the benefit of input and output performance management research model. This not only theoretically the governance structure and the innovation performance of the existing framework of logical analysis more perfect, but also for the listed companies to improve the governance structure and mechanism, to provide theoretical support to improve the level of innovation performance management.

2. The Neural Network Data Mining

With the development of information technology, data mining technology from the laboratory into the enterprise, especially have established their own data warehouse resources for many enterprise level, data mining has become an important research topic among them. In foreign countries, there have been such as Nuggets powerful data mining tools in our country. This study is still in the theoretical research. Data mining is the valuable information from the massive data found hidden, and provide new reliable technology guarantee for the scientific research and strategic decision-making. It will adopt the algorithm to find new data model or relationship from the large number of original data. It is the product of artificial intelligence technology and database technology. The combination of data mining has been widely used in prediction and decision support system, enterprise development strategy, marketing and channel Information industry and other fields.



Figure 1. Data mining

Artificial neural network is an information processing method developed in the study of biological inspiration under the nervous system. It simulates the biology nervous

system structure, a large number of processing units composed of nonlinear adaptive dynamic system, the nonlinear dynamic characteristics of large scale practice is highly nonlinear, global network, large-scale parallel processing and high robustness and a fault tolerance, associative memory, abstraction and adaptive ability. And this kind of abstraction and adaptive ability generally called self-learning ability. Self-learning is the most important feature of neurons, by learning to construct the model to analyze the data of the model, for a large number of data samples, the discovery of new knowledge through learning neural network. Automatic adjustment, neurons between the input/utput according to certain rules, change the internal state of the input/utput showing Human intervention some principle of artificial neural network method because it requires very little, so as to overcome the deficiency of the general information processing method. Through the network and ANN as the new development direction of the future, we will become the main research object and the direction of development.

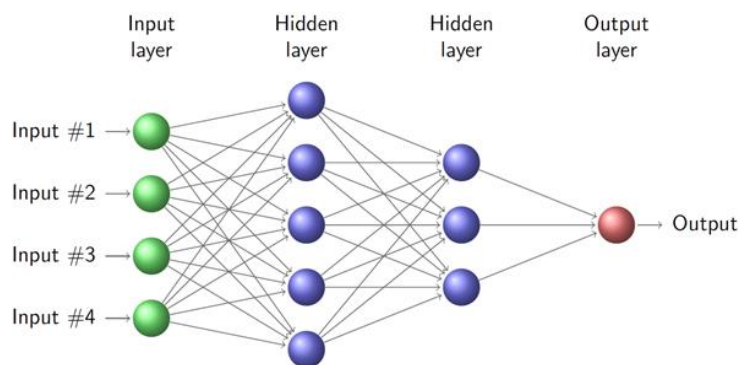


Figure 2. Artificial neural network

3. Theoretical Analysis and Research Hypothesis

3.1. R&D input and innovation performance

In the era of knowledge economy, R&D investment is considered to be a necessary means to enhance the competitive advantage of enterprises. R&D investment can improve the efficiency and competitive advantage by having the core technology of the product and improving the technological process of the product.

Many scholars both at home and abroad have conducted relevant empirical studies on the relationship between investment and innovation performance, but they did not get the same conclusion. Some empirical results show that the relationship between R & D investment and innovation performance is significantly positive. Nelson research shows that human capital externalities generated by the innovation incentives, educated more than other workers of special capital alternative, high level of education is low educational level of workers labor instead of good. Based on this, the paper puts forward the hypothesis:

H1: Company R&D investment and the company's innovative performance has a positive impact

H2: The technical personnel input and innovation performance of Listed Companies in Colleges and universities are positively correlated

3.2. Governance of the board of directors of the company's investment in innovation

It is generally believed that the appropriate size of the board of directors can ease the agency costs in the process of technological innovation. Zahra (2000) were investigated in 231 medium-sized manufacturers in the United States, found that the board is an inverted U curve relationship between scale and R & D investment, namely medium-sized board on the innovation activities of the most favorable [7]. Liu (2010) study on manufacturing continuous disclosure spending on R&D of 2004-2008 years and the high technology industry listed companies as samples, studies show that the board of directors, there exist two threshold between scale and R & D investment value (6.5 and 10.5) of the non-linear relationship between the optimal scale of the Board shall be 7 or 9 people [8]. Based on the existing research, taking into account the characteristics of research activities and results of unpredictability, this paper argues that the smaller size of the board, the more easily achieve the same development decision, to avoid too many meaningless discussion to extend the development cycle and development cost. Based on this, this paper puts forward the research hypothesis:

H3: the size of the board of directors and the company's Innovative Patent output and financial performance is a negative relationship.

H4: the size of the board of directors has a negative effect on the company's innovation input and output.

Independent directors of the company to undertake the supervision of the company's board of directors, the company's main R&D activity on the company's long-term value is useful for supervision. According to Chung and other studies suggest that the relationship between R&D expenditure and enterprise performance by the proportion of outside directors, the securities analysts focused on a high proportion of independent directors of the company, its performance is positively related to R&D expenditures and enterprise (Chunget, *et al.*, 2003) [9]. And because the proportion of independent directors will be too high, because it is only through the financial statements of the past and short-term financial information as the basis for decision-making, it will reduce the board of directors of the company executives to make correct and effective decision research (Baysingeret, *et al.*, 1990) [10]. Therefore, this paper puts forward the research hypothesis:

H4: the proportion of independent directors and innovative performance was negatively correlated.

3.3. Characteristics of the board of directors and innovation investment performance

The research team population characteristics of directors, domestic research is still in its initial stage, mainly from the characteristics of the internal population education team, age, professional background and tenure, the company's innovative performance characteristics of the external population and equity incentive and annual salary [11-12]. On this basis, combined with the characteristics of the governance structure of Listed Companies in universities, this paper puts forward the research hypothesis.

The listed company is founded by the development of transformation of scientific research in Colleges and universities, has "University derivative" traits, such as Han Zhongxue (2014) found to have the technical background of the board members can influence from the strategic decision-making and can effectively improve the technical efficiency of companies [14]. Li Zhengwei, *et al.*, (2011) believe that the professional background heterogeneity among the top management team members will have a significant positive impact on the performance of the enterprise [15]. Li Wen, Xia Qinghua (2012) derived by empirical research on China's 211 university found that academic entrepreneurs to participate in the enterprise management has a significant role

in the USOs performance, in deeper, more investment, more conducive to enhance the level of enterprise performance. Based on this, the paper puts forward the hypothesis 5:

H5: the technology background of the senior executives of listed companies is significantly positively correlated with the innovation performance.

Education level can reflect the senior management team of the company's long-term development strategy of cognition and the ability to control. Wu Yanbing (2009) stressed that the cultivation of innovative ability is closely related to a person's education. Liu (2015) study the University listed companies as a sample, the study found that the degree of heterogeneity of executive education and the main revenue growth is positive correlation, and the net profit growth was negatively correlated. In addition, listed companies are in the high-tech industry, the level of education of the senior management team plays an important role in the clear cognition of enterprise technology development strategy, so this paper puts forward the hypothesis 4:

H6: the education level of the board of directors has a significant positive impact on the company's innovation performance.

The impact of senior executives on R & D is mainly divided into two cases: young executives and senior executives. Barker, Mueller (2002) believes that the younger the manager, the more holding company stock, the more the company's R & D expenses. Wang Wenqing (2008) studies have shown that, compared with non state-owned enterprises especially private enterprises, political relations and corporate performance of state owned enterprises and private enterprises are negatively correlated with the political relationship is positively correlated with corporate performance. Based on this, the paper puts forward the hypothesis 5:

H7: the age level of the board of directors and the company's innovative performance is negatively correlated.

Wu Jiong (2011) studies indicate that TMT age heterogeneity is positively correlated with corporate performance, executive team occupation sources of heterogeneity is negatively correlated with corporate performance, executive team education level, team tenure heterogeneity and corporate performance has no significant correlation [17]. In Colleges and universities of China listed companies belong to the management of state-owned enterprises, management appointed by the chief executive, members of the age heterogeneity on the one hand enable the team presented the enterprising spirit. On the other hand can be older, experienced executives to avoid a strategic control, both with the onrush, should be therefore, promote each other, this paper assumed 8:

H8: the age heterogeneity of top management team is positively correlated with the firm's innovation performance.

Zahra, *et al.*, (2000) found that the proportion of managers' ownership has a significant positive correlation with enterprise technological innovation. Beyer, *etc.* (2011) to 1406 Belgian companies as a sample, found that the manager does not hold shares of the company, the company often R & D investment is not enough [19]. Equity incentive can reduce the conflict of interests of managers and shareholders, enthusiasm for technical innovation to improve the management, on the other hand, especially in the high-tech industry [20], can motivate executives to improve long-term R & D investment, so as to enhance the innovation performance, this paper proposes 9 hypotheses:

H9: Board of directors and corporate innovation performance is positively correlated.

The increase of corporate executive compensation will increase the risk of senior members of the opportunity cost, because of its increasing psychological considerations of innovation is expected to reduce the investment risk, tend not to invest in innovation to

improve the company's short-term interests, so as to realize the steady growth of individual short-term compensation. The results show that there is no significant positive correlation between executive compensation and firm performance. Based on this, this paper puts forward the research hypothesis 10:

H10: the relationship between executive compensation and corporate innovation performance of Listed Companies in Colleges and universities.

3.4. The influence of board governance and executive incentive on the efficiency of resource management

Based on Sirmon (2007, 2011) the research, the enterprise only has the resources is not enough, must carry on the management to the resources, including the resources obtain, the combination and the use and so on many activities. And for the long period of technological innovation activities, the risk of greater innovation activities is the case, the direction of research and development of innovative resources, R & D personnel selection and configuration process is the process of resource allocation and decision making. Therefore, the board of directors governance level, the executive ability background and the executive incentive to the company's resources allocation efficiency will have a different impact. Specific to the input and output of technology innovation, effective governance of the board of directors and executive incentive will produce better efficiency of resource allocation through innovation resources so as to enhance the efficiency of the input and output, therefore, the author puts forward the research hypothesis 9-10:

H11: the scale of the board of directors of Listed Companies in Colleges and universities has a positive moderating effect on the input and output efficiency of innovation resources

H12: the relationship between R & D investment and innovation performance has positive effect on the relationship between executive incentive of Listed Companies in Colleges and universities.

4. Research design

4.1. Research sample and data

This paper adopts the following method to select the A shares in the listed company: (1) the listed company with a university or college by using CSMAR database search in the top ten shareholders; (2) to search the Internet using "the concept" and other words; (3) to verify and test for the samples by Financial Street published on the website of the prospectus excluding, University Foundation for outstanding shares of stock investment data, (4) according to the selected data of listed companies, excluding the research data and other key information disclosure of company. Finally, we collected the sample data of the listed companies of 2006-2014 in this paper.

A member of the board of directors, the board of the company's annual report issued by the technical background in cninf resume and Internet search information to confirm the number of patents, companies get through the patent information service platform, the State Intellectual Property Office (Baiteng network) and the disclosure of the annual report information collection and manual.

4.2. Research variables

(1) Dependent variable: the measure of firm's innovation performance. This paper draws on the research of Ernst (1999), by means of the State Intellectual Property Office

to retrieve the number of patents (PAT) as the index of the number of patents () as indicators to measure the level of innovation performance. Learn from Zhu Guojun (2013) years of research, select the company's annual main business income (INCOM) as an indicator to measure the company's innovative financial performance.

(2) focused on the input and output variables based on the logic, this paper selected the following four aspects: research and innovation investment characteristics as independent variables include: 1.R&D input intensity (RD), the R & D investment / business income; 2.the development of human input (RDP), the technical personnel accounted for a percentage of the total number of employees; 3. TMT age (RYE), with the average age of the executives calculation; 4. age heterogeneity (AGEH) measured by the coefficient of standard deviation, the standard deviation divided by the mean, the greater the coefficient showed high heterogeneity; characteristics of executive incentive human external: including senior executives annual salary (COM), the average number of executives members of the remuneration calculation.

The variables of this study are shown in Table 1.

Table 1. Variables and data sources

Variable	Var	Variable name	Description	data sources
dependent variable	PAT	Number of patent applications	Ln(PAT)	State Intellectual Property Office
	INCOM	Main business income	Ln(INCOM)	CSMAR database
independent variable	RD	R&D input strength	R & D investment / operating income calculation	CSMAR database
	RDP	R & D investment	Technical personnel account for the percentage	Annual reports of listed companies
Adjustment variable	BS	Size of the board of directors	Ln(number of the board of directors)	CSMAR database
	NID	Proportion of independent directors	The number of independent directors /board of directors	CSMAR database
	RT	The professional background of the board of directors	The technical background of the board of directors	CSMAR database
	RE	The education level of the top management members	Doctoral graduate student is 5, master's degree is 4, undergraduate is 3, college is 2, rest is 1	CSMAR database
	RYE	Senior management team age	average age	CSMAR database
	COM	Annual remuneration of executive members	Average number of executive compensation	CSMAR database
control variable	CSIZ	company size	Ln(total assets)	CSMAR database
	GRO	Corporate growth	Annual growth rate of main business income	CSMAR database
	IND	industry	Medicine, electronics, machinery 1, The other is 0	
	ZON	Regional characteristics	The eastern and southern regions are 1, the central and western regions are 0	
	CO	Organization form	State owned enterprises and state holding enterprises are 1, private and private holding enterprises is 0	

4.3. Model setting

In this paper, using the generalized Douglas (Cobb-Douglas) knowledge production function, the introduction of board governance and executive incentive governance indicators, the governance structure of the model to estimate the regulatory effect. In the interaction of the test of enterprise innovation resources and governance structure on the innovation output, this paper follows the Aiken and West (Aiken & West) proposed regulatory regression analysis, using three steps: first layer regression into control variables; then add variables of enterprise knowledge resources and external support, inspection the main effect; finally add interactive, interactive interpretation test variation, and the regression coefficient is significant.

On this basis, draw lessons from the method of stepwise regression, the first stage of the regression analysis of the control variables, the second stage of input and output regression analysis, the third stage of all the variables for regression analysis. Based on the above assumptions and variables, the empirical study of the model is as follows:

$$\begin{aligned} \text{LnINCOME}_{it} &= \beta_0 + \beta_1 \text{LnRD}_{i-1t} + \beta_2 \text{LnRDP}_{i-1t} + \mu_{it} + \varepsilon_{it} \\ \text{LnINCOME}_{it} &= \beta_0 + \beta_1 \text{LnRD}_{i-1t} + \beta_2 \text{LnRDP}_{i-1t} + \beta_3 \text{LnBS}_{it} + \beta_4 \text{LnNID}_{it} + \mu_{it} + \varepsilon_{it} \\ \text{LnINCOME}_{it} &= \beta_0 + \beta_1 \text{LnRD}_{i-1t} + \beta_2 \text{LnRDP}_{i-1t} \\ &\quad + \beta_3 \text{LnBS}_{it} + \beta_4 \text{LnNID}_{it} + \beta_5 \text{LnRT}_{it} + \beta_6 \text{LnRE}_{it} + \beta_7 \text{LnRYE}_{it} \\ &\quad + \beta_8 \text{LnAGEH}_{it} + \beta_9 \text{LnCOM}_{it} + \alpha_1 \text{LnGIV}_{it} + \alpha_2 \text{LnIND}_{it} \\ &\quad + \alpha_{43} \text{LnZON}_{it} \mu_{it} + \varepsilon_{it} \end{aligned}$$

5. Empirical Results

5.1. Regression analysis

This paper uses EVEWES 7 analysis, firstly the data stability test was carried out, using ADF test method, test results, although ZL RDP, LIB, FEDUM of non-stationary series, but a single whole sequence is stationary, therefore, in this paper a first-order differential processing of all data. As in the regression equation (3) multiple variables exist, if the existence of multicollinearity among variables, then the coefficient estimate is not credible, differential processing of the data, further analysis of variance among the variables of the expansion factor (VIF) can be found, the variance between each variable expansion factor the mean of 3.221, far less than 10, that each variable is double collinearity in the acceptable range. In the use of panel data analysis, the main consideration of the two models, namely, fixed effect model and random effect model. In this paper, Hausman test is used to select. First, the random effect as the original hypothesis, after Eviews calculation, the P values of the three equations are equal to or close to 0, so reject the original hypothesis. So choose fixed effect model. Tobit model for the continuous distribution in the positive, but the data structure with positive probability zero, can obtain unbiased estimators, consistent.

For the analysis of panel data, this paper selects the generalized least squares regression, in order to obtain reliable estimates of the results, the regression results see Table 2.

Table 2. Governance structure and innovation performance regression results

variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Innovation patent output	Innovation performance	Patent output	Innovation performance	Patent output	Innovation performance
RD	0.033 (-1.398)	-0.581*** (-6.191)	-0.014 (-0.580)	-0.044 (-0.801)	-0.005 (-0.239)	0.078* (1.674)
TPR	-0.033*** (-4.084)	-4.186*** (-12.961)	-0.222** (-2.149)	-0.392* (-1.818)	-0.133 (-1.329)	-0.313* (-1.719)
BS			0.393** (2.462)	5.598*** (15.821)	-0.184 (-0.617)	0.129 (0.227)
NID			-0.376 (1.201)	-15.821*** (-4.235)	0.436 (1.308)	-0.115 (-0.179)
RT					0.278** (2.307)	0.118 (0.548)
RE					- 2.021*** (-3.087)	8.441*** (7.585)
RYE					- 0.547*** (-2.738)	-0.323 (-0.842)
AGEH					0.068*** (2.707)	0.756 (25.086)
COM					0.335*** (4.154)	0.586*** (4.059)
GRO	-0.074* (-1.874)	-0.766*** (-4.892)	-0.054 (-1.349)	-0.200** (-2.203)	-0.041 (-1.054)	-0.021* (-0.286)
IND	1.514*** (4.191)	1.051 (0.991)	1.498*** (4.259)	0.773 (1.373)	1.321** (3.930)	-0.790 (-1.520)
ZON	0.391 (1.044)	-0.346 (-0.318)	0.361 (0.991)	-0.885 (-1.529)	0.246 (0.721)	0.093 (0.178)
CO	-0.381 (-1.101)	1.801* (1.786)	-0.384 (-1.142)	1.352** (2.526)	-0.395 (-1.254)	1.188** (2.481)

By Table 2, the model 1 and model 2 respectively, give the regression results of the innovation output, innovation financial output and innovation investment of the listed companies in Colleges and universities. The results show that R& D investment intensity and technical personnel input and innovation patent output is not significant correlation, which is a negative correlation between technical personnel, but not significant. This shows that China's listed companies to increase R&D investment have not brought significant improvement in the level of innovation. This may be related to the listed companies and universities university cooperative innovation, the core technology will only belong to company, and to enhance the academic reputation of the University hold the relevant patent. Model 3 and model 4 verified the characteristics of board of directors in innovation patent output and innovation of financial output adjustment relationship shows that board size and corporate innovation patent and innovation of financial output at 0.05 level of significant positive correlation ($p=0.39$), assuming the H1 support, the size of the board of directors to the board of executives. The decision-making behavior plays a positive incentive. But the proportion of independent directors and innovation performance relationship is significantly negative correlation ($p=-0.37$, $p=-15.8$) at the 0.01 level, but the relationship between the independent directors and the patent output is not significant, assuming that H2 is supported. This is consistent with the research results of Ding Ping (2008) and so on [23]. According to Hu Yuanmu (2012) research, technology independent directors will have a positive impact on innovation performance, but analyzes the independent directors of listed companies can be found in the

background, many independent directors as financial experts and lawyers do not have a technical background, this is probably one of the reasons for this result.

Model 5 and Model 6 were verified based on the governance of the board of directors, the influence of the characteristics of human capital and incentive of executive directors, found that there was a significant positive correlation between the executive compensation and the innovation of patent output ($p=0.34$), significant at the 0.01 level. Visible, through the director of executive pay incentives, can enhance the subjective initiative and enthusiasm of the executive, the positive role of this incentive in the University of Listed Companies involved in equity participation.

The technical background of the directors and the company's patent output was significantly related to the level of 0.05, but the relationship between the financial performance and innovative financial performance is not significant, assuming that H3 is verified. There was significant positive correlation between the executive education and innovation patent and innovation performance, the H4 hypothesis is verified, the results prove that the directors and executives of the human capital can also be used as a kind of heterogeneous resources, is an important factor in the formation of technological innovation capability. Executives' age and patent output had a significant negative effect on the 0.01 level, assuming that H5 was supported. But there is no significant correlation between innovation performance and innovation performance. This is consistent with the conclusions of Li Qianbing (2011).

5.2. Regulation effect analysis

To further test the moderating effect of corporate governance on corporate innovation investment, according to Ren Haiyun (2011) study, introduction of board governance, executive demographic characteristics and executive incentive and investment in research and development of interaction, if there is no significant relationship between governance variables and innovation performance, that governance variables is pure variable, if significant correlation governance and corporate performance, governance variables are semi variable; when governance variables and R & D interaction did not pass the test of significance, if the variables of corporate governance and corporate performance or R & D variables in a significant correlation, corporate governance variables are not variable, if the variables of corporate governance and corporate performance or R & D variables there is no significant correlation between, according to certain standards will be grouped test samples, see groups of R^2 is significantly different, To further determine whether the corporate governance variables are homogeneous regulatory variables.

Using hierarchical regression method, respectively introducing interaction terms board size, the proportion of outside directors and R & D strength (BS·RD, NID·RD), the board of directors interaction scale, the proportion of outside directors and technical manpower (BS·PRD, NID·PRD), the regression results are shown in Table 3. Model 1, model 2 and model 3, respectively, to test the regulation effect of governance structure index.

Table 3. The level of the board of directors on the regulation of patent output

variable	Model1	Model2	Model3	Model4	Model5
RD	2.531 (1.485)	0.787 (0.472)	0.828 (0.064)	1.283 (0.768)	-11.292* (-1.652)
PRD	1.199*** (4.120)	0.042 (0.123)	0.795 (0.296)	0.269 (0.799)	4.340 *** (2.819)
BS		0.442*** (5.679)	0.443*** (5.653)		
BS·RD			0.006 (0.001)		
BS·PRD			-0.334 (-0.283)		
NID				2.273*** (5049)	2.516*** (5.347)
NID·RD					33.158* (1.876)
NID·PRD					-11.429*** (-2.691)
GRO	-0.035 (-0.390)	-0.094 (-1.053)	-0.094 (-1.058)	-0.076 (-0.847)	-0.094 (-1.058)
IND	1.350*** (9.952)	1.269*** (9.670)	1.262 (9.433)	1.212*** (9.024)	1.262 (9.433)
ZON	0.514*** (3.307)	2.531* (1.485)	0.345* (2.199)	0.428*** (2.827)	0.345* (2.199)
CO	0.023 (0.211)	-0.488*** (-3.461)	-0.486*** (-3.439)	-0.375** (-2.782)	-0.486*** (-3.439)
R2	0.235	0.293	0.293	0.281	0.296

From the income of Table 2, the scale of the board of directors is significant positive correlation with the R&D investment and technical manpower investment, which indicates that the board of directors of Listed Companies in Colleges and universities is willing to invest in innovation resources. At the same time, the board of directors interaction scale and R&D capital investment and technological manpower was not significant, but the size of the board at the 1% level through the significant test, indicating the size of the board of directors in technology innovation patent output activities, no regulation of R&D investment and technology human input, and has a direct relationship with the innovation patent the results show that the output of the board size of the intervention level of decision-making is smaller. Hypothesis is verified. While Table 3 shows that the proportion of independent directors and R&D investment is a significant negative correlation, but the technology and human input is positive correlation significantly, verified by independent directors in corporate decision-making tendency through the financial statements hypothesis. In addition, the proportion of independent directors and R&D investment and technology investment impact on innovation activities of human interaction were significant, indicating the presence of independent directors to run R & D investment decision of R&D, but has adverse effects on the technology and human resources management decision.

Table 4. The level of the board of directors on innovative financial performance adjustment

variable	Model1	Model2	Model3	Model4	Model5
RD	2.531 (1.485)	-9.135*** (-2.598)	73.715*** (3.193)	-1.552 (-0.348)	40.195*** (2.690)
PRD	1.199*** (4.120)	3.740*** (5.122)	43.164*** (9.047)	6.872*** (7.643)	42.253 *** (12.559)
BS		7.842*** (47.768)	7.972*** (57.116)		
BS · RD			-35.261*** (-3.467)		
BS · PRD			-17.474*** (-8.346)		
NID				42.495*** (35.396)	47.067*** (45.758)
NID · RD					- 116.758*** (-3.02)
NID · PRD					- 102.007*** (-10.99)
GRO	-0.035 (-0.390)	0.002 (0.011)	-0.055 (-0.347)	0.283 (1.180)	0.177 (0.910)
IND	1.350*** (9.952)	1.078*** (3.895)	0.568 (2.390)	-0.065*** (-0.182)	-0.291 (-0.996)
ZON	0.514*** (3.307)	-1.167*** (-3.630)	-1.015*** (-3.629)	0.316 (0.783)	-0.073 (-0.221)
CO	0.023 (0.211)	1.828*** (6.145)	1.917*** (7.617)	3.439*** (9.553)	2.531*** (8.437)
R ²	0.235	0.836	0.883	0.733	0.821

From Table 4, the scale of the board of directors and the interaction of RD and PRD were significantly negative, which shows that the scale of the board of directors and the company's main business revenue relationship has a moderating effect, the scale of the board of directors is not conducive to the implementation of R & D projects RD. Interaction between the proportion of independent directors and the interaction of PRD and RD were significantly negative, indicating the relationship between the proportion of independent directors on the RD and the company's main business revenue, regulate the proportion of independent directors is also not conducive to the development of the implementation of the project. The reason may have two: one is the R&D technology itself has the isolation board, resulting in increased scale due to the non technical director, will be more focused on short-term gains, while ignoring the long-term value of the company R & D investment; two is the quality of independent directors is not good, because it is not specifically involved in the company the operation, therefore unable to have the performance potential of R & D project supervision.

Using hierarchical regression method, the interaction term were introduced to directors and senior technical background, director of executive education, executive director and director of executive compensation incentive and the age of R & D strength (RT·RD, RE·RD, RYE ·RD, COM·RD), and the interaction and human input (RT·PRD, RE·PRD, RYE· PRD, COM·PRD), the regression results in Table 5.

Table 5. Moderating effect of executive population characteristics and incentives on Patent Output

variable	Model1	Model2	Model3	Model4	Model5	Model6	Model7	Model8
RD	0.890 (0.511)	1.795 (0.528)	0.215 (0.125)	3.738 (0.344)	0.978 (0.587)	4.443 (0.323)	0.670 (0.407)	8.599 (0.629)
PRD	0.797** (2.584)	1.712*** (3.671)	0.072 (0.202)	1.475 (0.772)	0.079 (0.229)	2.336 (0.669)	-0.145 (-0.421)	-7.825** (-2.448)
RT	0.641*** (3.543)	1.192*** (4.645)						
RT·RD		-0.578 (-0.154)						
RT·PRD		- 2.212*** (-2.706)						
RE			0.281*** (5.092)	0.284*** (5.132)				
RE·RD				-0.787 (-0.283)				
RE·PRD				-0.396 (-0.746)				
RYE					0.019*** (5.550)	0.020*** (5.363)		
RYE·RD						-0.068 (-0.245)		
RYE·PRD						-0.046 (-0.651)		
COM							0.098*** (6.507)	0.100*** (5.347)
COM·RD								-0.674 (-0.598)
COM·PRD								0.635** (2.416)
GRO	-0.041 (-0.460)	-0.053 (-0.590)	-0.075 (-0.839)	-0.080 (-0.895)	-0.088 (-0.998)	-0.090 (-1.008)	-0.087 (-0.993)	-0.071 (-0.812)
IND	1.288*** (9.557)	1.254*** (9.343)	1.213*** (9.041)	1.211 (8.946)***	1.250*** (9.473)	1.241*** (9.358)	1.189*** (9.054)	1.137*** (8.513)
ZON	0.459*** (2.988)	0.375** (2.402)	0.455*** (3.017)	0.403** (2.519)	0.381** (2.513)	0.368* (2.381)	0.351** (2.345)	0.346** (2.296)
CO	-0.127 (-1.068)	-0.274** (-2.146)	- 0.463*** (-3.191)	-0.470*** (-3.197)	-0.447*** (-3.244)	-0.473*** (-3.371)	- 0.542*** (-3.927)	- 0.517*** (-3.759)
R2	0.259	0.276	0.283	0.284	0.291	0.293	0.309	0.322

From the Table 5, the technical background of the directors of the board of directors of the technical staff has a significant positive relationship, significant at 1% level. Description of technical background executives tends to select the technical personnel strategy. But the technical background of the executive director of the technical personnel involved in the patent output has a negative regulatory effect, and in the 1% level significantly. Director of executive education background of adjusting the relationship between patent output and R&D investment to participate in the activities of technical personnel are not significant, the executive incentive has a positive moderating effect on the technical personnel involved in the patent activities, and significant at the 5% level, but for R&D involved in the regulation of patent output is not significant.

Table 6. The role of executive population characteristics and incentives to innovation performance

variable	Model1	Model2	Model3	Model4	Model5	Model6	Model7	Model8
RD	5.276 (0.596)	25.014* (1.745)	22.808*** (-5.763)	86.738*** (4.112)	-6.676** (-2.050)	103.883*** (4.180)	-7.935*** (-2.588)	140.557*** (6.018)
PRD	20.213*** (12.892)	37.666*** (19.123)	2.553*** (3.082)	34.763*** (9.366)	3.727*** (5.516)	20.687*** (3.274)	2.772*** (4.307)	12.186** (2.231)
RT	6.451*** (7.012)	17.034*** (15.725)						
RT · RD		14.132* (0.895)						
RT · PRD		42.232*** (12.243)						
RE			5.425*** (42.449)	5.501*** (51.013)				
RE · RD				25.369*** (4.697)				
RE · PRD				9.091*** (8.817)				
RYE					0.359*** (52.030)	0.369*** (56.565)		
RYE · RD						-2.231*** (-4.420)		
RYE · PRD						-0.353*** (-0.709)		
COM							1.565*** (55.776)	1.583*** (61.179)
COM · RD								-12.26*** (-6.368)
COM · PRD								-0.777* (-1.728)
GRO	0.974** (2.107)	0.756* (-1.058)	0.274 (1.321)	0.148 (0.850)	0.072 (0.415)	-0.04 (0.246)	0.210 (1.285)	-0.168 (1.121)
IND	1.885*** (2.752)	1.229* (2.168)	-0.124 (-0.401)	-0.207 (-0.788)	0.676*** (2.622)	0.520** (2.164)	-0.065 (-0.267)	-0.168 (1.121)
ZON	1.365* (1.746)	-0.273* (-0.415)	0.792** (2.272)	-0.515* (-1.654)	0.521*** (-1.760)	-0.822*** (-2.938)	-0.686** (-2.458)	-0.976*** (-3.79)
CO	9.389*** (15.522)	6.543*** (12.100)	1.516*** (4.516)	1.397*** (4.888)	2.272*** (8.426)	1.944*** (7.651)	1.866*** (7.252)	1.803*** (7.669)
R2	0.002	0.327	0.800	0.859	0.858	0.879	0.875	0.896

From Table 6 the directors, executives and technical background of R&D investment and technology manpower into the interaction between the main business income has a positive regulatory role, and respectively in 10% and 1% significant level, this research is in accordance with the correct implementation of technical background, executives can use their professional background to promote technological decision. The interactive terms of educational level and R&D investment and technical manpower input have positive moderating effect on the main business income, and are significant at the 1% level. In the high and new technology industry, the higher education level executives can grasp the technical direction, thereby enhancing the decision-making performance. The board of directors and executive compensation executives age have negative significant relationship to the regulation of R&D investment and technology manpower performance, show that the board of the older executives, the short-term compensation level is high, then the relationship between R&D investment and technology investment and human performance is not significant, the project execution performance is poor, this conclusion is consistent with the hypothesis that get confirmed.

In general, the input of innovation resources, with governance structure factors, the coefficient of relationship between innovation input and output changes, overall strengthening of the input-output efficiency of innovation, although the study found that the input-output efficiency of universities of listed companies on innovation resources did not bring significant innovation performance, but the efficiency of the Board Governance, the board of directors and executive human capital management can enhance investment in innovation resources play a positive effect, the basic path for resource picking, governance capacity and innovation performance. This is consistent with the results of Ge

Baoshan (2009), the impact of resource acquisition on competitive advantage is not significant, resource integration can only be used to bring the corresponding competitive advantage for the enterprise.

As for China enterprises, resource picking ability is insufficient, lack of ability to identify valuable resources, and resource picking process are not effective, so we need a middle course, by setting up scientific company governance structure, choose to have a technical background of the directors and executives to affect the enterprise innovation performance.

6. Conclusions

In this paper, we use 2006-2014 China University of shares of listed companies as research samples, according to the results of empirical research and theoretical analysis have been put forward hypotheses, and then use the Cobb Douglas production function, the process of model test on the relationship between resource based view of governance structure and innovation performance of the company. Based on the analysis and discussion of the test results, the following conclusions are drawn:

1. The impact of corporate governance on R&D and technology human input output

(1) in the case of the 1 lag, the innovation of the listed companies in China's colleges and universities is less than expected, this relationship is not significant difference between the University holding and the shares of listed companies. (2) the size of the board of directors in the lag 1 period, and corporate innovation performance showed positive correlation, but not significantly negatively related to innovation performance; the proportion of independent directors and the board of directors of the company; no obvious relationship between the innovation performance of ownership and corporate members, the management and our country's equity incentives is relatively low about. (3) the human capital characteristics of directors, such as the technical background, academic structure and the company's innovative performance is a significant positive correlation, but at the same time, the average age of the company also has a positive correlation with the company's innovation performance. There is correlation between executive compensation incentive and corporate innovation performance.

2. The moderating effect of corporate governance on R&D and technical human activities

(1) The relationship between corporate governance structure of Listed Companies in Colleges and universities and the relationship between the company's patent output and the company's innovation performance has a regulatory effect on the relationship between R&D investment and technical personnel input.

In the R&D input and technology personnel input and patent output relations, in addition to the size of the board of directors, the other indexes can regulate the relationship; in the relationship between business income of R&D investment and technology investment and the company's main personnel in Universities of listed companies each corporate governance indicators are adjusting the relationship. But is not homogeneous regulation, the role of indirect regulation.

(2) The scale of the board of directors, the proportion of independent directors on the R&D investment and technical personnel and the company's patent output and the relationship between the company's innovative performance and the role of reverse regulation. The empirical results of this study show that the board of directors of listed companies governance failed to positively regulate R&D investment and technical personnel into innovation performance, expand the scale of the board of directors did not play a positive effect on the supervision of independent directors, but also because of unable to play an active role in vase director.

(3) The technical background of the board of directors, the degree of education will help to enhance the R&D investment and technical personnel into innovative performance.

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