

# A Study on the Relationship Between Technical Independent Directors and Enterprise Innovation Under Media Attention

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## To cite this article:

Zheng Yong, Lai Anqi, Rongrong Lin, Yong Hu. A Study on the Relationship Between Technical Independent Directors and Enterprise Innovation Under Media Attention. *Journal of Finance and Accounting*. Vol. 9, No. 6, 2021, pp. 258-267. doi: 10.11648/j.jfa.20210906.16

**Received:** May 26, 2021; **Accepted:** October 4, 2021; **Published:** November 29, 2021

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**Abstract:** Independent director system plays a unique role in increasing the diversity of board members and increasing a company's intellectual capital. Based on prospect theory and signal theory, the media can also be considered to change the reputation level of independent directors on the board of directors of listed companies by disclosing relevant information about them and company operations. Moreover the media attention can not only accelerate the dissemination and promotion of knowledge and information, but also weaken the competitiveness of companies, reduce the value of companies, and then weaken their enthusiasm to invest in innovative projects. This paper takes listed companies in the Chinese information technology industry from 2012 to 2017 as the research object and uses the multiple linear regression method to model the relationship between technical independent directors and enterprise innovation under the attention of the media. It is found that the technical independent director plays a positive role in consulting, supervising and strategic decision-making, which can improve the company's innovation performance. At the same time, media attention weakens the positive impact of technology independent directors on enterprise innovation. The outcomes improve our understanding of the role of media in enterprise innovation and provide a new perspective and reference value for the construction of independent director systems and enterprise innovation.

**Keywords:** Technical Independent Director, Enterprise Innovation, Media Attention

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## 1. Introduction

The key to innovation is to get people. According to the upper echelons theory [4], there are degrees to the differences in team members' experience, technical abilities and social resources, which lead to different views on the same problem and provide different information and resources for the team. Technical independent directors can play a unique role in increasing the diversity of board members and increasing a company's intellectual capital. Therefore, when choosing directors, enterprises regard individual characteristics as an important factor

An independent director system is an important corporate governance arrangement that has a far-reaching impact on business activities, including innovation. With abundant

theoretical and practical experience, technical independent directors can not only make independent judgments on the company's operation and management activities but also accurately identify some details of innovation and R&D activities, pay more attention to risk factors, and more easily detect and recognize how to reduce inefficient innovation investment. These factors have a positive impact on the company's innovation and R&D investment activities and effectively identify and weaken the shortcomings of enterprises in technological innovation research.

Media attention involves the information processing and information transmission carried out by the media, which is reflected in the contents, types and delivery of media reports. In existing research, scholars generally believe that the number of news reports on listed companies reflects the

media's attention to listed companies and directly affects the overall reputation of listed companies in the industry and capital market. Based on prospect theory [24] and signal theory [25], the media can also be considered to change the reputation level of independent directors on the board of directors of listed companies by disclosing relevant information about them and company operations. The reputation mechanism can encourage independent directors to maintain "independence" and play a supervisory role. If technology independent directors fail to perform consulting and supervision functions in R&D activities, their reputation will be damaged, and ultimately, technology independent directors who are found not to act will be replaced through the general meeting of shareholders [22].

In addition, many economic studies show that technological innovation will lead to a knowledge "spillover effect". As an important information intermediary of the capital market, the media can accelerate the dissemination and promotion of knowledge and information. Under the high exposure of media, enterprise decision makers believe that technological knowledge spillover will weaken the competitiveness of the company, decrease the value of the company, and then weaken their enthusiasm to invest in innovation projects [32, 12]. Therefore, this paper studies the effect of media attention and technology independent directors on corporate innovation based on the technical background characteristics of independent directors from the perspective of media concern, thereby expanding the research in this field.

## 2. Literature Review

The so-called technical independent director is an independent director with a technical background. Technical background is a history of professional knowledge and skills in the industry had by, e.g., professors, teachers and researchers of technical specialties in institutions of higher learning or research institutes, who have professional qualifications or experience in technology research and development [2, 7]. The independent director system introduced by China's enterprises is relatively new, and the development of independent technical directors has not been popularized. The research of domestic independent technology directors is still in the exploratory stage. However, relevant literature shows that there are independent directors with technical backgrounds on the board of directors of listed enterprises in the manufacturing or IT industry, the proportion of technical independent directors is more than 60% in enterprises with technical directors, and evidence shows that technical expert directors can effectively improve the innovation output performance of a company, which verifies the innovation-driving role of technical independent directors [8]. Wu and Zhang suggested that the establishment of an independent director system has a significant positive impact on the innovation output and innovation quality of enterprises according to the data of listed companies in China from 2001 to 2016

[26]. Hu et al. found that the existence of technology independent directors will weaken the adverse impact of founder shareholding intensified by venture capital participation on enterprise innovation investment based on the data of IT companies listed on GEM in 2016 and previous years [6].

Technology independent directors impact innovation and R&D for their enterprises. To perform their duties and give full play to their functions of consulting and strategic decision-making, technical independent directors will pay more attention to and support enterprises in carrying out technological innovation activities and making technological innovation decisions conducive to improving enterprise efficiency. Their high social status and strong business ability make technical independent directors the "hub". For example, biological research professors can be employed as "hubs" to manage the relationship between enterprise innovation and development of environmental protection in industries with high environmental sensitivity [19]. Another study shows that boards of directors with a technical background can promote the technological innovation of enterprises [10]. The rich theoretical knowledge of experienced independent technical directors can make up for the lack of professional knowledge in decision-making among management and provide strategic suggestions for the innovation of the company [17]. Technical independent directors have enough technical knowledge to identify opportunistic behavior of managers manipulating R & D expenses [18].

Technology independent directors impact the innovation output performance of enterprises. Independent directors have the ability to supervise and constrain management. At the same time, from the perspective of enterprise innovation output performance management, the existing literature examines the role of independent director systems. The results show that the behavior of increasing R&D investment does not directly promote the improvement of independent R&D and innovation ability. However, when listed companies are equipped with technology executive directors and technology independent directors, innovation output efficiency increases. Li found that technology expert independent directors can help companies improve the application proportion and authorization proportion of invention patents (high-quality innovation) and reduce the application proportion and authorization proportion of design patents (low-quality innovation), which can help companies improve their innovation ability [13].

Media factors are increasingly taken into account in the research of independent directors and enterprise innovation. The effectiveness of the media lies in the role of the reputation mechanism. The higher the sensitivity of stakeholders to reputation, the better the supervision effect of the media. Ning suggested that reputation is an important mechanism to encourage and restrict the behavior of independent directors [16]. Yermack found that reputation incentives have a stronger constraint on the behavior of independent directors than the material incentives of independent directors according to a study of Fortune 500

companies [33]. Some researchers believe that media attention can alleviate information asymmetry, effectively play the supervision function, and enlarge the "absence" phenomenon of independent directors in professional consultation and independent supervision [27]. Other researchers found that giving appropriate and moderate play to the influence of media attention can effectively promote enterprise innovation [20].

In addition, according to the market pressure hypothesis, some scholars believe that media attention does not play a role in corporate governance but forms a short-term market pressure mechanism, and R&D and innovation, as strategic activities with high investment costs and long return periods, are easy to ignore or even suppress. Media attention will bring huge competition and market pressure to enterprises and managers, thus aggravating managers' short-sighted behavior, which is not conducive to promoting enterprises' independent innovation activities [5].

Relevant studies verify the existence of a market pressure mechanism. A research shows that the news characteristics of media reports make them pay more attention to short-term situations or emergencies that can attract readers' attention, which puts external market pressure on management and drives them to sacrifice the long-term development of the enterprise to meet short-term performance goals [30]. At this time, the company's decision makers often take measures to restrain enterprise innovation investment. Tong's research found that there is a significant negative correlation between media attention and exploratory innovation of enterprises [23]. Shapiro also found that, as an important information medium in the capital market, the media tended to report shorter and more explosive stories and the company's short-term performance indicators to cater to investors' interest [21]. Many economic studies show that technological innovation will lead to knowledge "spillover effects", enterprise innovation will be hindered by news reports related to performance, and news reports related to product innovation will lead to knowledge leakage to competitors, thus hindering enterprise innovation investment [3]. However, Xia and Liu confirmed that media attention plays a positive role in corporate performance from the perspective of manager heterogeneity [29].

Technology independent directors who have professional knowledge in innovation are more willing to carry out exploratory innovation, but media reports will make enterprises conservative in the choice of innovation. Therefore, this paper argues that media attention is likely to play a negative regulatory role between technology independent directors and enterprise innovation input and output levels to a certain extent and that media reports can alleviate the information asymmetry between investors and independent directors. Moreover, after consulting the reports of independent directors of listed companies, we find that most of the reports mentioned that "independent directors pay attention to the relevant media reports of the company", which proves that media attention will have an impact on independent directors from the perspective of practice.

In short, from the existing research, we know that

technical directors, as the core of enterprise science and technology research and development, can effectively improve the efficiency of enterprise science and technology research and development. With the in-depth study of technology independent directors, their promotion and influence on scientific and technological innovation has become increasingly obvious. Therefore, there is still much research space in the field of technology independent directors and enterprise innovation. Through the summary and analysis of domestic and foreign experts and scholars' research on the economic consequences of media reports and corporate innovation, it is found that the role of media and technology independent directors in promoting and inhibiting corporate innovation is still controversial, and more in-depth research is needed. Based on the above discussion, the following research hypotheses are proposed:

H1: *Ceteris paribus*, enterprises with technology independent directors have high innovation and R&D investment intensity.

H2: *Ceteris paribus*, there is a positive correlation between technological independent directors and enterprise innovation output performance.

H3A: Media attention plays a negative regulatory role in the relationship between technology independent directors and enterprise innovation and R&D investment.

H3B: Media attention plays a negative moderating role in the relationship between technology independent directors and enterprise innovation output performance.

## 3. Research Design

### 3.1. Data and Sample

This paper selects A-share high-tech listed companies without ST or ST \* in Shanghai and Shenzhen from 2012 to 2017 as the sample and excludes those without continuous R&D expenditure, with abnormal or invalid data, or with missing data. To eliminate the impact of extreme values, 1% - 99% of the data extreme values are processed by WONSORIZE.

To ensure the authenticity and reliability of the data, the data used include the information of independent directors, innovation performance and financial indicator data from the China authoritative database CSMAR, and the media attention data come from Baidu news. At the same time, using the annual reports of listed companies and CNKI and other professional information sources, the data are verified again. Through the above steps, this paper obtained and sorted a total of 6 456 effective observation values of 1076 sample enterprises. Using Excel 2019 and Stata 15.0 and other measurement tools for data processing, this paper conducts an empirical analysis on the relationship between technology independent directors and enterprise innovation performance under media attention.

### 3.2. Dependent Variable

This study uses the relative number index to measure the

level of enterprise innovation and R&D investment. Thus far, the measurement of enterprise innovation R&D investment mainly uses the following four methods: (1) The total current R&D investment directly used by the enterprise; (2) The natural logarithm of the total R&D investment of the enterprise; (3) The total R&D investment divided by the total assets; and (4) the total R&D investment divided by operating income. Among them, the first two are absolute indicators, and the last two are relative indicators. Both them have been used. Compared with absolute quantitative indicators, relative quantitative indicators avoid the impact of the scale effect on research results, so most studies use relative quantitative indicators to measure R&D investment. There are many factors that affect the business income of an enterprise, which will make it unstable and volatile, and then, the total assets will be more stable than the income. Therefore, this study will use the relative quantity index to measure the level of innovation and R&D investment and use the total amount of R&D investment divided by total assets to measure the level of innovation and R&D investment, which is expressed by the symbol RD.

The measurement of enterprise innovation output performance. Since innovation is abstract and subjective for companies, many recent empirical studies on corporate governance and innovation also rely on the use of patent data to quantify it. Other researchers use the number of original patents and the number of patents cited to measure the financial and technical value of an innovation. To ensure that the data distribution conforms to the normal distribution, this paper uses the natural logarithm of the total number of patent applications plus 1 to measure a company's innovation output performance level, which is represented by the symbol PAT [1, 28].

### 3.3. Independent Variable

The measurement of technical independent directors is based on the methods used in previous studies [7, 14]; that is, technical independent directors are manually selected according to the technical background matching with the main business activities of the enterprise, and TECH is used to represent technical independent directors. When an enterprise has technical independent directors, TECH is 1; otherwise, it is 0. The information of senior executives comes from the CSMAR database.

### 3.4. Moderator Variable

This paper selects media attention (represented by MED) as the moderator variable. Media attention is determined by the number times a company is reported on by the media. At present, the commonly used method is to use the number of times the company name appears in network news headlines to represent the media attention of the corresponding company. Due to the increasing influence of the Internet, the content is increasingly deep, and the coverage is increasingly extensive. Therefore, this paper acquired the annual number of media reports of a sample company by entering the stock code from the Baidu News Search Engine and used it to measure the media attention degree (MED) [15, 31].

### 3.5. Control Variable

Referring to the previous literature (Xia, etc, 2018; Xia, etc, 2017), we control the company size (SIZE), board size (BS), ownership concentration (SH1), proportion of independent directors (INDRACRAT), nature of enterprise property rights (SOE), net asset interest rate (ROA), asset-liability ratio (LEV) and other variables [11]. In summary, the definition of variables is summarized in the table below:

Table 1. Variable Definition.

Variable name	variable symbol	measurement
Dependent variable	Innovation R & D Investment	RD
	Innovation Output	PAT
Independent variable	Technical Independent Director	TECH
Moderator variable	Media Attention Degree	MED
	Company Size	SIZE
	Board Size	BS
	Ownership Concentration	SH1
control variable	Proportion of Independent Directors	INDRACRAT
	Nature of Property Rights	SOE
	Net Interest Rate of Assets	ROA
	Asset-Liability Ratio	LEV
	Year	YEAR

### 3.6. Modeling

To verify the above research hypothesis, this paper constructs the following four econometric models:

The test model of the impact of technology independent directors on enterprise innovation and R&D investment

$$RD = \alpha_0 + \alpha_1 TECH + \alpha_2 SIZE + \alpha_3 BS + \alpha_4 SH1 + \alpha_5 INDRACRAT + \alpha_6 SOE + \alpha_7 ROA + \alpha_8 LEV + \varepsilon \quad (1)$$

Model (1) is mainly used to verify the influence of technology independent directors on innovation investment

in enterprises. If  $\alpha_1$  is significant and positive, it means that the independent director of technology has a positive

correlation with the innovation investment of enterprises. If  $\alpha_1$  is significant and negative, it means that the independent director of technology has a negative correlation with

$$PAT = \beta_0 + \beta_1 TECH + \beta_2 SIZE + \beta_3 BS + \beta_4 SH1 + \beta_5 INDRCRAT + \beta_6 SOE + \beta_7 ROA + \beta_8 LEV + \epsilon \tag{2}$$

Model (2) is used to explain the relationship between technology independent directors and innovation output performance. Due to the lagging nature of R&D output, the

$$RD = \gamma_0 + \gamma_1 TECH + \gamma_2 MED + \gamma_3 TECHMED + \gamma_4 SIZE + \gamma_5 BS + \gamma_6 SH1 + \gamma_7 INDRCRAT + \gamma_8 SOE + \gamma_9 ROA + \gamma_{10} LEV + \epsilon \tag{3}$$

$$PAT = \gamma_0 + \gamma_1 TECH + \gamma_2 MED + \gamma_3 TECHMED + \gamma_4 SIZE + \gamma_5 BS + \gamma_6 SH1 + \gamma_7 INDRCRAT + \gamma_8 SO + \gamma_9 ROA + \gamma_{10} LEV + \epsilon \tag{4}$$

Models (3) and (4) mainly test the moderating effect of media attention on technology independent directors, innovation R&D investment and innovation output performance. Therefore, cross product (TECH × MED) centralized processing is introduced for the regression test. If the coefficient of cross product ( $\gamma_3$ ) is significantly negative, it indicates that media attention is negative. It moderates the relationship between independent directors of technology and enterprise innovation; that is, media attention restrains the impact of independent directors of technology on enterprise innovation, so H3A and H3B are assumed to be true.

innovation investment in enterprises.

The test model of the impact of technical independent directors on enterprise innovation output performance:

patent data index is used to measure the output effect of enterprise innovation activities by lagging one-stage data.

The test model on media attention moderating effect

## 4. Result

### 4.1. Descriptive Statistics

Before the in-depth empirical regression analysis, a descriptive statistical analysis of the main variables is carried out to preliminarily understand the data characteristics of the main research variables (see Table 2).

Table 2. Descriptive Statistics.

Variable	Number of samples	Mean	Standard deviation	Minimum	Maximum
RD	6,56	0.059	0.109	0.001	0.748
PAT	6,456	4.352	1.510	1.386	8.923
TECH	6,456	0.611	0.500	0.000	1.000
MED	6,456	9.569	0.901	8.331	12.331
SIZE	6,456	21.930	1.165	19.800	25.741
BS	6,456	8.314	1.624	5.000	17.000
SH1	6,456	32.600	13.540	8.350	69.660
INDRCRAT	6,456	34.630	8.822	11.800	54.550
SOE	6,456	1.844	0.528	1.000	4.000
ROA	6,456	0.028	0.041	-0.047	0.223
LEV	6,456	0.381	0.207	0.001	0.839

Through the descriptive statistical results, we can see that the minimum value of enterprise innovation R&D investment (RD) is 0.001, the maximum value is 0.748, the mean value is 0.059, and the standard deviation is 0.109, which indicates that the proportion of total R&D investment in total assets of various enterprises varies greatly, and the innovation R&D level of Chinese enterprises still needs to be improved. The average value of the innovation output index (PAT) is 4.352, the minimum value is 1.386, and the maximum value is 8.923. There is a large gap between the outputs of different sample companies. We should pay more attention to patents and other innovation activities and provide more human, material and financial support for enterprise technology innovation activities.

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In terms of the media attention moderating variable, the natural logarithm of the average annual news media coverage of the sample companies is 9.569, the minimum is 8.331, and the maximum is 12.331, which reflects that the listed companies in the high-tech industry are highly concerned with the public and the public opinion pressure of the news media, and the media exposure rate varies greatly among enterprises. By observing the sample data, it is found that the number of news reports and patents increases with company size, which is a variable to be controlled in the analysis, and other basic factors affecting media reports and innovation output.

From the perspective of control variables, the average proportion of independent directors (INDRACT) is 34.63%. There are differences in the number of independent directors

among different enterprises, but they all reflect the institutional imprint of the independent director system. The maximum value of SH1 is 69.66, the minimum value is 8.35, and the average value is 32.6. It shows that there is a large difference in the shareholding ratio of the largest shareholder in the sample enterprises, and the situation of equity concentration generally exists in most enterprises. The average LEV of the sample enterprises is 0.381, while the average ROA is only 0.0275, which indicates that the profit level of high-tech enterprises in China needs to be further improved. For the size of the company, the size of the board of directors, the SOE of the nature of enterprise property rights and other control variables, the gap between the

maximum value and the standard deviation are relatively small, which shows that the sample distribution is relatively uniform and contains basically no outliers as a whole.

#### 4.2. Correlation Analysis

In this paper, the Pearson correlation coefficient and variance expansion factor are used to test the rationality of the research hypothesis and variable setting to ensure that there is no multicollinearity between variables, which leads to the relatively low accuracy of parameter estimation. The correlation analysis was performed by Stata 15.0 software, and the results are as follows:

Table 3. Pearson Correlation.

Variable	RD	PAT	TECH	MED	SIZE	BS
RD	1					
PAT	0.159***	1				
TECH	0.102***	0.576***	1			
MED	0.015**	-0.263***	-0.189***	1		
SIZE	-0.280***	-0.124***	-0.114***	-0.091***	1	
BS	0.072**	0.008*	-0.01	0.002	0.098***	1
SH1	-0.017	0.032*	0.016*	0.018*	-0.027	-0.041
INDRCRAT	-0.015*	0.021	0.041*	-0.027	0.014	-0.112***
SOE	-0.077**	0.03	0.045	0.002*	-0.183***	-0.187***
ROA	0.045	0.050*	0.050*	-0.041*	0.032	0.069**
LEV	-0.031*	-0.045	-0.067**	-0.002*	0.065**	0.011
SH1	1	INDRCRAT	SOE	ROA	LEV	
INDRCRAT	-0.025	1				
SOE	-0.085***	0	1			
ROA	0.028	0.005	-0.032	1		
LEV	-0.063**	-0.056*	-0.009	-0.192***	1	

Note: \*\*\* represents  $P < 0.01$ , \*\*represents  $P < 0.05$ , \* represents  $P < 0.1$

The correlation test results show that the independent variable technology independent director has a significant positive correlation with the dependent variable R & D input and the correlation coefficient is 0.102, which is consistent with the expectation of hypothesis H1; The independent variable technology independent director has a positive correlation with the dependent variable innovation output at the significant level of 1%, and the correlation coefficient is 0.576, which is consistent with the expectation of hypothesis H2. At the same time, there is a significant correlation between other variables in this paper, which initially supports

the research hypothesis. This shows that in companies with technology independent directors, if the company's innovation performance is relatively good, it is more likely to be related to the technology independent director's better role in consulting, supervising and strategic decision-making.

In addition, the absolute values of the correlation coefficients among the independent variables, dependent variables and control variables are mostly less than 0.3, the maximum value is 0.576, and the rest are less than 0.5, which indicates that there is no multicollinearity problem among the research variables [32]. The results are shown in the table below:

Table 4. Statistics of Variance Expansion Factor.

	TECH	LEV	ROA	SOE	SIZE	BS	INDRCRAT	SH1	MED
VIF	2.51	1.09	1.08	1.07	1.07	1.06	1.02	1.02	1.02
1/VIF	0.398	0.916	0.924	0.931	0.937	0.941	0.978	0.983	0.984

Previous studies have shown that there is no multicollinearity if the largest variance expansion factor VIF of each variable is less than 10. Table 4 shows that when the independent variable is a technical independent director, the mean VIF is 1.35 and the VIFs of the other variables are less than 10, which other researchers have shown that there is no serious multicollinearity problem among the research

variables.

#### 4.3. Regression

The impact of technology independent directors on enterprise innovation and R & D investment as following:

Model (1) was used for regression, and the results are

shown in column (1) of Table 5. The regression results show that the coefficient of the explanatory variable technology independent director (Tech) is 0.116, technology independent director and enterprise innovation and R&D investment are positively correlated at the 0.01 significance level, the adjusted R-square of the model is 0.412, and the goodness of fit is within the acceptable range. This shows that when an enterprise sets up technology independent directors, innovation and R&D investment will be positively affected, and innovation and R&D are the core growth powers of the company. Independent directors with technology professional backgrounds can better understand the risks in innovation and R&D activities to enhance the scientific decision-making ability of the board of directors, strengthen the constraint mechanism, and make R&D investment more efficient and accurate. The results are consistent with hypothesis 1.

**Table 5.** Regression Results of Technology Independent Directors and Innovation.

Variable	Model 1	Model 2
	RD (1)	PAT (2)
TECH	0.116*** (12.47)	2.332*** (39.62)
SIZE	-0.028*** (-11.97)	-0.051** (2.13)
BS	0.005** (2.48)	0.016* (7.86)
SH1	0.005 (1.23)	0.009 (1.99)
INDRCRAT	0.011 (-0.23)	0.001 (-2.53)
SOE	-0.025*** (-4.11)	-0.017** (-6.73)
ROA	0.113** (2.44)	0.474** (2.67)
LEV	-0.001** (2.13)	0.087** (1.65)
Constant	0.69*** (10.14)	4.139*** (6.57)
Year	Control	Control
F Value	116.485	203.247
Adjusted R <sup>2</sup>	0.412	0.604
N	6456	6456

Note: the values in brackets are t statistics, \*\*\*represent  $P < 0.01$ , \*\* represent  $P < 0.05$ , \* represent  $P < 0.1$

The impact of technical independent directors on enterprise innovation output performance as following:

The regression result of model (2) is shown in column (2) of Table 5. The regression coefficient of the explanatory variable technology independent director (TECH) and enterprise innovation output performance (PAT) is 2.332, which is significant at the 1% level. The F statistic used to test the significance of the whole equation is 203.247, and the corresponding p value is 0.0000, which indicates that the regression equation is highly significant. The P values of the regression coefficients of all explanatory variables are less than 0.01; thus, they are significant at the 1% level, and the sign is consistent with the theoretical expectation. The test of hypothesis H2 shows that the appointment of independent technology directors is a variable to promote the innovation performance of enterprises. The establishment of independent technology directors in enterprises can significantly improve technology innovation performance; that is, independent technology directors can play the role of supervision, consultation and strategic decision-making to improve

technology innovation performance. The adjusted R2 of model (2) is 0.604, which is similar to that of the same topic. Therefore, hypothesis 2 is valid.

The moderating role of media attention between technology independent directors and innovation as following:

Model (3) and model (4) in Table 6 show the regression results of whether regulatory effects occur between technology independent directors and enterprise innovation. In model (3), the interaction coefficient between technology independent directors and media attention is negative at the 1% significance level; that is,  $\gamma_3 = -0.617$ , which is statistically significant and shows that media reports as external governance channels weaken the positive relationship between enterprise innovation R&D investment and technology independent directors. Thus, H3A holds. This means that the governance role of the media may hinder enterprises from investing in innovation projects and restrict technology independent directors from playing professional consultations and independent supervision and strategic decision-making functions. It also means excessive supervision of the media and the existence of a knowledge spillover effect. As an information intermediary, media reports will attract the attention of enterprise competitors, leading to management's reluctance to carry out innovation activities.

**Table 6.** Regression Results of the Moderating Effect under Media Attention.

Variable	Model 3	Model 4
	RD (3)	PAT (4)
TECH	2.329*** (41.33)	0.016*** (0.06)
MED	-0.515* (-0.14)	-0.011 (-0.01)
TECHMED	-0.617*** (-9.78)	0.007 (0.05)
SIZE	-0.048*** (-1.96)	-0.028** (1.13)
BS	0.002** (0.01)	0.005* (1.02)
SH1	0.002 (0.22)	0.008 (1.39)
INDRCRAT	0.003 (-0.01)	0.001 (-0.53)
SOE	-0.035*** (-4.15)	-0.017** (-6.73)
ROA	0.122** (2.69)	0.425** (1.67)
LEV	-0.332** (2.139)	0.187** (2.65)
Constant	4.119*** (0.604)	1.691*** (0.98)
Year	Control	Control
F Value	207.318	64.775
Adjusted R <sup>2</sup>	0.636	0.311
N	6456	6456

Note: the values in brackets are t statistics, \*\*\*represent  $P < 0.01$ , \*\* represent  $P < 0.05$ , \* represent  $P < 0.1$

However, the interaction coefficient in model (4) has no significant correlation. It can be seen that media attention has no moderating effect on the relationship between technology independent directors and enterprise innovation output performance. The adjusted R-squared values of the two models in Table 6 are 0.636 and 0.311, which shows that the model has a good fit and that the empirical results of the model are reliable.

#### 4.4. Robustness Test

To ensure the stability and reliability of the regression results, this paper uses the results of Jiang, etc. [9] for reference, uses the natural logarithm of total R&D investment (LNRD) as the dependent variable to replace the index of innovation R&D investment (RD), and takes the number of invention patent applications (PAT\_INV) as the independent variable to replace PAT. In addition, the relationship between media attention and enterprise

innovation performance may be affected by the size of the company. Specifically, the larger the scale of the company, the more attention will be given by the multimedia, and the lower the performance of innovation and R&D will be. Therefore, this paper also uses the method of replacing control variables, which uses the logarithm of operating income (LNSALES) to replace the logarithm of total assets (SIZE) to express the company size to test the model robustness.

Table 7. Results of Robustness Test.

Variable	LNRD	PAT INV	LNRD	PAT INV
	Model (1)	Model (2)	Model (3)	Model (4)
Dependent Variable				
TECH	3.029*** (35.21)	0.036*** (0.07)	2.978*** (41.78)	0.046*** (0.09)
MED			-0.525* (-0.19)	-0.012 (-0.02)
TECHMED			-0.727*** (-8.78)	0.008 (0.09)
LNSALES	-0.058*** (-1.94)	-0.028** (1.13)	-0.078*** (-1.76)	-0.034** (1.24)
BS	0.012** (0.01)	0.009* (1.79)	0.013** (0.01)	0.017* (1.04)
SH1	0.009 (0.34)	0.014 (1.29)	0.015 (0.53)	0.012 (1.69)
INDRCRAT	0.003 (-0.01)	0.082 (-0.63)	0.014 (-0.02)	0.001 (-0.93)
SOE	-0.096*** (-4.34)	-0.197** (-7.13)	-0.235*** (-3.15)	-0.087** (-5.53)
ROA	0.925** (2.99)	0.725** (3.67)	0.322** (2.63)	0.525** (1.77)
LEV	-0.932** (3.13)	0.187** (2.65)	-0.332** (2.39)	0.187** (2.65)
Constant	4.898*** (0.72)	2.064*** (1.08)	7.768*** (0.73)	8.691*** (2.98)
Control Variable Year				
F Value	197.465	68.957	182.987	65.231
Adjusted R <sup>2</sup>	0.582	0.423	0.482	0.498
N	6456	6456	6456	6456
MEAN VIF	1.65	1.65	2.11	2.11

Note: the values in brackets are t statistics, \*\*\*represent  $P < 0.01$ , \*\* represent  $P < 0.05$ , \* represent  $P < 0.1$

The results are shown in Table 7 after the empirical test again. H1, H2 and H3A are still valid. At the 1% confidence level, there is a significant positive correlation between technology independent directors and the innovation R&D investment and innovation output performance of enterprises. In the relationship between technology independent directors and the R&D investment of enterprises, media attention plays a negative moderating role, which is consistent with the above empirical results. Although there are slight differences in the regression results, there is no substantial change in the overall results, which proves that the empirical results of the above model are robust.

## 5. Conclusion

This paper studies the influence of media attention and the existence of technical independent directors on corporate innovation by taking the technical background characteristics of independent directors as moderating variables. The empirical results are as follows:

As the expert supervisor of the management, the technology independent director with sufficient technical knowledge can improve the independence of the board of directors and improve the problem of insufficient innovation and R & D. At the same time, the technology independent director increases the R & D investment in the current research field of the company, rather than expanding to other

fields to speed up the innovation and development.

The company will do more in innovation when the technical expertise of independent directors is related to the business field of the company. Technology independent directors play their functions of consultation, supervision and strategic decision-making and promote an increase in the patent application rate and authorization rate. As the company allocates more resources to technology invention patents, enterprise innovation performance will be improved.

The development of enterprises is in line with the law of "survival of the fittest". News media plays a role in the market supervision mechanism, which is more in line with market demand. This paper explores the relationship between media reports and technology independent directors and enterprise innovation and reveals the negative regulatory role of media reports on the positive impact of technology independent directors and enterprise innovation activities. When the news media pays close attention to the enterprise, it shows that the operation of the enterprise and the appointment of technical independent directors are under the good supervision of public opinion, and their decisions will be more in line with the long-term development of the enterprise. It also shows that external governance channels play an excessive monitoring role in restraining future innovation. News reports related to products can also stimulate the interest of future investors and encourage investors to pay more attention to corporate decision-making,

thus bringing governance pressure to managers.

We should pay attention to the problem that the nature of media reports needs to be refined in the future. That is, different media reports lead to different degrees of attention. For example, the degree of public attention given to neutral reports will be different from that paid to positive reports and negative reports. In future research, we can establish a more complete index system to actively explore a comprehensive and reasonable method to measure the level of enterprise innovation input and output. Finally, the lack of sufficient incentives for independent directors may be taken into account as a factor of whether effective supervision is effective in future research.

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