

An Empirical Study on Influencing Factors of the Patenting Behavior in Enterprises

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Abstract

In recent years, the enterprises, as the main innovation subject in China, have made high achievements in the field of patent. The influencing factors of the patenting behavior in enterprises have caused the wide attention of many scholars at home and abroad. Based on the institutional theory, this paper focuses on the influencing factors of the patenting behavior in enterprises by the empirical research. The research results indicate that the internal factors are the main factors affecting the patenting behavior while the external factors are the secondary factors; and that the internal and external factors of the enterprises affect the patenting behavior through intermediary, namely the different motivations of employees. At last, this paper puts forward some suggestions for the patenting behavior in enterprises.

Keywords

Enterprise, The Patent Behavior, Motivation

1. Introduction

Since entering the 21st century, patents have become important intangible assets and key strategic resources in the country, industry, region and even organization levels as the knowledge of the all world is of intense competition. In 2005 the State Council promulgated the “National Long-term Science and Technology Development Plan”, which proposed the implementation of IPR strategy and technical standard strategy.” National Intellectual Property Strategy”, promulgated in April 2008, marked the formal implementation of the Intellectual Property Strategy. Currently Chinese enterprises, as the main innovation subject, actively apply for patents and make outstanding achievements in this field, but there exist significant gaps in the implementation of the patenting behavior between the different companies [1]. What factors might cause these gaps in some companies? Cohen *et al.* found that there are many factors that affect the employees implementing the patenting behavior, in addition to

the protection of its own intellectual property achievements and avoidance of competitors' infringements [2]. Then what factors influence employees' patenting behavior? How influencing factors drive the patent behavior which employees implement? And are driving paths consistent? This series of questions are worth exploring. Based on the institutional theory, this paper mainly studies the elements of employees implementing the patenting behavior, and tests their motivations. After discussing whether the patenting behavior is an intermediary role between the influencing factors of patenting activities and the results of employees' patenting behavior, this paper provides some suggestions and recommendations for China's enterprises to further deepen IPR, and there also lies the value of this paper.

2. Literature Review

2.1. Influencing Factors of Enterprises Implementing Patenting Activities

The implementation of the patenting behavior is a process of system, which is inseparable from the society, economy, institution, market, enterprise itself, and so on. The involved areas are quite wide and the factors that influence employee's patenting behavior are not a few, which attract many scholars to begin to pay attention to the process of the employees' patenting behavior.

Bae and Chen *et al.* studied influencing factors of the implementation of employees' patenting behavior in terms of the level of corporate human resources [3]. Chinese scholars Liu *et al.* indicated that enterprises' human resources management systems to a certain extent affect their innovation capacity and performance, and ultimately influence their ability to implement the patent behavior [4]. The stylized facts reported by Darroch, Miles and Buisson are that the relationship between the entrepreneur's orientation and the implementation of employees' patenting behavior is positive; if an entrepreneur is lack of patent awareness, resulting in the company's patent work hard to run, its patent ability will be greatly weakened; in terms of the entrepreneur's patent awareness, its level of patent innovation ability is also enhanced significantly [5]. Schumpeter found that innovation capability of large enterprises is stronger than that of small businesses [6], but with the deepening of research, some researchers questioned this conclusion, such as Brouwer and Kleinknecht, who studied patenting behavior of enterprises and found that: in terms of market share, sales and marketing network, brand name and advertising, the small enterprises are not of competitive advantages comparative to large enterprises, thus small businesses pay more attention to the implementation of the patenting behavior than large enterprises [7]. China's State Intellectual Property Office (SIPO) comprehensively surveyed the patent situation of all businesses once implementing patenting behavior in 2006, and found that patent applications exist obvious gaps in enterprises of different sizes: the average patent applications of large enterprises are 24.7; that of small and medium enterprises are 5.9; that of micro-enterprises are only 3.7 [1]. These results are mostly consistent with Xu's empirical analysis conclusion in terms of the patenting behavior of enterprises in Zhejiang Province in China [8]. In addition to firm size, Arundel indicated that there are three factors that influence the patenting behavior of employees, namely innovation strategies, information sources of innovation and industrial characteristics [9]. Based on empirical analysis, Peeters and Potterie found that innovative obstacles have a negative impact on the implementation of employees' patenting behavior [10]. Li further researched the influencing factors of the patenting behavior of employees, namely the enterprise learning ability, regional economic growth situation, the patent system and policy, the culture shaping of intellectual property rights and so on [11]. **Table 1** summarizes the above scholars' literatures of influencing factors of enterprises implementing patenting activities.

2.2. Motivations of Employees Implementing Patenting Activities

Arundel investigated the motivations of employees' patenting behavior in Italy, Britain, Germany and other European countries, and found that the motivations of 80% of European employees, who implement the patenting behavior, include protecting innovations, avoiding competitors to imitate, enhancing the bargaining position of enterprises, preventing third-party infringement proceedings, getting license revenue, opening up foreign markets, and assessing internal R & D productivity [12]. Based on the investigation on Swiss companies, Harabi indicated that the motivations of employees implementing the patenting behavior include preventing the product to be imitated, protecting license revenue, enhancing bargaining position, entering to foreign markets through directly investment and production or indirectly licensing agreements, destroying production lines or research and development of competitors, and assessing the performance of R & D personnel [13]. Duguet, Kabla collected

Table 1. Literature review of influencing factors of enterprises implementing patenting activities.

Influencing factors	Specific influencing factors	Researchers
Internal factors	Corporate human resources and staffing levels	Bae and Chen, Liu S.-S., Liu X.-X., Liu T.-T.
	The quality of entrepreneurs	Darroch, Miles, Muisson,
	Enterprise scale	Schumpeter, Brouwer and Kleinknecht
	Enterprise innovation ability	SIPO, Xu M.-H.
	Enterprise learning ability	Li W.
External factors	Innovative sources of information needed	Arundel
	Industrial characteristics	Arundel
	Regional economic growth	Li W.
	Patent system and policy	Li W.
	Intellectual property culture	Li W.

statistics of the motivations of employees' patenting behavior in 299 French enterprises, including protecting innovations not to be imitated, defensively stopping competitors innovating, improving bargaining position, obtaining license revenue, occupying foreign markets, and encouraging R & D researchers [14]. Schalk *et al.* surveyed the motivations of implementation of the Germany employees' patenting behavior, which comprise of protecting innovation not to be imitated, defensively stopping competitors innovating, offensively blockading, improving conditions for negotiations, encouraging R & D researchers, improving technical images, obtaining license revenue, and etc. [15]. Pitkethly took the Japanese and British companies as the survey subjects, and found that the motivations of employees implementing the patent behavior are divided into protecting innovation not to be imitated, offensively blockading, trading potential, improving the quality of the negotiations, and obtaining license revenue [16]. Cohen studied the motivations of the implementation of employees' patent behavior in the United States and Japan, finding that preventing imitation, patent blocking, preventing the infringement proceedings, enhancing their reputation, improving bargaining position, obtaining license revenue, internal performance measurement are included [17]. OECD (Organization for Economic Co-operation and Development) investigated some enterprises, according to the importance of patenting motivations in descending order: preventing products to be imitated, enhancing the negotiating capacity, and technology-driven defensive blockade [18]. Liu investigated the motivations for Chinese software companies finding that the patent behavior includes: improving the company's reputation, taking as a bargaining chip, increasing access to investment, protecting innovation not to be imitated, becoming market leadership, blocking competitors' R & D, joining to the patent pool, and obtaining patent licensing revenue [19]. It is summarized in **Table 2** that domestic and foreign scholars investigated the patenting motivation of employees.

3. Theoretical Framework and Hypothesis

Lin *et al.* argued that motivation is a psychological tendency or driving force that can stimulate and maintain individual action and promote individual action toward a certain goal; and the motivation has three functions: (1) stimulating function: stimulates people to produce a certain kind of specific behavior; (2) pointing function: makes people's behaviors point to a certain goal; and (3) maintenance and regulation function: makes people's behavior last for some time, and adjusts the strength and direction of their behaviors [20].

Richard and Edward found that people's motives in some extent are not the same: the differences of motivation are not only in the level of motivation, but also show different types; Motivation orientation refers to intrinsic attitudes and aims to produce certain behaviors; it is not same how external motivations and internal motivations induce human behaviors, in general internal motivations producing higher quality of learning and creativity [21].

The patent behavior is a creative activity, mainstream psychologists believe that the environment will affect individual motivations, of which the demand is generated in the following three ways: (1) individual motivations

stimulated by strong internal demands; (2) individual motivations stimulated by strong external incentives; (3) individual motivations stimulated both by internal demands and external incentives. Richard and Edward noted that individuals have the innate potential of the psychological growth and development, and a potential to make a choice based on experience is self-determination, namely, an individual to choose a certain action affected by internal demands and external incentives. Process theories suggest that the clear goals need to be developed to influence the individuals' needs, and then drive their actions. Taken Korean employees as samples, Shin found that the intrinsic motivation plays a certain mediating role in the positive relationship between transformational leadership and creativity among subordinates, and plays a fully mediating role in the correlation between transformational leadership and creativity among subordinates [22].

As can be seen from **Table 1**, internal and external factors of enterprises can affect employees implementing the patent behavior. Internal factors include: level of corporate human resources, quality of entrepreneurs, enterprise scale, enterprise innovation capability, and enterprise learning capability. These factors are derived from endogenous factors from enterprises. And external factors of enterprises include: information sources of innovation required, industrial characteristics which enterprises, regional economic growth, the patent system and policy, and intellectual property culture. These factors, however, are exogenous factors from the enterprises.

Based on the above scholars' researches, this paper employs "the motivation of employees implementing the patenting behavior" as a mediating variable, reflecting how internal and external factors of enterprises affect employees who implement the patent behavior. The theoretical model in this paper is shown in **Figure 1**.

Based on the conceptual model in **Figure 1**, this paper proposes the following hypotheses:

H1: influencing factors of employees implementing the patenting behavior are positively correlated with the results of the patent application.

Table 2. Literature review of motivations of employees implementing patenting activities.

Influencing factors	Specific influencing factors	Researchers
Incentive motivation	Measuring internal performance Achieving personal goals Stimulating employees (money, promotion and mental stimulation) Obtaining patent financing	Harabi, Duguet and Kabla, Schalk, Cohen <i>et al.</i>
Honorary motivation	The number of patents driven by government assessment indicators The requirements for high-tech enterprise certification Improving technical images Increasing enterprise value	Liu S., Duguet and Kabla
Transaction motivation	Improving cooperation position Promoting of exchange potential Having access to capital markets Obtaining license revenue	Harabi, Schalk, Cohen, Liu S.
Blocking motivation	Blocking competitors actively Blocking competitors passively	Harabi, Duguet and Kabla, OECD, Schalk, Cohen, Liu S. <i>et al.</i>
Protection motivation	Avoiding innovation to be imitated Protecting markets (domestic and foreign markets) Becoming industry standards of patents	Harabi, Duguet and Kabla, OECD, Schalk, Cohen <i>et al.</i>

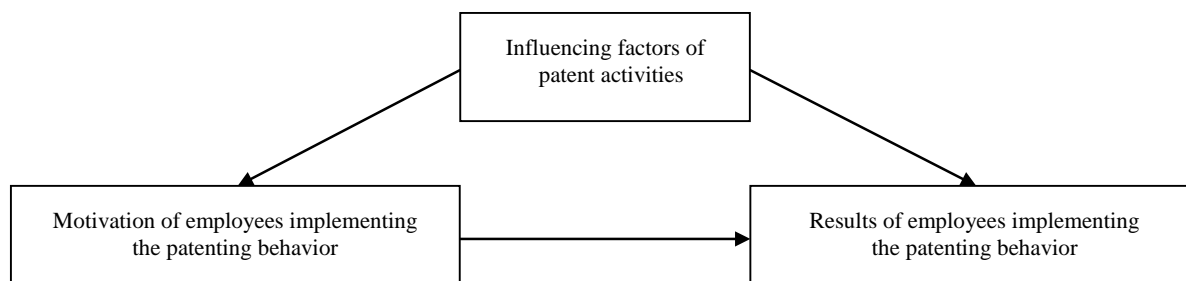


Figure 1. Conceptual model of the present study.

H2: influencing factors of patenting activities affect the motivations of employees implementing the patenting behavior, which plays an intermediary role, and then affect the results of employees' patenting behavior.

4. Empirical Analysis

4.1. Selection of Samples

The reason why we choose the staff of enterprises in Guangxi province as sample is that the number of patent application and licensing of Guangxi has been growing rapidly since 2006. On April 26, 2014 (the 14th World Intellectual Property Day), the Nation Intellectual Property Office issued the "National Patent Strength Report of 2013". The report indicates that the national rankings of comprehensive strength of patent of Guangxi (No.27, 2011) rise from No.23 at 2012 to No.20 at 2013, which means its rank rockets up 7 in entire nation during these two years. In 2013, the total number of accepting patent application of Guangxi is 23249, including the accepting of innovation patent (14380), with the year-on-year growth of 121%, which stays in the first position in China. As the main body of independent innovation subject in Guangxi, enterprises have achieved high grades in patent applications. The statistics data of Guangxi Science and Technology, for instance, point out that the totally of invention patent application of enterprises is 2527 in 2012 with the year-on-year growth of 162.7%, which is 26.7% higher than the entire region(province) level. Because the number of the effective invention patents, accounting for 43.7 percent of all valid invention in Guangxi, is 1118, the local enterprises in Guangxi become a good sample for this study.

With the help of Guangxi Science and Technology Department, we grant a total of 510 questionnaires to the employees from 28 different enterprises 7 of industrial parks (2 state-level economic development zones and 5 province-level economic development zones) in different cities and received 425 copies back. The terminal number of effective questionnaires, without invalid copies, is 390, which figures out the effective recycle rate of questionnaire is 76.47%. The information of the employees are shown in **Table 3**.

4.2. Empirical Results

This paper selects "the time of R & D" and "the education background of employees" as the main control variables. Independent and dependent variables are measured with Likert 7 point scale and the measured items are derived from the maturity scale of existing literature combined with interviews with the employees and some further fine-tuning.

(1) Questionnaire reliability and validity test

To extract the questionnaires, the influence factors of the staff to implement the patenting behavior can be divided into 2 main parts: internal factors and external factors, which are subdivided into 10 item measurements. The motivations of the staff to implement the patent behavior can be divided into 5 categories including 17 item measurements. Using the analysis-measurement-reliability analysis of SPSS and eliminating the lower coefficient of CITC, we can get the results through the questionnaire reliability test. These figures are shown in **Table 4**.

Table 3. Information of the employees.

Item	Subitem	Ratio
Gender	Male	68.4%
	Female	31.6%
Age	Under 30	13.4%
	30 to 39	38.1%
	40 to 49	34.9%
	Over 50	13.6%
Education background	High school or below	30.9%
	Specialized subject and undergraduate	50.7%
	Master or above	18.4%
Patent type	Number of application for invention patent	12.4%
	Number of application for utility models patent	58.5%
	Number of application for design patent	29.1%

Table 4. The reliability test results of questionnaire sample after collating.

Code		Mean value	Standard deviation	CITC	Cronbach α coefficient after deleting items	Cronbach α coefficient	
Influencing factors	Internal factors	Level of human resource	4.31	0.914	0.604	0.759	0.799
		The quality of entrepreneurs	5.69	0.835	0.5	0.778	
		Enterprise scale	5.793	1.03	0.573	0.765	
		Enterprise innovation ability	5.241	1.134	0.592	0.762	
		Enterprise learning ability	5.69	0.986	0.581	0.763	
	External factors	Innovative sources of information needed	4.793	1.03	0.573	0.765	
		Industrial characteristics	4.241	1.134	0.592	0.762	
		Regional economic growth	3.69	0.986	0.581	0.763	
		Patent system and policy	4.966	0.85	0.48	0.782	
		Intellectual property culture	4.966	0.765	0.384	0.796	
Motivation of employees	Incentive motivation	Measuring internal performance	5.552	0.723	0.462	0.697	0.73
		Achieving personal goals	5.552	0.723	0.462	0.697	
		Stimulating employees	4.69	0.649	0.414	0.712	
		Obtaining patent financing	5.897	0.607	0.529	0.671	
		Measuring internal performance	4.759	0.677	0.58	0.648	
	Honorary motivation	The number of patents driven by government assessment indicators	5.241	1.134	0.592	0.762	
		The requirements for high-tech enterprise certification	5.69	0.986	0.581	0.763	
		Improving technical images	4.966	0.85	0.48	0.782	
		Increasing enterprise value	3.966	0.765	0.384	0.796	
	Transaction motivation	Improving cooperation position	3.897	0.607	0.529	0.671	
		Promoting of exchange potential	3.759	0.677	0.58	0.648	
		Having access to capital markets	3.655	0.658	0.477	0.689	
		Obtaining license revenue	3.69	0.835	0.5	0.778	
	Blocking motivation	Blocking competitors actively	3.793	1.03	0.573	0.765	
		Blocking competitors passively	3.897	0.607	0.529	0.671	
	Protection motivation	Avoiding innovation to be imitated	3.759	0.677	0.58	0.648	
Protecting markets (domestic and foreign markets)		3.69	0.649	0.414	0.712		
Becoming industry standards of patents		3.897	0.607	0.529	0.671		

This paper uses exploratory factor analysis to test the structure validity of samples and then detects whether the Bartlett sphericity test and the KMO test are suitable for factor analysis. Generally, KMO value above 0.8 means that it is pretty suitable. Value between 0.7 and 0.8 means suitable. Value between 0.6 and 0.7 means not that suitable. Lower than 0.6, this value is denied. If the value of Bartlett significance probability is less than 0.01, then the scale is fit for factor analysis. The test results of using SPSS 17.0 are shown in [Table 5](#).

The results indicate that it is suitable for factor analysis. The results of variable factor analysis are shown in **Table 6**.

(2) Correlation analysis

We get the load values for each variable through the confirmatory factor analysis of **Table 7** and coefficient value for each latent variable by multiplying the coefficient value which is under the corresponding indicators. The relationship among variables can be preliminarily judged through the correlation analysis of variables.

Table 5. Result of Bartlett and KMO test of sample data questionnaire.

Dimension	KMO value	Bartlett value	Sig
Influencing factors	0.581	117.353	0.000
Motivation of employees	0.752	31.523	0.003

Table 6. Factor analysis of variable.

Factors	Specific load values of internal and external influencing factors	Interpretable variable	Confidence value		
Influencing factors	Level of human resource	0.852	40.64%		
	The quality of entrepreneurs	0.746			
	Enterprise scale	0.821			
	Enterprise innovation ability	0.643			
	Enterprise learning ability	0.548			
	External factors	Innovative sources of information needed		0.742	65.22%
		Industrial characteristics		0.652	
		Regional economic growth		0.451	
		Patent system and policy		0.654	
		Intellectual property culture		0.524	
Incentive motivation	Measuring internal performance	0.824	23.15%		
	Achieving personal goals	0.851			
	Stimulating employees (Money, promotion and mental stimulation)	0.759			
	Obtaining patent financing	0.754			
Honorary motivation	The number of patents driven by government assessment indicators	0.824	38.28%		
	The requirements for high-tech enterprise certification	0.724			
	Improving technical images	0.657			
Motivation of employees	Increasing enterprise value	0.584	50.52%		
	Improving cooperation position	0.528			
	Promoting of exchange potential	0.741			
	Having access to capital markets	0.645			
	Obtaining license revenue	0.547			
Blocking motivation	Blocking competitors actively	0.824	60.54%		
	Blocking competitors passively	0.851			
Protection motivation	Avoiding innovation to be imitated	0.621	67.46%		
	Protecting markets (domestic and foreign markets)	0.515			
	Becoming industry standards of patents	0.459			

(3) Regression analysis

This study mainly uses the hierarchical multiple regression method to test the hypothesis, based on variable setting. Firstly, the control variables (R & D time and education background of employees) are added into the regression model to research the influence of independent variables on the dependent variable under the condition of effects of control variables. Secondly, the independent variables (internal and external influence factors of enterprises) are added into the regression model. Finally, the assumptive mediating variables (incentive motivation, motivation of reputation, motivation of transaction, motivation of barrier, motivation of protection) are added into regression analysis to test whether these mediating variables can intervene in the process of various independent variables to affect the dependent variable. The regression results are shown in **Table 8**.

Table 7. Relevant coefficient of Pearson variable.

Variable	Relevant coefficient							
	1	2	3	4	5	6	7	8
1 Protection motivation	—							
2 Blocking motivation	0.267**	—						
3 Transaction motivation	0.337**	0.224**	—					
4 Honorary motivation	0.352**	0.405**	-0.252**	—				
5 Incentive motivation	0.024	-0.075	0.241**	0.414**	—			
6 External factors	-0.079	0.056	0.021	0.214**	-0.064	—		
7 Internal factors	0.254**	0.224**	0.254**	0.371**	0.251**	-0.014	—	
8 Number of patent	0.024	0.014	0.051	-0.001	0.142*	0.321**	0.331**	—

Note: ***p < 0.001, **p < 0.01, *p < 0.05, †p < 0.1.

Table 8. Results of regression.

Variable	Relevant coefficient							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Constant	-0.654*	3.214***	4.251**	5.019**	3.584*	5.241*	2.524**	2.987**
Control variable								
R & D time	0.114**	0.376**	0.321**	0.337**	0.315**	0.364**	0.347**	0.434**
Education background independent variable	0.125**	0.381**	0.326**	0.341**	0.319**	0.368**	0.341**	0.439**
External factors		2.521*	1.658*	0.349	0.304	1.558*	1.024*	0.245
Internal factors		1.084***	1.121*	2.142*	1.702**	1.951**	2.017**	0.152
Intermediary factor								
Intensive motivation			0.865**					0.813**
Honorary motivation				0.412*				0.387*
Transaction motivation					0.297*			0.251*
Blocking motivation						0.114*		0.101*
Protection motivation							0.364*	0.307*
F	13.151***	15.142***	22.041***	21.941***	23.541***	22.624***	20.561***	17.652***
R ²	0.165	0.384	0.542	0.571	0.554	0.581	0.541	0.552
Adjusted R ²	0.154	0.353	0.512	0.544	0.529	0.558	0.508	0.528

Note: ***p < 0.001, **p < 0.01, *p < 0.05, †p < 0.1, N = 390.

As we can see in the **Table 8**, the overall significance level of these three models (model 1, model 2, model 3) passes the test, and the influence factors of the patenting behavior of employees have significant effects on the dependent variable (the quantity of patent application of employees), therefore H1 is confirmed.

Both internal factors ($b = 1.084$, $p < 0.001$) and external factors ($b = 2.521$, $p < 0.05$) have significant positive correlation with the number of patent application of enterprises, but the internal factor has a more significant correlation.

(4) Mediator analysis

Baron and Kenny proposed a mediator analysis method. If a variable meets the requirements of the following three aspects: (1) both independent variables and hypothetical mediating variables have significant correlation with dependent variables; (2) independent variables have significant correlation with hypothetical mediator variables; (3) the correlation between independent variables and dependent variables becomes insignificant or less significant when the hypothetical mediating variables are added into the regression equation, then that variables are playing the role of mediator [23].

Based on Baron and Kenny methods, we examine whether the five motivation factors of employees play the role of mediators between the influence factors of patent application and the results of patent application. Regressing data from Model 3, this paper uses R & D time and education background as control variables and add the “incentive motivation” variable that make the regression coefficients of both internal and external factors decrease. Then we use “a test program of mediator effects”, proposed by Wen and *et al.*, to make a Sobel test [24], and the result is 2.6025, the significance of 0.008. These results show that the “incentive motivation” plays the partial role of mediator between both internal and external factors (independent variable) and the number of patent application (dependent variable).

When “reputation motivation” is added into Model, such as Model 4, the regression coefficient of internal factors decreases, and then make a Sobel test, of which the result is 2.9025, the significance of 0.005. The test result indicates that the “reputation motivation” plays a partial role of mediator between internal factors (independent variable) and the number of patent application (dependent variable). The regression coefficient of external factors becomes non-significant when the “reputation motivation” is added, which indicates that “reputation motivation” totally plays a role of mediator between external factors and the number of patent application.

When “transaction motivation” is added into Model, such as Model 5, the regression coefficient of internal factors decreases, indicating that the “transaction motivation” plays a partial role of mediator between internal factors (independent variable) and the number of patent application (dependent variable). The regression coefficient of external factors become non-significant which indicates that the “transaction motivation” totally plays a role of mediator between external factors and the number of patent application.

When “obstacle motivation” is added into Model, such as Model 6, the regression coefficient of both internal and external factors decreases, indicating that the “obstacle motivation” plays a partial role of mediator between both internal and external factors (independent variable) and the number of patent application (dependent variable).

When “protection motivation” is added into Model, such as Model 7, the regression coefficient of both internal and external factors decreases, indicating that the “protection motivation” play a partial role of mediator between both internal and external factors (independent variable) and the number of patent application (dependent variable).

When “intensive motivation”, “reputation motivation”, “transaction motivation”, “obstacle motivation” and “protection motivation” are added into Model 8, the regression coefficient of both internal and external factors becomes not significant, indicating that when these five motivation factors are added into Model separately, all of it only play a partial role of mediator while play the role of mediator totally when we add all these factors into model at the same time.

In light of the above analysis, the influence of internal and external factors on the number of patent application is achieved by different motivation variables as mediators. When all the motivational factors are added into the process of the influence of internal and external factors on the number of patent application, they play the role of mediator completely. Therefore, H2 is confirmed.

5. Conclusions and Recommendations

(1) Internal factors are the main factors that affect the implementation of the patenting behavior, and the ex-

ternal factors are secondary. Internal factors of enterprises such as the level of human resource, the quality of entrepreneur, the scale of enterprise, the innovation capability of enterprise and the learning capability of enterprises have an effect on the implementation of the patenting behavior strongly.

(2) The motivation of employees to implement the patenting behavior plays the role of mediator between the influence factor of the implementation of the patenting behavior and the number of patent application, namely, the results of employees to implement the patenting behavior are affected by various factors through different individual motivations as mediators.

Firstly, we can learn from Model 3 that “incentive motivation” plays the role of mediator between both internal and external factors (independent variable) and the number of patent application (dependent variable). Therefore, enterprises should take measures in order to stimulate the employees to be more creative, such as the scheme of patent application reward, position-promoting and wage-increasing, to strengthen the implementation of the patenting behavior of employees.

Secondly, we can learn from Model 4 that “reputation motivation” plays the role of mediator completely between external factors and the number of patent application, which indicates that under the background of the implementation of the patent policy of government and the economic environment of the knowledge economy, business managers have to take different measures to promote the implementation of the patenting behavior of enterprises to deal with external changes and pressures.

Thirdly, we can learn from Model 5 that “transaction motivation” plays the role of mediator completely between external factors and the number of patent application, which means that external factors of enterprises can influence the implementation of the patenting behavior via the “transaction motivation” as mediator completely. For example, regional economic growth and the implementation of intellectual property policy make the patent cooperation and trade between enterprises much important, and ultimately lead to high attention of patent application.

Fourthly, we can learn from Model 6 and 7 that “obstacle motivation” and “protection motivation” play the partial role of mediator between both internal and external factors (independent variable) and the number of patent application (dependent variable), which shows that in order to adapt the change of knowledge and economy environment, enterprises should protect their patent application of innovation continuously to obstruct the competitors and to further protect their markets.

Finally, putting these five factors of motivation together can play the role of mediator between both internal and external factors and the number of patent application completely. The findings of this paper tell us that in order to make the patenting behavior of enterprises to implement efficiently, business managers should pay attention to the all motivations of employees to implement the patenting behavior: the integrated effects of incentive motivation, reputation motivation, transaction motivation, obstacle motivation and protection motivation. Enterprises need to make relevant policies and incentive measures and then provide a proper platform so that these five motivational factors can achieve due effect synthetically, which can make the patenting behavior of enterprises implemented better and faster.

This study presents a number of limitations. For example, our understanding of the role of patents in the establishment of partnerships is modest, as is our knowledge of the nature of relational arrangements. Moreover, we could not control for characteristics of partnerships. Additionally, we do not examine whether the adoption of new influencing factors is directly related to the innovation process, and our findings are likely affected by the crude definition and metric of management practice employed. Future studies should pay attention to the more motivations of employees to implement the patenting behavior.

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