Indian Journal of Science and Technology, *Vol 9(24), DOI: 10.17485/ijst/2016/v9i24/96150, June 2016*
ISSN (Print) : 0974-6846
ISSN (Online) : 0974-5645

A Study on Patent Valuation Important Factors: Focus on China Industry

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Abstract

Background/Objectives: This study drew six important elements from the valuation models presented in the preceding research and technology value valuation institutions through an expert survey. In addition, an analysis was conducted on the differences in the important elements of patent valuation by each product group using the AHP method. **Methods/ Statistical Analysis**: As general methods widely used to evaluate patents, there are various methods, such as scoring method, expert screening, Delphi method and AHP; and this study will use AHP. In this study, analysis was conducted using Expert Choice 2000 and consistency percentage of respondents were also verified. It was found that all are suitable for the reference. Additionally, importance was derived using the arithmetic average of 10 comments of the surveyed population. **Findings:** The present study deducted important elements from the patent value assessment elements proposed in preceding studies by conducting a Delphi survey targeting experts. Therefore, patent valuation key factors were derived from 10 practitioners of Chinese companies and the significance of the derived factors was analysed. It appears that the technology aspect is more important than business value. The relative importance between lower standards compared to upper standards shows that technological application and expandability is no.1 with 39.5%, followed by technological uniqueness at no.2 with 29.5% and technological independence at no.3 with 29.5%. **Application/Improvements:** The present study includes the fact that the conclusively selected important factors of the patent value assessment help corporate research and development officers or executives in establishing objective and reasonable patent value assessment models.

Keywords: AHP, Delphi, Patent, Patent Valuation, Patent Valuation Factors

1. Introduction

Innovation is an important element that determines the improvement of companies' competitiveness, so they invest much in R&D and protect their products with intellectual property rights. In the past, capital and production equipment were important, but in the knowledge-based economy, intellectual property rights are perceived more importantly.

A patent is an important element that can determine companies' competitiveness, and global leading companies operate technology development department and patent department, etc. Currently, there are increasing academic and operational interests in patents, and in particular, many studies are conducted on patent valuation.

Most studies related to patent valuation are methodological studies concerning how to evaluate patents, and Kim et al. conducted a representative study of important factors in the patent valuation. Kim et al. (2010) drew a list of important factors and priority according to the importance using the ranking-type Delphi method with domestic experts in patent valuation [1].

Park (2010) drew and analyzed elements with relative importance different according to the characteristics of the product[2]. Park examined the valuation elements presented by the preceding research and technology value valuation institutions, and important elements affecting the value of patents were extracted by gathering experts' opinions. Park et al. (2011) analyzed the importance of patent valuation elements by each product group, using

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AHP[3]. Markus Reitzig (2004) conducted an empirical analysis of the indicators for patent valuation through the actual patents and presented indicators of new patent valuation [4].

Also, in order to measure the value of patents, in addition to the number of simple patents, various patent-based measures have been developed and used. Examples include the number drawn with a weighted value of the frequency of the citation of patents[5], the number of years of renewal of registration[6], Schankerman and Pakes (1986)[7], the scale of the patent group (The number of countries in which the patent has been applied, Putnam (1996))[8], and the number of claims[3].

In addition, the development of valuation models for patent valuation and report and study of valuation indicators are conducted by some technological value valuation institutions; however, there are few studies of the importance of the elements of patent valuation.

A patent is the source of the most important power by which companies can keep their competitiveness. Global companies could maintain their competitiveness continuously because they had the monopolistic market by using the optimum patent strategy. In spite of these interests, in the Chinese market, there is a less interest in patent valuation.

Yet, most companies exception a few are not much concerned about the intellectual property itself as well as patent valuation. Of course, the companies recognize that intangible assets like patent are important for them to grow up. However, China is still striving for the protection of its industries, so many people use others' intellectual properties without authorization. In addition, it is important to apply for patents, but in the future, it would be more important to understand and evaluate the value of the patents. Thus, this study will draw important factors of patent valuation with Chinese companies and analyze the importance of the drawn factors.

2. Theoretical Backgrounds

2.1 Patent Valuation Preceding Research

Patent valuation means the valuation of a technology protected by a patent, and technology valuation begins from technical, right and commercial perspectives[1]. In general, technology valuation and technological value valuation differ conceptually.

Patent's value was evaluated using existing valuation methods, cost-based method, which is a cost approach, market-based method which is a relative price approach, income-based method, which is a profit approach, and discounted cash flow, which evaluates the value by the conversion of the future cash flow to the current value[9].

However, these methods cannot measure the economic benefits of intangible assets, so the results of the valuation may appear different. In addition, since they mainly test quantitative properties, it is not the overall valuation[1].

Park (2010) gathered experts' opinions under the assumption that the importance of the impacts of 48 patent valuation elements on patent valuation would be relatively different according to the product attribute, finally extracted 10 elements, drew and analyzed the relative importance by each product attribute[2].

Kim et al. (2010) finally selected 10 out of 49 items using the ranking-type Delphi method with Korean patent valuation experts and as a result of patent valuation, important factors included the characteristics of the technology, the scope of the rights, and advantage and disadvantage compared to a competing technology[1].

Kim & Park (2012) proposed a method of evaluating patents as a measure for the vitalization of IP finance. They proposed stock valuation method, market approach and qualitative valuation method as patent valuation method and presented implications through the difference between these methods[9].

In Park et al. (2011), important elements affecting patent valuation were drawn; finally, seven elements were drawn by gathering experts' opinions; and they were analyzed, using Delphi and AHP methodologies with 10 experts, including patent valuation experts, professors, practitioners in charge of patent, and R&D experts. As a result of an analysis of priority by upper standards between alternatives, in terms of technology and right, semiconductor ranked first, cell phone, second, and mp3 player, third[3].

Kim & Park (2015) examined various patent valuation methods presented till now and proposed a patent valuation method using cloud sourcing appropriate for the era of big data[10].

2.2 Methodologies pf Patent Valuation

Patent valuation can also be divided broadly into qualitative methods and quantitative methods. The qualitative

methods include focused group interview method and Delphi method, etc. Experts' judgment, intuition, survey, and comparison, etc. are used [11].

The quantitative methods include estimation of score and class through relative comparison and a method of drawing an absolute size, etc. Models of the score and class of the technology to evaluate and a monetary value model are used[2].

3. Research Method and Valuation Criteria

3.1 AHP Model to Draw Elements for Patent Valuation

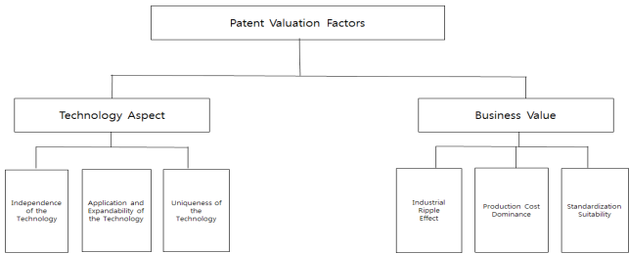

Figure 1. Analytic Hirearchy Structure.

As general methods widely used to evaluate patents, there are various methods, such as scoring method, expert screening, Delphi method and AHP; and this study will use AHP.

A research model consisted of the goal of the model in Hierarchy 1; two top valuation criteria in Hierarchy 2; and six sub-valuation criteria in Hierarchy 3. Based on the hierarchy diagram of Figure 1, the importance of the valuation of patents through an expert survey was estimated (Figure 1).

3.1.1 Establishing a Model

The proposes a decision making model concerning what important factors must be considered when model establishing companies assess patent values.

3.1.2 Analysis of the Patent Value Assessment Model

The subjects analyzed and researched in the present study are as follows. The studies of Kim et al. (2010), Park et al. (2011) and the assessment models (standard model assessment manual for small and medium business technology assessment, Korea Technology Credit Guarantee Fund, Kanagawa High Technology Foundation) of the technology value assessment agencies were the subjects of analysis[1,3].

3.2 Assessment Standard

The present research model carries out delphi research on the standards selected for experts with the elements of the patent value assessment proposed in preceding studies so that a more objective extraction of the important elements can be attempted.

The experts participating in the survey not only possess hands-on experience in the patent value assessment field as corporate research and development officers and executives in charge of patents, but also are able to influence the decision making process. The delphi research drew out the following assessment standards. Table 1 below shows operational definition.

4. Research Methods

4.1 Sample Extraction and Data Collection

The AHP survey was conducted on 10 Chinese experts between January 3 and 10, 2016. The experts that responded to the survey included 5 patent executives and five research and development officers.

Out of the whole sample, 70% of responders had an experience of less than five years, while those with five or more years was 30%, with the average job experience of the ten being 4.8 years. The general characteristics of the responders show that 80% had undergraduate degrees as their final academic background, while 20% had postgraduate degrees. The average rate of investment in research and development in comparison to the total sales of 2015 was 15%.

4.2 Judging Consistency Index and Substitutablility Index

The consistency rate of responders appeared in the order of 0.12, 0.04, 0.00, 0.10, 0.07, 0.03, 0.14, 0.00, 0.01, and 0.13. The study extracted the degree of importance from the group opinion of the ten subjects by using an arithmetic mean[12]. Analysis was conducted using Expert Choice 2000, and an analysis of the consistency rate revealed a significant level of CR=0.06.

Table 1. Assessment standard of the research model

Upper Standards	Lower Standards	Operational Definition
Technology Aspect	Independence of the Technology	Assessment to the degree that technology contributes to the final product.
	Application and Expandability of the Technology	Assessment on whether the technology is able to develop into different types according to the needs of the industrial environment and consumer demand by considering the level and range of technology application.
	Uniqueness of the Technology	Assessment of the uniqueness and imitability of the technology compared to existing technologies.
Business Value	Industrial Ripple Effect	Assessment of the economic and social ripple effect for the industry and the sustainability of its use (increased employment, import substitution, increased export).
	Production Cost Dominance	Assessment on whether price competitiveness can be secured by a comparative analysis on the cost reduction amount compared to alternate technologies, competing technologies and competing companies.
	Standardization Suitability	Assessment on the presence of a standardization guideline and an easy access to a standardization suitability mark

Table 2. Analysis or priorities between upper standard and lower standard

Upper Standards	Relative Importance between Upper Standards	Lower Standards	Relative Importance between Lower Standards Compared to Upper Standards	Relative Importance between All Lower Standards	Lower Standard Priorities
Technology Aspect	0.581	Independence of the Technology	0.395	0.230	1
		Application and Expandability of the Technology	0.295	0.171	3
		Uniqueness of the Technology	0.310	0.180	2
Business Value	0.419	Industrial Ripple Effect	0.356	0.149	5
		Production Cost Dominance	0.393	0.165	4
		Standardization Suitability	0.251	0.105	6
	1.000		2.000	1.000	

5. Positive Analysis Results

Table 2 shows the opinion of patent value assessment experts concerning the priority between upper standards and lower standards. A paired comparison between upper standards shows that the importance of the technology aspect and commercial aspect at 58.1% and 41.9% respectively.

It appears that the technology aspect is more important than business value. The relative importance between lower standards compared to upper standards shows that technological application and expandability is no.1 with

39.5%, followed by technological uniqueness at no.2 with 29.5% and technological independence at no.3 with 29.5%.

The research results show that technological application and expandability is number 1, out of the three important elements of the technology aspect. The reason for such a result seems to originate from the characteristics of the Chinese electronics industry. Technological application and expandability involves the assessment of whether the subject technology is close to the source technology which has a variegated application level and range[5].

The reason that technological application and expandability is no.1 is that the electronics industry is capable of developing applicable products or technologies from current technologies, and furthermore, because the possibility of developing various types of technologies depending on the needs of the consumer and the industrial environment is important [3].

The uniqueness of technologies comes at no.2 in the electronics industry due to the importance of pioneering uniqueness and new technologies in contrast to existing technologies. Can the relevant patent only be used by the holder of the technology? Does the possibility of imitation exist? These are important questions. Because there are swift technological trends and many competitors in the electronics industry in particular, highly unique technologies can prevent the loss of market share.

Technological independence comes at number 3. If a technological is only capable of commercialization with the support of another technology, then it loses independence. The smart phone company Xiaomi can be said to have low technological independence.

However, the high technological independence of Huawei has enabled its success in the global market. The relative importance between lower standards compared to higher standards has displayed a production cost dominance of 39.3% in terms of business value, taking first place, followed by industrial ripple effect at 35.6% at no.2, and standardization suitability at 25.1% at no.3.

In terms of business value, production cost dominance is number 1. If product cost dominance is high, it gravely affects price determination. For instance, if the Xiaomi Redmi Note did not have a systematic dominance in terms of product costs, it could never have been released at that price.

Industrial ripple effect which evaluates the economic and social ripple effect to the industry and the sustainability of use appears at number 2. In terms of business value, measuring the ripple effect of the developed technology is an important factor.

Technologies with a high ripple effect are able to create productivity and added value by expanding the device and service market. Standardization suitability comes at number 3. Generally, the standardization guidelines are established by each nation and industry. Possessing a standardized technology is important because it allows easy access to the relevant market.

6. Conclusions

The present study deducted important elements from the patent value assessment elements proposed in preceding studies by conducting a delphi survey targeting experts. Important elements deducted include three technological aspects and three business value aspects.

A surveys on Chinese corporate experts with the deducted elements revealed the relative importance between upper standards at 58.1% for the technology aspect and 41.9% for business value. The relative importance between overall lower standards were observed in the order of technology application and expandability (0.230), uniqueness of technology (0.180), independence of technology (0.171), production cost dominance (0.165), industrial ripple effect (0.149), and standardization suitability (0.105). It appears that experts perceive technology application and expandability and uniqueness of technology as more important elements than the other elements.

The present study, by examining the assessment elements presented in preceding studies, deducted important elements that affect patent value assessment, and finally extracted 6 important elements from the patent value assessments elements by collecting expert opinions.

The academic implications of the present study include the fact that the assessment models of major foreign and domestic technology assessment agencies are mixed in a variety of ways, and are formed differently according to the assessment purpose, but the results of the present study show that they can help build an academic system.

Furthermore, a hands-on implication of the present study includes the fact that the conclusively selected important factors of the patent value assessment help corporate research and development officers or executives in establishing objective and reasonable patent value assessment models when assessing patent values and that they

can be used to develop patent value assessment guidelines.

The limitations and future research direction of the present study are as follows. First, research must be conducted to enable a more visualized and objective patent value assessment by securing and strengthening the independence between each element. Second, the study failed to collect opinions from experts in various fields, and the restricted number of survey responses is difficult to generalize in other industries. Therefore, statistical analysis must be conducted by surveying more experts in the future and further studies must be carried out to verify the validity in terms of the weighted value and the respective elements of the patent value assessment.

7. Acknowledgement

We appreciate Sangsan Brick Co. supporting this research by the development fund of the Chungbuk National University.

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