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## Empirical Analysis of Patent Information Application in China's IT Industry

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**Abstract:** In this study, we put forward five-first indicators and fourteen- secondary indicators via., comprehensive method. We improved the new fuzzy evaluation matrix from the aspect of patent information management. Finally, we had access to patent information management performance in the research enterprise and the result showed that  $E = N \cdot BT = 81.9$ . By using the new indicators and research method, the countermeasures were given to improve enterprise's patent management performance especially in both protection and application.

**Key words:** Patent information management, AHP method, evaluation

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### INTRODUCTION

In the developed nations and the developing nations Intellectual Property Right (IPR) competition is becoming the focus of world competition. Different industries or enterprises aim to obtain a great deal of patents around their technology. Patent information resources have become an important strategic resource which affects national innovation, industrial innovation and enterprise technology innovation. According to statistics, the number of patent information accounts for 1/4 of 4 million scientific publications in the world per year and an annual increase still exceeds more than 100 million patents (Jia and Shao, 2008). The World IPR Organization holds that 60% of development time and 40% of R and D funding can be saved if R and D staffs can make the best use of patent information. Furthermore, 90-95% of inventions and creations in the world per year can be found in the patent literatures and many research results are disclosed only in the patent literatures rather than in other scientific and technical literatures. In fact the patent literatures are the main source of patent information resources.

The original EPO Secretary Dr Braendi once said that if Small and Medium-sized Enterprises (SMEs) did not make full use of patent information, their position in the world economy would decline (Young-II, 2011). Wu (1995) pointed out that patent information included patent information concerning R and D and the introduction of new technology, patent legal affairs information, the competitive patent strategy information, the market supervision patent information, as well as patent disputes

and litigation information (Wu, 1995). Li (2008) made the analysis of the value of patent information management to enterprises competitiveness (Wu and Yao, 2012). Ma Haiqun discussed the role of patent information to technology innovation (Shen *et al.*, 2012).

Being a kind of social information resources, patent information has shown the strong economic value and social value. In 2006, the Ministry of Science and Technology released a number of opinions on improving IPR information utilization and service capability to make IPR information service platform, in which the government stressed the importance of patent information. In 2008, China's government began to implement IPR strategy. Among them, the main tasks aimed to promote enterprises to establish and perfect patent management system, construct a unified patent information service platform and own the real-time and efficient patent warning mechanism. Patent information management is an important measure to implement patent strategy in China.

It is said that patent information can improve patent creation ability and technological process. With the help of patent search, enterprises can save the cost of technological innovation, shorten innovation cycles, rapidly conduct the implementation of patent strategy and accelerate the development in the process of SMEs technological innovation (Tian *et al.*, 2012). First, being the intrinsic part in implementing IPR strategy, patent information is the core elements to improve the competitiveness in enterprises. Secondly, patent information can indicate R&D and innovation direction for enterprises which can promote enterprises' sustainable development. Thirdly, patent information is the basis of

patent strategy which is information sources and objective basis of patent investigative strategy, patent application strategy, patent implementation strategy and patent defense strategy in enterprises. Nowadays China's large enterprises, such as Haier, Huawei and Lenovo have their own patent information management institutions which regularly purchase the domestic and international patent data, access to patent website to collect and analyze patent information. It was well known that Apple got the decisive win in patent case v. Samsung because Apple's patent management department had made staffs' inspiration and technology applied for the various patents in a timely manner. What's more, patent information analysis had been conducted to obtain infringement evidence, so that Samsung was sentenced to pay Apple \$ 1.05 billion due to patent infringements. Therefore, patent information is closely related with enterprises' survival, development and prosperity.

In this study, the quantitative analysis method AHP is used to conduct the performance evaluation of ZTE's patent information management based on the scientific evaluation index system.

**RESEARCH METHOD**

Patent information management means that enterprises effectively organize and utilize information in the process of patent operations by strengthening enterprises' information construction shown in Fig. 1, thereby enhancing the economic and social benefits of enterprises. The basic work of enterprise patent information management performance evaluation is to develop a systematic and scientific index system. There

are many factors including quantitative indicators and qualitative indicators which affect patent information management performance in enterprises. To have access to the comparability and operability of the evaluation results, some methods are accepted in the study. Firstly, the quantitative indicators are turned into the relative ones so that there are the comparable natures between the different quantitative indicators. Secondly, owing to the strong nonlinearity and fuzziness of qualitative indicators evaluation, the second level qualitative indicators are broken down into 2-5 elements to enhance the accuracy and operability. The index system analysis can be seen in Table 1.

**RESULTS AND ANALYSIS**

Because most evaluation indicators have ambiguity and indicators belong to the different stratification, the comprehensive evaluation can be conducted by methods combined with fuzzy comprehensive evaluation and AHP. 30 experts from Jiangsu Provincial patent Research Center, patent Research Center of Hubei Province, Wenzhou patent Research Center and Wenzhou patent Service Park are invited to conduct a comprehensive evaluation of ZTE's patent information management performance on the basis of evaluation indicator system:

**Step 1:** There is factors set  $U = \{U_1, U_2, U_3, U_4, U_5\}$ .  $U_i$  represents the factors to be considered and  $i = 1, 2, 3, 4, 5$ .  $U_1 = \{U_{11}, U_{12}\}$ ,  $U_2 = \{U_{21}, U_{22}\}$ ,  $U_3 = \{U_{31}, U_{32}, U_{33}, U_{34}\}$ ,  $U_4 = \{U_{41}, U_{42}, U_{43}, U_{44}\}$  and  $U_5 = \{U_{51}, U_{52}\}$

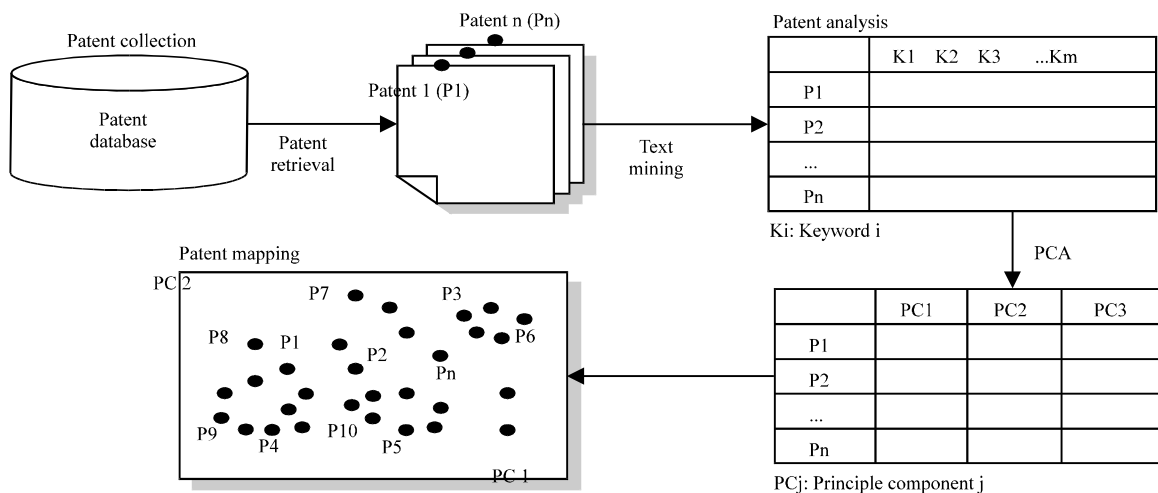


Fig. 1: Patent mapping process

Table 1: Enterprise patent information management performance evaluation index system

First level indicator	Second level indicator	Nature
Patent information management system (U <sub>1</sub> )	Patent safety management (U <sub>11</sub> )	Qualitative
	Patent flow management (U <sub>12</sub> )	Quantitative
Patent information management institution (U <sub>2</sub> )	Patent management agency (U <sub>21</sub> )	Qualitative
	Patent incentive mechanism (U <sub>22</sub> )	Qualitative
	Patent information application awareness (U <sub>31</sub> )	Qualitative
Patent information application (U <sub>3</sub> )	Patent information application sorts (U <sub>32</sub> )	Qualitative
	Patent information application links (U <sub>33</sub> )	Quantitative
	Patent information application level (U <sub>34</sub> )	Quantitative
	Patent intelligence analysis capability (U <sub>41</sub> )	Quantitative
Patent information achievements (U <sub>4</sub> )	Technology transfer capacity (U <sub>42</sub> )	Quantitative
	Independent innovation capability (U <sub>43</sub> )	Quantitative
	Market competitiveness (U <sub>44</sub> )	Quantitative
	Patent construction funding (U <sub>51</sub> )	Quantitative
	Patent personnel training (U <sub>52</sub> )	Quantitative

Table 2: Evaluation standard of evaluation indicators

Level N	Comment on evaluation indicators	Score N'
n <sub>1</sub>	High	≥90
n <sub>2</sub>	Higher	80-89
n <sub>3</sub>	General	60-79
n <sub>4</sub>	Poor	50-59
n <sub>5</sub>	Very poor	0-49

**Step 2:** To determine the evaluation level and its corresponding standard. There is review set  $N = \{n_1, n_2, n_3, n_4, n_5\}$ , where  $n_j$  represents the assessment results,  $j = 1, 2, \dots, 5$  and evaluation ranks are divided into five levels. The corresponding score of evaluation set and different ranks can be seen in Table 2 (Liu *et al.*, 2006)

**Step 3:** The single factor evaluation is given to obtain evaluation matrix  $R_i = \{r_{ij}\}$ . Since, indicator  $u_{ij}$  is fuzzy, the specific data cannot be drawn. The evaluation matrix can be seen by Delphi method according to  $j$ th reviews  $n_j$ . For statistical purposes, membership  $r_{ij}$  can be represented by the assessment level method from 30 experts' comments. These experts come from Jiangsu Provincial patent Research Center, patent Research Center of Hubei Province, Wenzhou patent Research Center and Wenzhou patent Service Park. The expert group's comments can be made through the mathematical processing to have the fuzzy evaluation matrix  $R_i (i = 1, 2, 3, 4, 5)$  which is given in Table 3

**Step 4:** The weight of the first level indicator and the second level indicator can be given via AHP method. The basic method is to conduct pairwise comparisons between the same level elements to quantitatively describe the importance. The pairwise comparisons are made via., AHP model elements in each level (Harker and Vargas, 1987).  $A = \{\alpha_{ij}\}$  and  $A_i = \{\alpha_{ij}\}$  can be seen in Table 3

**Step 5:** Evaluation matrix consistency checking is conducted in order to calculate the consistency ratio  $CR = CI/RI$ .  $CR$  is the ratio of the consistency index and random consistency index, where  $CI$  is the random consistency index and  $RI$  is the average random consistency index (Zahedi, 1986). If there is  $CR = 0.1$ , the consistency of the comparative judgment matrix is acceptable. There are the consistency ratio  $CR = 0.05$  of the first level indicator evaluation matrix  $R$  and the consistency ratio  $CR_i$  of the secondary level indicator evaluation matrix shown in Table 3

**Step 6:** The comprehensive evaluation is made to obtain the final evaluation results  $B$ :

$$B = A \cdot R = (A_1, A_2, A_3, A_4, A_5) \cdot \begin{matrix} R_1 \\ R_2 \\ R_3 \\ R_4 \\ R_5 \end{matrix} = (A_1R_1, A_2R_2, A_3R_3, A_4R_4, A_5R_5) = [0.32, 0.25, 0.19, 0.13, 0.10] \tag{10}$$

**Step 7:** There is patent information management performance  $E = N' \cdot B^T$  so as to make judgments to the score to determine the level of enterprises patent information management:

$$E = N' \cdot B^T = [97, 87, 78, 58, 49] \cdot [0.32, 0.26, 0.19, 0.13, 0.12]^T = 97 \times 0.32 + 87 \times 0.26 + 78 \times 0.19 + 58 \times 0.13 + 49 \times 0.12 = 81.9$$

The each score multiplied by its weight coefficient is equal to the total score. Obviously, ZTE's patent information management performance ranges between high and higher and the evaluation results are consistent

**Table 3: Fuzzy evaluation matrix and index weights**

First level indicator			Secondary level indicator			Fuzzy evaluation matrix $R_i$				
$U_i$	$\alpha_i$	CR	$U_{ij}$	$\alpha_{ij}$	$CR_i$	High	Higher	General	Poor	Poorest
$U_1$	0.23	0.05<0.1	$U_{11}$	0.70	0<0.1	0.3	0.2	0.3	0.1	0.1
			$U_{12}$	0.30		0.2	0.3	0.2	0.2	0.1
$U_2$	0.16		$U_{21}$	0.60	0<0.1	0.3	0.2	0.3	0.1	0.1
			$U_{22}$	0.40		0.2	0.3	0.2	0.2	0.1
$U_3$	0.28		$U_{31}$	0.35	0.068<0.1	0.1	0.3	0.4	0.2	0.0
			$U_{32}$	0.26		0.1	0.1	0.3	0.3	0.2
			$U_{33}$	0.22		0.0	0.2	0.3	0.3	0.2
			$U_{34}$	0.17		0.1	0.1	0.3	0.3	0.2
$U_4$	0.21		$U_{41}$	0.32	0.022<0.1	0.2	0.3	0.3	0.2	0.0
			$U_{42}$	0.19		0.1	0.1	0.3	0.3	0.2
			$U_{43}$	0.21		0.0	0.1	0.3	0.4	0.2
			$U_{44}$	0.28		0.0	0.3	0.3	0.2	0.2
$U_5$	0.12		$U_{51}$	0.60	0<0.1	0.2	0.3	0.4	0.1	0.0
			$U_{52}$	0.40		0.3	0.2	0.3	0.2	0.0

with the actual situation of ZTE Company. The weight distribution reasonableness of index system has been verified in this instance. E value of Huawei, Haier and BYD Company can be obtained through AHP method, respectively. The calculation results show that the ZTE Company's management performance is significantly higher than other enterprises.

**CONCLUSION**

Firstly, enterprises must set up a team composed of patent information management professionals which can adapt to enterprise development scale and enterprise development stage. It is necessary for the team to have a comprehensive and basics knowledge of patent laws, but also has information management, science and engineering background. They can engage in the creation, management, protection and utilization work in the field of patents, trademarks and copyright. What's more, they can take part in the formulation and implementation of enterprises business strategy.

What's more, enterprises should make full use of patent information resources. On the one hand, enterprises should take advantage of the existing free patent databases, including all areas of patent database resources from provinces, autonomous regions and municipalities directly in China. On the other hand, the qualified enterprises can create the special topic patent databases. For example, the patent Office of Guilin Star Technology Company established the special topic patent databases and configures patent search and patent information analysis system (He, 2009). Finally, enterprises should utilize the expired patents. Because the expired patents belong to the public resources, enterprises should seriously dig and find the expired patents from the numerous national patent databases, so

that those patents can turn waste into treasure and turn them to our advantages. From 2012-2015, drugs quantities of patent expire will be 111, 120, 132 and 122, respectively in multinationals. Chinese pharmaceutical enterprises should actively urge the relevant departments of China government to implement the compulsory licensing, produce the local brands of generic drugs and expand the drug market share at home and abroad.

Thirdly, China should establish the coordination mechanism for patent information management and utilization. First of all, China should establish the foreign patent information network. The implementation of foreign patent information liaison training programs and the Information Letters mechanism along with the rapid processing mechanisms relation to patent abroad should put to use. Then, China should have the coordination mechanism of patent information. Patent foreign information networks must be conducted collaboratively together with China's export enterprises information system, so as to have access to data and information resources sharing & complementary and make patent information maximize their effectiveness.

Finally, China's enterprises should protect patent information. On the one hand, patent lawsuit information should be controlled timely especially the defeated case information. On the another hand, patent license with other enterprises can not make any disclosure including the licensing fees, licensing period as well as licensing programs. Lastly other patent transaction details should be not included in the publicly-available documents.

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