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Measuring the value of patents with fuzzy multiple criteria decision making: insight into the practices of the Industrial Technology Research Institute

Benjamin Wang [b], Chih-Hung Hsieh [a,*]

[a] College of Management, Yuan Ze University, Taoyuan, Taiwan
[b] Technology Transfer Center, Industrial Technology Research Institute, Hsingchu, Taiwan

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ABSTRACT

This study addresses the construction of a value measurement system for numerous patents across disciplines. We collected dozens of variables through a review of the literature and a survey of a panel of experts. Then we ran a factor analysis to extract 10 independent criteria and we used these to construct a hierarchical structure in which the criteria were categorized into "strategic values," "commercialization values," and "protection values." The weight of each criterion was determined by an analytical hierarchy process survey. Finally, we used a fuzzy survey designed using the 10 criteria to measure the values of a large number of patents and to divide the patent families into three classes. To test the method, we used the 4346 patents of the Industrial Technology Research Institute as an empirical case to illustrate the usefulness of the method. The results indicated that the method is useful not only for assessing the value of numerous types of patent across disciplines but also for probing small differences among similar patents and adjusting the weights of criteria to comply with organizational objectives. We found that 14% of 4346 patents were highly valuable whereas 75% of patents were intermediate value, and 11% were of low value. We discuss managerial insights for each class of patent and limitation of the hybrid model.

1. Introduction

1.1. Demand for patent valuation

Patent valuation deeply affects a firm's business operations in several ways. For example, research and development (R&D) managers need to estimate the value of patents for outlining R&D direction (Reitzig, 2003). Intellectual property (IP) managers need to prioritize strong patents not only to reduce application costs and maintenance fee, but also to maximize the profit generated from patent commercialization (Hsieh, 2013). To undertake further commercialization of patents, marketing managers have to select valuable patents and evaluate their value (e.g., by estimating royalty income) before they are licensed or transferred to others (Gallini, 2002).

Patent valuation also has a dramatic influence on some important business activities (Hanel, 2006). For instance, when firms go public (initial public offerings), when knowledge-intensive firms engage in merger or acquisitions, and when strategic alliances are formed, it is important for firms to value their IP before a business activity is launched (Breitzman and Thomas, 2002). Inevitably, the increase in patents has led to an increasing trend of litigation, which draws the attention of R&D managers when they consider how to value and prioritize a strong patent (Olson Lanjouw, 1998). In particular, many litigation cases have shown that some patents can be quite valuable (Guellec and van Pottelsberghe de la Potterie, 2000). Gambardella et al. (Gambardella et al., 2008) suggested that only 3% are premium (i.e., hold a very high value). Thus, how to extract premium and potentially high-value patents from a

* Corresponding author at: 135 Yuan-Dung Rd., Chung-Li, Taoyuan 320 Taiwan. Tel.: +886 926390011.
E-mail address: john@saturn.yzu.edu.tw (C.-H. Hsieh).

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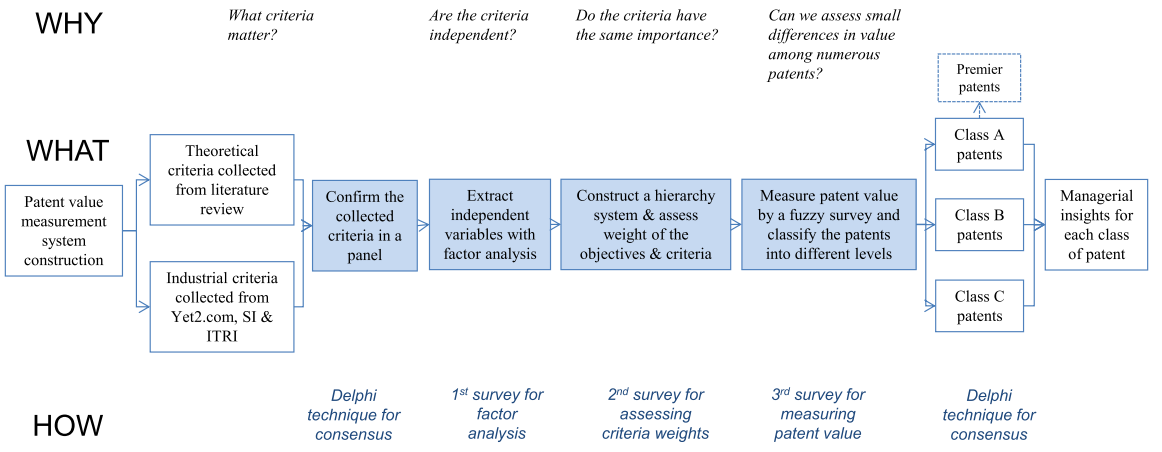

Fig. 1. Research process of this study.

firm's patent portfolio is an essential issue for managers and business decision makers.

1.2. Problems of current patent valuation approach

Despite the fact that the demand for reliable measurement of patent value is high, however, there are no empirical studies that could confirm the validity of the theoretical assumptions underlying the question of which criteria determine a patent's value (Hanel, 2006). Although fairly detailed standards exist for valuing businesses, and although litigation has shown that some IP can be quite valuable, until recently, no standards detailing the unique factors that must be considered in valuing IP have been promulgated in final form (Reitzig, 2004).

Some scholars have used quantitative methods to measure patent value based on various criteria. However, such studies have some limitations. For example, the criteria used in some such research have been incomplete. In addition the criteria have often differed among studies, and have not all been independent criteria. For instance, the value of a patent is related to its cost and thus the profit it has generated, whereas commercialization value is somewhat related to market value.

Therefore, it is necessary to re-examine these criteria and prove their independence. In addition, we cannot assume that the importance of each criterion is constant, thus, we also assessed the weights of the criteria. Furthermore, most currently available studies have assessed only a small number of patents (usually dozens to hundreds) and have often considered patents only in a specific industry or technological field. Thus, we argue that it would also be worthwhile to test the valuation of a large set of patents in different technological fields.

1.3. Research objective and design

The aim of this study was to establish a system to measure the value of patents and prioritize patents into three classes: highly valuable (A class), intermediate valuable (B class), and no obvious value (C class); this would allow appropriate assessment of IP value and efficient management of IP rights. The research process used for this study is outlined in Fig. 1.

As shown in the figure, a literature survey was undertaken to find the best existing models and criteria for patent valuation to establish a definitive patent valuation system that would be able to select for high-quality patents through various values and judgment criteria. Both theoretical and industrial criteria were included and analyzed in this study. To ensure that a complete set of criteria was used, a panel was established to extend and confirm the set of criteria. Then, we conducted a survey to prove the independence of our collected criteria and extracted a final set of criteria, in which each criterion is independent of the others. Through a second survey, we constructed a hierarchy system and assessed the weight of each criterion. Finally, we used the independent criteria to conduct a third survey to determine the value of a large number of patents and classify them into the three classes. It is hoped that this valuation system can be put to use to enable more effective utilization of intellectual rights generated by public research institutes and high-tech firms.

This approach can be used primarily in cases of uncertainty and where multiple criteria are needed for valuation and decision making. An empirical case study of the Industrial Technology Research Institute (ITRI), one of the leading public research organizations in Asia, is provided to demonstrate the usefulness of the patent value measurement system developed in this study.

The remaining parts of the present report are organized as follows: following a theoretical analysis in Section 2 that discusses value determinants, i.e., objectives and criteria, the design of the patent value measurement system and the data sources used for it are described in Section 3. Section 4 presents the multivariate statistical results of the empirical study, and Section 5 presents the conclusions.

2. Literature

2.1. Patent valuation approaches

To collect useful criteria for patent valuation, we used the key words “patent value” and “patent valuati*[1]” to extract the

[1] The asterisk represents possible word variations such as “valuation” and “valuating.”

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