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Fuzzy-QFD approach based decision support model for licensor selection

Ling Wang [a,b,*], Yi-Kai Juan [c,b], Jie Wang [b], Kai-Meng Li [d,b], Colin Ong [b]

[a] School of Business, China University of Political Science and Law (CUPL), Beijing, China
[b] Center for Sustainable Development and Global Competitiveness, Stanford University, CA, USA
[c] Department of Architecture, National Taiwan University of Science and Technology (NTUST), Taipei, Taiwan
[d] China International Engineering Consulting Corporation (CIECC), Beijing, China

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ABSTRACT

The patent marketplace has expanded significantly as an increasing number of patents are being filed. In turn, the demand for patent intermediaries is also expected to grow. One channel of patent flow for patentees to realize revenue is patent out-licensing, which involves high risk and uncertainty and a consuming need for coordination. Most patent licensing studies have focused on licensing modes, patented technology valuation, and price negotiation. However, many patent licensing issues involve a lack of systematic and objective assessment. This study attempts to establish a licensor selection model based on a hybrid model that embeds fuzzy logic within Quality Function Deployment (QFD) for the patent transaction platform. Experts from industries and professional organizations help a patent intermediary establish licensor selection and licensee requirement criteria, and establish weighting measures based on the input criteria and published patent specifications. We found that quality and applicability of patents and qualification and identification of licensors in patent licensing are the main factors for deriving a decision. With this model, licensees can select an optimal licensor according to their requirements. In a case study of a Chinese high-tech company, results reveal that the proposed hybrid fuzzy-QFD approach can successfully deal with complex licensing selection criteria to find an optimal solution and has the potential for handling multiple criteria decision-making problems in the patent marketplace.

1. Introduction

Intellectual property (IP), particularly patents, has long been an incentive mechanism for promoting innovation in a modern society. Through a patent, an inventor is granted an exclusive property right for a certain period of time (Kamien & Tauman, 1983; Saracho, 2000). A patent holder can usually benefit from the market monopoly of his patent. For most technology-based enterprises, their patents are regarded as an important measure of their technological advancement and competitive advantage. This motivates the demand for patent trading, especially in a rapidly evolving business and economic environment, as well as the shift of dominate innovation paradigm from a closed into an open innovation model (Chesbrough, 2003), and the enactment of new regulations (Mowery & Ziedonis, 2002).

Due to an increasing number of patents being filed, the patent marketplace has expanded significantly. Determining a method to effectively and efficiently conduct patent transactions has emerged as an interesting and important research topic. In a public patent marketplace, there are four major external patent transaction channels: licensing, purchase, sale, and joint venture. Within these four transaction channels, licensing, purchase, and sale of patents are three typical trade mechanisms. Joint venture is an emerging strategic behavior in which two or more organizations jointly invest in a certain patent or a set of patents and share the costs and benefits of those patents (Sharpiro, 1985; Yi, 1999). The most popular method of patent transaction due to its flexibility in patent trading is patent licensing. For example, IBM's 1998 patent licensing revenues reached $1 billion, providing more than 10% of the company's net profits that year. Also in 1998, the amount US based companies collected in patent licensing fees from foreign companies rose to $36.8 billion, while the amount they paid to foreign companies rose to $11 billion (Rivette & Kline, 1999).

Patent licensing is one source of profit for the inventor. Licensing provides a means for the inventor to charge for the right to use the invention (Gallini, 1984). The practice of patent licensing is widespread across almost all industries. The practice is valuable to both patent licensor (LR), as a supplier, and patent licensee (LE), as a consumer. Arrow (1962) analyzed various data sets of income from licensing and found out that patent licensing not only reduces production costs but also helps inventors generate profit

* Corresponding author at: School of Business, China University of Political Science and Law (CUPL), 25, Xitucheng Road, Haidian District, Beijing 100088, China. Tel.: +86 1058909407.
E-mail addresses: lingw01@cupl.edu.cn (L. Wang), rik@mail.ntust.edu.tw (Y.-K. Juan), jiewang@stanford.edu (J. Wang), likm@ciecc.com.cn (K.-M. Li), cgong@stanford.edu (C. Ong).

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under general instances. Kamien (1986, 1992, 2002) discussed different licensing strategies and their impact on industry's market structure and potential revenues for inventors. In other research, Katz and Shapiro (1985, 1986) studied a three-stage, asymmetric duopoly game of R&D rivalry to demonstrate the impacts of disparate patent licensing strategies. For most previous studies of the licensing selection problem, discussions have been mainly focused on licensing selection strategies between one licensor and multiple potential licensees, under the assumption that those licensees engaged in Cournot competition amongst themselves (Kamien, 1992). However, such an assumption is unrealistic due to the fact that licensees become increasingly more active and selective for licensing patents. In addition, a licensee takes into account not only the patented technology's quality and cost (Kamien & Tauman, 1983), but also its feasibility.

More specifically, most patent licensing studies have focused on explanations for licensing, licensing modes, patented technology valuation, and price negotiation (Rostoker, 1984; Wang, 1998). However, patent licensing often suffers from the lack of a systematic and objective method for assessment. That is, a systematic and objective assessment framework for the patent licensing selection process among multiple licensors and licensees is largely missing. With patent licensing becoming a more mutually selective process for both licensor and licensee, an effective and structured licensing selection method becomes highly desirable.

The objective of this research is to develop a decision support system for a licensee to evaluate the relevant characteristics of licensable patents and their patent holders, and then to select the optimal patent and its licensor for practical purposes. The licensing selection model for a licensor is based on a hybrid model embedding fuzzy logic within Quality Function Deployment (QFD). First, licensor selection criteria and licensee requirements and their weights are assessed by experts from industries, research institutions, and professional organizations; next, a proposed fittest licensor is proposed for a licensee through the patent transaction platform. With this model, licensees can select the optimal licensor according to their requirements. The method is further illustrated using the case study in which results reveal that the proposed hybrid fuzzy-QFD approach can deal with complex licensing selection criteria and find an optimal solution for a licensee. The method demonstrates the potential for handling multiple criteria decision-making problems in the patent marketplace.

2. Patent transaction platform

2.1. Patent marketplace and patent intermediaries

With the innovation paradigm shifting from a closed mode to an open mode, patents created within an organization and from outside patentees can be more readily exchanged and employed for commercial activities (Rivette & Kline, 2000). In other words, patents are able to cross organizational boundaries to realize more potential business value in patent markets (Chesbrough, 2003; Chesbrough, Vanhaverbeke, & West, 2006). For example, many critical patented technologies invented in the Xerox Palo Alto Research Center have been commercialized by other companies, such as 3Com Corporation and Adobe Systems Incorporated. By utilizing an open innovation paradigm, diffusion of new technologies and their commercialization can be accelerated.

The enactment of new regulations has also critically influenced the patent marketplace in recent years. Mowery, Sampat, and Ziedonis (2002) studied major changes of regulations related to the patent system in the United States and discovered that over the years, new regulations have been introduced to encourage more creativity in patentees and to improve the development of the patent marketplace. One eminent example is the enactment of the Bayh–Dole Act. Before Bayh–Dole, the US government had accumulated over 30,000 patents but only 5% were commercially licensed. After the Bayh–Dole Act of 1980, more research collaboration existed between industry, universities, and government. Licensing and commercialization of patents were enhanced significantly. The Association of University Technology Managers (AUTM) reported that the number of universities that had technology licensing and transfer offices increased from 25 in 1980–200 in 1990 (Mowery & Ziedonis, 2002), which indicated that the Bayh–Dole Act indeed generated expeditious development for patent commercialization.

With potentially increasing amounts of patents (Alcácera, Gittelmanb, & Sampatc, 2009) and revenue generated from patents, patentees pay more attention to licensing their patents for commercial projects. Licensing is usually characterized by high risk, uncertainty, and daunting coordination efforts. In addition, there are fundamental asymmetric information problems between licensees and licensors in patent licensing. Complexities of the patent licensing process increase demand for a patent intermediary, acting as a platform, to facilitate more efficient patent trading. Practically, these intermediaries exist in the forms of patent brokers, patent exchanges, patent aggregators, patent securitizers, patent investment funds, patent defense funds, and other firms that explicitly engage in patent transactions as part of their core operations (Ashby & Monk, 2009). It can be readily characterized by the term "patent market match maker."

Nowadays, patent intermediaries serve as a supporting agent for an innovation-enabling infrastructure helping firms to compete efficiently in a global economy, as shown in Fig. 1. Modern patent management (Ernst, 2003; Tsuji, 2002; Yu, Liu, & Li, 2001) can be described as a three-aspect process embedded within the whole lifecycle of an innovation: innovation selection and patent information acquisition and analysis, innovation achievement and patent protection, and innovation profit and patent commercialization. The development of patent intermediaries and public service platforms has been regarded as an external supporting factor for innovation and patent management strategy (Millien & Laurie, 2007). Based on available statistics, in 2008, 72% of identified patent intermediaries were located in the United States. Within the US, patent intermediaries clustered in regions known for technological innovation. California, mostly regions around Silicon Valley, hosted about one third of all US intermediaries. It demonstrates that high-tech clusters typically include specialized suppliers and service providers for patent management (Ashby & Monk, 2009). The patent intermediary serves as a new business model for patent transaction and acts as a patent transaction platform in a patent marketplace.

2.2. Architecture of a patent transaction platform

The patent transaction platform can be thought of as a service platform, which provides patent licensees information sharing, decision support, and trading services for required patented technology. Without such a platform, as in the case of a traditional patent trading paradigm, licensors and licensees have to collect information individually and randomly, and they have to negotiate every time with each other from the beginning of a patent licensing transaction, as shown in Fig. 2(a). It is an inefficient process, but the situation can be improved by using a patent transaction platform. Licensors provide patent information to the platform and licensees send their requirements to the platform. They only need to communicate with each other at the last stage of trading, as depicted in Fig. 2(b), eliminating unnecessary and time-consuming communications during the process.