Technological Forecasting & Social Change 79 (2012) 180–185

Contents lists available at SciVerse ScienceDirect

Technological Forecasting & Social Change

FROM MY PERSPECTIVE

The patent paradox – New insights through decision support using compound options

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A R T I C L E I N F O

Article history:
Received 13 April 2011
Received in revised form 19 July 2011
Accepted 13 August 2011
Available online 28 September 2011

Keywords:
Real options
Decision support
Patents
Intellectual property
Policy

A B S T R A C T

By considering the patent from the perspective of a compound option it is possible to offer useful insights into what a patent does, when it is worth patenting, and the effects of changes to patent regulation and enforcement in terms of maximizing economic and societal benefits. A paradox exists because stronger patent laws with longer durations allow greater profit to the inventor, but strong and long patent protection discourages related innovation as the protection for the underlying technology becomes broader and duration is longer. Through the demonstration that under current regulation the net present value of a sample patentable invention must be a little over half a million dollars ($556,000) at the time of patent filing, insight is offered into when it is economically advisable to patent. The effect of changes to patent regulation can also be rapidly assessed using this technique. Consequently, the compound option provides value to policy makers for decision support in assessing the impact of changes to patent policy and to inventors and patent attorneys on assessing whether it is economically rational to patent.

1. Introduction: what do patents really offer the patent owner?

Historically, patents protected against a loss in profits resulting from a breach of the patent. In high profile cases such as Polaroid's *Land Camera* and the Black and Decker's *Snake Light*, the patent holder demonstrated that a loss in profits was a direct result of patent violation [1]. As a result, Black and Decker obtained settlements that in some cases involved an amount greater than the market price of the competing products [2]. Polaroid was only able to claim for a loss of profit on the number of additional cameras that they could have produced in their existing facilities, if Kodak had not entered the market while the patent was still in effect. New questions have been raised about the role of patents due to *patent trolls*, for example in the case of Rim vs. NTP a large settlement was received by a firm that owned a patent, but had no intention of offering product or services based on these patents [3].

This evolution in patent interpretation not only has implications for inventors and private laboratories, but also non-commercial institutions that patent technology, with no intention of producing products based on the technology they patent. For example, instead of a university or a federal laboratory licensing a patented technology to a third party, they may wait for the third party to make a profit and demand the payment they desire – as there is no longer a requirement to demonstrate a loss of profit to receive awards, the incentive to license technology is changed.

Thus the problem, if a patent gives too much protection the resulting monopoly transfers value to the holder at the expense of the product producer and users discouraging production and use of new products [4,5]. Conversely in the absence of protection,

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doi:10.1016/j.techfore.2011.08.017

innovation and invention are discouraged. Thus the policy makers' task is to identify the ideal balance to encourage innovation. Increasingly, there are concerns that the legal system is not working as intended [6,7] and is actually discouraging the innovation it intends to encourage [8–10].

Past studies suggest that the use of patents is limited outside of the pharmaceutical and chemical industries [11]. While more recent studies [9,10] suggest that other industries – such as semiconductors and automotive – utilize patents, it is clear that patents are used selectively by certain industries and not by others. This suggests that our current approach to patent regulation maybe overly appealing for a small number of industries and associated firms, while being inappropriate for innovation occurring in many other industries. A starting point for better understanding this balance is to determine under what circumstances patents are valuable. While the literature has identified an increasing number of reasons for patenting [10], the primary reason remains the protection of profitability of an invention through the right to exclude others from producing a product and collecting damages if the patent is infringed [10]. Consequently, we focus on determining the value of an invention, that is its current market value, to make it worthwhile protecting at the time of patenting.

2. Valuation of patents

By determining the value that a patent must have to be worthwhile, we gain insight into whether the patentable invention under consideration should be patented. Past techniques for valuing patents focused on a variety of different approaches, including: Rules of thumb – royalty rates based on gross revenue [12,13]; Cost Approach – based on the investment required to develop technology that could offer or replace the patented property [14,15]; Income Approach – the profit that is a result of the patent [14,15]; and Options approach [4,16,17]. We propose the use of a real options approach and add to the existing literature by offering a compound option as a more appropriate representation of how a patent functions. The analogy of a compound option as a patent is offered. Thus is followed by a sample calculation to assist in determining what intellectual property must be worth currently to warrant patent protection at the time of patenting.

The source of a patent's value is that it provides an option for the holder to sue in case of an identifiable breach of the patent. Given that the firm decides to exercise the option to sue, the firm then obtains another option to pursue collection of the payments associated with the awarded suit if the payments are worth more than the cost of collection. This two-step process – an option on an option makes the patent a two-step compound option on the present value of the cash flows associated with collecting the awards of an infringement suit. That is, the first option is to sue the patent infringer and the subsequent option is to pursue collection of awards from the infringer. Consequently, Geske's [18] compound option pricing model (1) has been applied to obtain insights into valuing patents (see Appendix A).

When a firm purchases a patent, the intent is to protect the cash flows associated with the potential markets protected by the patent. This is accomplished as the patent allows the holder to sue potential infringers of the patent, during the time that the patent is in effect. Suing infringers is the option purchased by the patent. There are other possibilities available to the firm, like charging a licensing fee to the infringer. Suing does not guarantee the firm that it will recover lost cash flows, because the firm has to win the suit and to collect the award from the infringer. If the firm wins the suit, there is the cost of collecting damages and the possibility that damages will be uncollectable. Thus the patent is an option to sue, which in turn is an option to collect cash flows associated to winning the legal suit. Hence, there are three decisions related to a patent: (1) Whether to patent intellectual property, (2) Whether to sue in case of infringement, and (3) Whether to attempt to collect lost cash flows if the patent holder wins the suit.

If the patent holder wins an infringement suit, it may not be worthwhile paying the fees associated with collecting the award. In other words, the option to sue must first be “in-the-money” in order to economically justify suing. And if the legal suit is won, the collection option must also be “in-the-money” in order to justify the associated expenditure. For example, if the infringing company is bankrupt or declares bankruptcy, an award is not worth collecting as the expected collection cash flows (damages) are less than the present value of the legal fees required in order to effectively collect.

The two-step compound option pricing model is useful as it describes and quantifies the essential features of a patent. Having demonstrated how a two-step compound option has the same properties as a patent, its operationalization is considered. As mentioned earlier in this paper, the collection of damages in cases of infringement is the primary reason given for seeking patent protection [10]. The compound option approach captures the value associated with the primary reason for patent protection, but does not assess the value associated with other benefits that a patent may offer. These other reasons include: formation of defensive Intellectual Property (IP) blockades [9,10,19,20,22,23], formation of offensive IP blockades [9,21,22], firm reputation [10,21,22], market extension [19–21,23], internal performance indicator [10,19–22], exchange potential [9,10,19–23], licensing potential [19–23], and in response to the practice of other firms [9,23]. In order to determine, whether an invention that is not worth patenting based on the primary reason for infringement protection is still worthwhile patenting an assessment should be made on the probable value of these additional benefits.

3. Data requirements for calculation of the patent value as a compound option

To calculate a two-step compound option pricing model one requires:

1. t: the current time (date)
2. S_t: “Stock price” at time t
3. σ: Volatility of the stock price return underlying the compound option