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ABSTRACT

The purpose of this research is to choose the patent risk management strategies, which is a critically important and challenging issue to the company. With the increasing ownerships of patent, the risk occurs frequently and sophistically. It might be difficult to carry on the appropriate countermeasures to organize the effective patent risk management for the company. In this paper, we study the alternative patent risk management strategies affecting on the company’s economic performance. Several impacts of the mainly investments, including the R&D investment, mitigation strategies, and the insurance premium, are measured by the net cash flow. We draw our data from the small-to-medium-sized enterprises in information industry in China. Specifically, a system dynamics simulation model is developed to analyzing the process. The results show that investing in R&D has a higher payoff compared with investing in the mitigation measurements. The insurances reduce the risk of the firms effectively in certain range. In addition, it is demonstrated the policy strengths is not that important as we thought. Our study suggests the importance for firms to account for these actions in overall patent risk management and suggest that the effect of the policy strengths could be ignored.

KEYWORDS

INTRODUCTION

Nowadays, incidents occur frequently and intensively, the amount of the money paid for the suits is increasing. On one side, patent portfolios are likely to drive the firm to create new innovations and gain benefits. On the other side, the impacts of patents infringement are considered a potential financial risk for a number of companies. Patent risk management is tasked with avoiding the risks induced from the process of patent using [1]. Enterprises may counter a wide variety of risks that are present with several strategies.
Each strategy entails different costs, effectiveness, and potential risks; many of these are difficult to quantify. The business value derived from patent may be difficult to estimate, although undeniable.

In the actual cases, academics tend to explore the intellectual property risks beginning with the patent risk [2]. The most researchers surveyed the patent risk-related strategies by examining the benefits or the costs of the strategies to the business community. One stream devotes to measuring the patent value using classic economic analysis or a Real options method [3-5]. A different stream examines the patent risk to take the related actions, using qualitative and quantitative methods [6, 7]. Other streams advocate for a combined approaches to addressing patent risk issues [8, 9].

System dynamics is based on the principles developed by Forrester [10] to study managerial and dynamic decisions using control principles. Hyzone et al. [11] develops a system dynamics simulation model for analyzing the effects of patent licensing costs. Given the range of factors involved in patent risk managing process and the complex dynamics among the factors, this study uses system dynamics to investigate how the strategies can be expected to impact the benefit or the risks of the enterprises.

This paper aims to develop a system dynamic model that allows IPR managers to examine the effects of alternative decisions on the organization’s IPR input. The formation of the model is firstly based on some key propositions developed from the analysis of the current literature on corporate patents risk management. The model is used to examine the implications of alternative strategies in a variety of scenarios. The proposed model was developed using the VENSIM software program.

SYSTEM DYNAMICS MODEL OF PATENT RISK MANAGEMENT

Model Structure of the Patent Risk Management

The model (figure 1) for patent risk management represents an integration of concepts covering three facets, involving the property of patent value, risk performance, and circumstance dynamics.

The module for Patent Value describes the impact of R&D investments on the cumulative level of intellectual capital. Circumstance Dynamics describes the characters of the environment, considering the market, technology, and policy backgrounds. The consequence of the legal risk contains patents invalid, issues resulting infringement, the reputation lost, etc. The economic risk changes the market share and the incomes of the firm. The patent risk management takes charge of the IPR investments and the measurement, including the R&D and patent management expenses.

The amount of income (cost) that a company receives (pays) due to contracts depends on the patent value in relevant technologies. Companies obtain their income from any of the product business. The profitability of the company is measured by accounting for the net present value (NPV).
Patent Risk Management Model

In this section, a model showing how patent risk management strategies could affect the economic performance of firm, is presented based on the propositions developed in the previous section. The model is depicted in Figure 2. It aims to assist in the understanding of academics and managers for the “what if” scenarios for patent risk management. The company’s profitability depends on the market position of the patent related product and the risk tolerance of the firm. It is hypothesized that only government policy affects the decision of firms to adopt strategies of patents risk response.
Major Equations

We take the R&D activity as an accelerator of the companies’ patent portfolio value. R&D investments \( i(t) \) increase the cumulative patent value of the company, denoted by \( V(t) \). The dynamics of the cumulative patent value \( V(t) \) for the company can be written as.

\[
\frac{dV(t)}{dt} = i(t) - \frac{V(t)}{\tau + \frac{1}{d}}
\]

(1)

Where the parameter \( \tau \) is the mean lifetime of a company’s patent and the parameter \( d \) is the discount rate of the technology, and thus the rate at which cumulative patent value becomes outdated.

The vulnerabilities in the patent articles’ attributes and treating process combined with the strength of the security procedures will determine the overall vulnerability. We define the IPR risk-tolerant capacity (IRC) of the firm at time \( t \) as

\[
IRC(t) = \frac{CT(t) \cdot IC(t)}{PCR(t)} \cdot ln_vu(t)
\]

(2)

Where \( CT \) the countermeasure is top limit, \( IC \) is the insurance coverage, \( PCR \) is the policy change rate, \( ln_vu(t) \) and is the normalization coefficient of the vulnerabilities at timer.

We describe the possible outcomes or incomes and respective payoffs of the company’s patent-related infringement litigation according to the researching result of Micaelian12]. We consider the initial value of the reputation as 50. The value increase 1 or 2 as regular, and decrease 2 when lose a lawsuit. Considering the financing constraints as the results of the financing support, we use the Whited & Wu [13] index as our measure for investors’ decisions.

SIMULATION RESULTS

Simulation of the model was conducted using VENSIM PLE. The unit time frame selected was a month, and the model was run over a period of 100 months, representing a patent management planning horizon. The base scenario was calibrated for a small enterprise, using a set of plausible values for the constructs. This involved an asset base of ¥5,000,000 patent value and the total vulnerabilities of 65. The results are appear in Figure 3. The patent value demonstrates an exponentially decreasing trend. As the patent technological value decrease, the market share of the company shrinks in proportion. The trend of the firm’s reputation cuts down first and then climbs up, instead of changing monotonically. Profits trigger the incentive to involving the patent issues.
Alternative Patent Risk Management Strategies Investment Scenarios

We evaluate the effects of different patent risk management actions from the total cost point, with the factors including the R&D investment, mitigation strategy cost, and the insurance premium. The trends of economic performance and the total legal cost are presented in Figure 4-6.

As the increasing of the R&D investment, the revenue and the legal expenses increase too. As the insurance premium increases, the total legal cost and the economic performance increase both. Mitigation strategy is primarily aimed at internal IPR ability checking; it is suggested that this is a greater threat than external threats.
The Effects of the Policy Changing Strengths on the Economic Performance

In the model, the intensities of patent protecting and punishment present the external facts influencing the management strategies. We calculated the resulting profits for different policy strength (Figure 7). At the tested patent policy strength (0.1 to 0.9), there turns from the growing number of the total legal cost yield reducing returns of the economic performance. The total compensation returns moderate increasing, correspondingly. The total income rises slightly when the strength turns to 0.7 and 0.9, which leads to the mildly augment of the economic performance.
DISCUSSION AND CONCLUSION

Our system dynamic simulation model can be extended in several ways. However, to the extent that qualitative conclusions are consistently supported by simulations with non-extreme parameters, these discontinuities need not be explicitly modeled. This seems to be the case in our model: even with non-extreme royalty rates, the product markets would become unprofitable with very low or very high cumulative royalty rates. Any aberrant behavior triggers a closer examination of the relevant constructs and may require recalibration and restructuring of the model.

In conclusion, our model appears valid for gaining instructive insights. In particular, it shows how company patent risk management takes effect through a complex dynamics with major nonlinearities. Furthermore, the parameters of the model can be estimated based on evidential data, although it may not be easy to produce reliable estimates on the relevant cost structures and patent portfolios.

In this paper, we have developed a system-dynamics model for evaluating the effects of firm’s patent risk related strategies. Several mainly investments are valued measured by the economic performance, including the R&D investment, mitigation strategies, and the insurance premium. As a major policy implication, our simulation results suggest that the R&D investments to the patent value led to a better payoff than other IPR investments, while the policy strengths are not as important as we thought. The model also indicates that investment in all areas of risk management is needed to effectively protect patent assets.

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REFERENCES