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Utilizing patent analysis to explore the cooperative competition relationship of the two LED companies: Nichia and Osram

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ABSTRACT

This study used patent analysis to explore the co-opetition behavior between the two light emitting diode (LED) manufactures, Nichia and Osram, from the two critical technological fields in the LED industry: LED components and phosphor. The results of patent analysis indicated that Nichia had advantages in the field of LED components, while Osram had advantages in the field of phosphor. Therefore, there existed cooperation opportunities for the two opponents in the LED industry, because their technological capabilities were partially complementary. Therefore, Nichia and Osram were willing to make a compromise to solve the patent litigations between them and further agreed to offer cross-licensing of patents for each other. Their strategic interaction was changed from full competition to co-opetition which is win–win for them. This study demonstrates that patent analysis is a useful tool for R&D management and technical analysis, and the results of this study can provide a valuable reference for managers in formulating patent portfolio.

1. Introduction

Light emitting diode (LED) industry is a high-tech industry and possesses two characteristics, technological development with high speed and intense market competition. Although LED was launched into the market at 1968, Nichia in Japan was the first company to possess the ability of mass production of white LED that is most practicable in 1996. Subsequently, other LED companies, e.g., Osram, Agilent, and GEL core, focus on the research and development of white LED. They also possess the ability of mass production of white LED after 2000. In the LED industry, the major LED manufactures, such as Nichia, Osram, Toyoda Gosei, Cree, Lumileds, etc., spend much resources on R&D [1]. The advantages of LED include greater energy efficiency, lower maintenance costs, longer lifetimes, broader design flexibility, and environmental friendliness [2]. Thus, LED can reduce overall energy usage in the U.S. by 10%, reduce global carbon emissions by tens of millions of tons per year [3].

White LED has high potential global market in the future, because its application is broad in the world. White LED can be generated from LEDs either by combining three individual monochromatic LEDs or by coating a blue LED with phosphorescent material [2]. Because combining three individual monochromatic LEDs is difficult to heat dissipation, coating a blue LED with phosphorescent material is a better solution for the generation of white LED. Nichia and Osram are both pioneers of the indium gallium nitride (InGaN) for white LED. The first commercially available white LED based on phosphors was produced by Nichia. Nichia used a blue light emitting InGaN and coated the chip with yellow fluorescent phosphor Y_3 Al5O12: Ce (YAG: Ce), while Osram used Tb3Al5O12: Ce (TAG: Ce) for white light production later [4]. Nichia and Osram contribute excellent technologies to the LED market. At present, white LED is extensively applied to backlight of cell phone, personal digital assistant, LED screen, etc. In order to occupy the white LED market, there existed cooperation opportunities for the opponents in the LED industry. For example, Nichia and Osram were willing to make a compromise to solve the patent litigations between them and further agreed to offer cross-licensing of patents for each other in 2002.

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Because LED companies need to develop high-tech, they focus on key technologies to apply patents in several major countries not only to secure the technological advantage of LED market but also to form the competition barriers of LED technologies. When the growth of the LED market is steadily high and the R&D competition of the LED related technologies is continuously intense, LED companies should pay more attention on patent analysis. Although a LED company can enhance technological capabilities and obtain competitive advantages via patent development, however, as it faces patent infringement lawsuit, it would spend much money and time on the patent infringement litigation. In addition, the LED company could not well concentrate on its business operation, R&D activities, and implementation of strategic plans such that it would lose its competitive capabilities and miss business opportunities indirectly. According to Antitrust Guidelines for the Licensing of Intellectual Property, the cross-licensing may provide mutual benefits by integrating complementary technologies, reducing transaction costs, clearing blocking positions, and avoiding costly infringement litigations. Therefore the cross-licensing is one of important strategic alternatives for LED companies if they face the threat of patent infringement lawsuit. The white LED area is a main field of patents, cross-licensing and infringement lawsuits in the LED industry [5]. After a long time of patent infringement lawsuits, Nichia and Osram signed a patent cross-licensing agreement in 2002 covering the rights of the LED chips and related packaging technology. In order to protect the intellectual property right (IPR) and to obtain the competitive advantage, there were many patent lawsuits among LED companies many years ago. However, Nichia and Osram, the two pioneers in LED industry, made a settlement of their patent lawsuits in June 2002 and agreed to offer cross-licensing of patents for each other in the technological fields of indium gallium nitride (InGaN) semiconductor and related packaging technology. Why did Nichia and Osram change their relationship from full competition to co-opetition? This study explores their co-opetition behaviors via patent analysis.

Although previous studies argued companies can use the patent information to evaluate companies' R&D capabilities are complementary or substitutive to select the targeted merger and acquisition candidates [6], they did not mention the co-opetition behavior such as the cross-licensing strategy. In addition, although some previous studies applied patent indicators to explore the co-opetition strategy and suggested that the co-opetition strategy should be one of the major alternatives [7], they did not discuss companies' R&D capabilities are complementary or substitutive. Based on the mention above, this study does not only use the patent analysis to explore the co-opetition behavior between Nichia and Osram based on their cross-licensing, but also analyze their R&D capabilities are complementary or substitutive.

Formulating the cross-licensing strategy needs to consider the viewpoints from both of the licensee and the licensor and to evaluate from the dynamic perspective, not the static one [8]. Patent data include complete R&D records which contain cross-sectional and longitudinal information so that it is appropriate for companies to use patent information to monitor the technological development of competitors and to select the proper cross-licensing strategy. U.S. is one of huge markets in the world, so most high-tech companies are willing to apply their most potential patents in U.S. in order to protect the technological advantages and to shape the entry barriers. Therefore, this study pays attention on U.S. Patent and Trademark Office (USPTO) database to undertake the patent analysis of Nichia and Osram to explore their co-opetition behaviors.

2. Patent analysis

Patents, one kind of firms' important intangible assets, cannot only provide competitive advantages, but also enable firms to generate revenue by selling the unique products from their R&D outputs [5,9]. The patent system is one of conventional commercial institutions and it is designed to encourage innovation. Inventors of patents obtain exclusive rights over the commercial exploitation of their patents for a specific period, but they should disclose their invention. Although one of the requisites of a patent is novelty, the importance of a patent is related to its usefulness and commercial value. As patent databases became more available in computer-readable form, an increasing number of researchers used patent databases not only to invent new products and technologies [10] but also to explore the relevant R&D managerial issues [11–16]. Widely available in the area of management, patent indicators not only represent the outcomes of inventions, but also display their commercial value. In addition, patent indicators cannot only measure firms' technological capabilities and competitive advantages [17], but also develop the patent map to discover new technology or business opportunities [18,19].

With respect to patent information, prior studies found out that patent information can provide more information than R&D information in financial statements [20–23]. Moreover, Trajtenberg argued that patent indicators can demonstrate the information of firms' R&D capabilities which were scarce in financial statements [24–26]. Prior researches pointed out that patent information can provide abundant information to complement financial data when evaluating corporate performance. Patent information can support technology management in five areas: support of R&D investment decisions, human resource management and knowledge management in R&D activities, effective protection of intellectual property right, identification and assessment of external technological sources, and value maximization of patent portfolio [12]. Effective patent protection is identified as one of important sources to obtain competitive advantages, because it provides two major functions: first, granted patents protect the assignees, at least for a period of time, from imitation; second, patent protection supports the internal use of technologies [27]. Patented technologies can be used to achieve important operational and strategic benefits and to obtain competitive advantages [27].

Patents contain important information for R&D management. The value of patent information can be attributed to several reasons: first, patent information is available even for companies that are not required to disclose R&D data; second, patent information can be discussed under several sub-fields (e.g. business units, products, technological fields, or inventors), and this enables companies to undertake more precise competitor analysis [28,29]. In addition, a large amount of technological information is contained in patents which are classified according to standardized schemes. Comparing to other information sources, patent