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Open Innovation and Changing IP Strategy in the Fourth Industrial Revolution

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Abstract: This paper provides firms with a framework on how to create an IP strategy in the context of open innovation and Industry 4.0. A systematic review of the literature was used to create the framework from existing studies relating to open innovation and intellectual property. Synthesis of these articles lead to the creation of a 5-part framework which starts with (1) recognizing IP as a valuable asset to the firm and conducting an internal IP audit; (2) Factors that can affect the firm's participation in innovation, (3) Methods of protecting IP in open innovation; (4) Utilizing the firm's IP portfolio and (5) strengthening the firm's IP portfolio through internal or external innovation sources.

Key Words: IP strategy; Open Innovation; Industry 4.0; Innovation Systems

1. INTRODUCTION

The Fourth Industrial Revolution—Industry 4.0—disrupts industries as it provides firms with new technologies that would positively impact pre-existing tools and equipment by enhancing use and connectivity through data. With this, for firms to succeed in Industry 4.0, firms must use data to provide insights into markets and be agile in learning and experimentation to gauge the interest and feedback of consumers for more successful ventures and innovations (Caylar, Noterdaeme, & Naik, 2016). Internal research and development may not be enough to provide the data and agility required by industry 4.0. Thus, companies may choose to source innovation externally through open innovation. Open innovation (OI) is a way for companies to create and capture value from innovation externally by acquiring from others and allowing others to use the firm's products to create something new (Gorbatyuk, Van Overwalle, & Van Zimmeren, 2016). As industry 4.0 is powered by data and intertwined value chain networks, firms can acquire knowledge from different sources and combine this with their knowledge and expertise. External sources are beneficial to firms as information and capabilities are widely available, so individuals and external firms can create and innovate themselves. Thus, these external sources may have ideas and innovations that could create new or better products for firms without having to go through lengthy and costly research and development phases. These sources can be customers in virtual communities that provide feedback and recommendations, or it could be other firms that can create innovation through a joint venture or have pre-existing technologies that can be used (Hippel, 2010). Moreover, firm profits and benefits to society (social welfare) can increase when firms move towards open innovation (Gambardella, Raasch & Von Hippel, 2017). External sources benefit alongside the principal firm with increased profits and knowledge for both while users are provided better products that they are more willing to pay higher for.

Before firms can reap the benefits of OI, firms must consider intellectual property. Intellectual property rights (IPRs) gives IP rights owners the exclusive right to commercially exploit their creation and prevent unauthorized use. IP rights are commonly seen as a tool for firms to defend their products and asserting their position by filing infringement cases against those that try to imitate or use their protected goods (sword and shield approach). However, the sword and shield approach to IP rights is not effective when partnered with OI as it limits the flow of innovation and knowledge between firms and external sources. Firms who

protect their products and assert their right to sue excessively may deter external sources from participating in OI with the firm as such strategies have the potential to limit and halt any benefit that could have come from collaboration.

On the other hand, OI has been criticized for risking IP and trade secrets of firms due to IP ownership, contractual issues and open access that OI provides to external actors. With this, there is a need for firms to see IP not just as a tool but as an asset that creates leverage and freedom of action that provides firms choices on how to use their IP rights to effectively innovate, use OI and succeed in Industry 4.0 (Dubiansky, 2006). Thus, firms must create a sound IP strategy that lays down the foundation of how to use their IP rights as an asset but also acknowledges and mitigates the risks that OI poses on intellectual property.

One of the top firms utilizing OI is Huawei Technologies Co. Ltd. Huawei collaborated with various industry members from equipment providers to handset manufacturers to mobile service operators to make Long Term Evolution - Machine to Machine (LTE-M) technology a possibility and to ensure that equipment and capabilities would be ready for 5g mobile telecommunications. Huawei was able to identify capable firms with shared interests and established a system to ensure cohesiveness and collaboration among different partners and projects. Huawei also devised a system that would limit and resolve conflicts and disagreements through contracts and discussions between all partners. With this, Huawei was able to utilize OI to create new technology that would benefit Huawei, external firms and users (Bagherzadeh et al., 2017).

2. METHODOLOGY

This paper utilized a systematic review of the literature approach to answering the research question of how to create an IP strategy that would merge OI and IP protection. The databases used for this research are Elsevier Scopus, Google Scholar and Emerald Insight. The keywords used were "open innovation," "intellectual property," and "strategy." Synonyms of these keywords, such as "collaborative innovation," and "intangible assets" were also considered. Moreover, the articles were subject to inclusion and exclusion criteria. Only official academic publications focusing on OI that consider intellectual property, whether using qualitative or quantitative methods were included. For exclusion, all papers published outside the time range of 2012-2018 were not considered.

3. RESULTS

Synthesizing the results of the articles included in the review has led to the creation of a framework for firms in deciding their IP strategy in open innovation.

1. Recognize IP as an asset

Firms must evaluate their current line-up of protected products and determine how each connects to the firm's core capabilities and objectives by conducting an IP audit. An IP audit enables the firm to take into account all available IP assets along with assets that have potential IP. IP audits are done based on a firm-defined purpose, either the firm is conducting a general-purpose audit or a specific-purpose audit. General-purpose audits are commonly done when firms have just been established or experiencing structural change. While specific-purpose audits occur for a specific event such as a licensing deal, general-purpose audit looks at all IP assets while a specific-purpose audit only looks at event-related IP assets. Once a purpose has been defined, the IP audit continues by (1) identifying and accounting for IP assets; (2) determining the action needed to create and maintain IP assets; and (3) determining the status and ownership of IP assets (Gargate, Siddiquee & Wungkar, 2018).

This process aids firms to prioritize IP that is essential, those that are the foundations of the firm's present and future products and core capabilities and must be completely protected, and IP that can be open to others (Baldwin, Carliss & Henkel, 2012). This provides a clear context to base IP strategy decisions on as misclassification can lead to loss of competitive advantage due to a loss of capabilities or a loss of potential growth due to the restriction of non-essential IP that could have led to more value. In acknowledging IP as an asset, firms need IP departments to look over their IP strategy and serve as an intermediary between teams and high-level executives. This is to align intellectual property strategy with the corporate strategy while

still being flexible to take into account specific-project goals on a case-by-case basis (Bican, Guderian and Ringbeck, 2017). IP audits and creation of IP departments pose a challenge to some firms due to the lack of skilled workers who can identify and understand IP assets enough to create a sound strategy. Moreover, firms face the challenge of having to involve different departments to develop a comprehensive assessment of IP assets based on varying viewpoints.

(2) Factors that affect openness to innovation

Firms who have unclear or ineffective business models are less likely to capture value from innovation as there is no clear goal for which open innovation strategies and IP strategies can be utilized. IP strategies are affected by business models as the firm's business model, and objectives determine the essential and non-essential IP of the firm and how the firm aims to utilize these assets. The intensity of competition may also affect innovation as an increase in competition may result in either an increase in innovation, when firms are closer in capabilities to each other and decrease in innovation when firms have significant discrepancies in capabilities with smaller firms unable to keep up (Li and Nguyen, 2017). Moreover, firms who are confident in the protection and management of their IP are more likely to engage in open innovation as risks of IP appropriation are lower (Drechsler and Natter, 2012).

(3) Protecting IP in Open Innovation

Intellectual property can both enable or disable open innovation. The nature of intellectual property can lead to disabling open innovation as IP gives the owner the right to commercialize innovation and disable others from using this innovation exclusively. On the other hand, IP can enable open innovation by creating property rights that sets clear boundaries for a knowledge market that fosters innovation through commercialization (Bican, Guderian and Ringbeck, 2017).

It is essential to protect IP in open innovation as it can result in IP leakage or IP holdup. IP leakage occurs when external actors, who are not authorized to learn a firm's IP such as competitors, gain knowledge of it. IP holdup refers to a situation when the external IP owner tries to get a more considerable license or acquisition fee once the firm has already invested in the external innovation (either financially or by assimilating into the firm's products). In sharing IP, firms can use the modular intellectual property approach to have better control over shared IP. The modular approach separates innovations into modules that can be exclusively controlled by the firm and modules that can be shared to others (Henkel, Baldwin and Shih, 2013). For example, Amazon allows external developers to develop features for Alexa, its patented smart speaker software, through the Alexa Skills Kit. With this, Amazon has separated Alexa into modules; wherein one module contains the core capabilities and code of Alexa that is protected by Amazon IP while another module is open to developers to build on this IP and create external innovation through features. IP modularity can decrease the effect of IP holdups and leakages as it will not affect the entire system or product as only one module will be disrupted.

IP modularity is not always the most effective way to protect IP and increase value in open innovation. Combining separate IP into a single module by integrating components may be more beneficial when there are components which have weak IP protection, that is valuable income or differentiating sources, and some which have strong IP protection. Combining these components into one module then extends the strong IP protection of some components to the other ones. For example, Hewlett-Packard (HP) integrated printer ink cartridges with the printer itself through proprietary cartridges that were protected by the printer's IP protection and reduced the chance of competing suppliers of ink cartridges for HP printers. This arrangement ensured that HP could continue to profit from the lucrative printer ink cartridge business.

Another way to protect IP is to enter contractual relationships. Contracts provide contingencies, in case of breach of agreements, allocation of rights and responsibilities and overall creates clear guidelines that decrease the chance of miscommunication and protects trade secrets and IP. Contracts and non-disclosure agreements can only minimize risks from collaborations up to how much is covered by these agreements and the good relations between firms involved (Bican, Guderian and

Ringbeck, 2017). In the early phases of collaboration, such as idea generation, non-disclosure agreements are the most effective as it protects whatever the firm has already shared with the collaborating partner. Once there is a clear goal and concept to follow, contract negotiations may begin to ensure proper IP allocation and protection. When the development has started, and there is a more tangible product, formal IP strategy may come into play based on the nature of the output. These mechanisms are needed to mitigate risks of IP leakage and opportunistic behavior of partners as clear guidelines and penalties, in case of breach of contract, have already been set and agreed upon (Manzini and Lazzarotti, 2015).

(4) Utilizing IP portfolio

Once, the firm's IP portfolio has been thoroughly evaluated, each IP is subject to choices of utilization. IP can either be excluded from others or be open to others through licensing or the open source approach (inclusion strategy). Inclusion strategy is considered a management exploitation strategy as the firm uses existing IP to achieve economies of scale by allowing others to build on the firm's IP to create new knowledge (Cammarano, Caputo, Lamberti and Michelino, 2017).

Licensing IP would depend on the nature and environment of the industry; a general rule would be not to license any IP that would result in the degradation of value or profit of the firm. For example, Disney has given licenses to toy manufacturers to use the likeness of their characters, this not only provides more reach for Disney but also does not affect how they will utilize their IP rights over these characters and benefits from such.

Licensing of one's IP is most beneficial when the firm has innovations that are difficult to imitate due to factors such as adequate IP protection or technological complexity. The firm also has higher bargaining power when it comes to licensing fees due to the exclusivity of its invention (Holgersson, 2012). The open-source approach can also be taken, wherein protected IP has been distributed for free under specific terms. Open sourcing enables users to customize their experience, which can lead to higher customer satisfaction and increased innovation from external sources (Hanson, Heron and Ricketts, 2013). Firms must be careful in using this approach, as this is the riskiest in terms of IP leakage. With this, firms must ensure that this matches their business model and corporate goals, as well as provide clear separation of IP modules to protect the core product.

(5) Strengthening IP portfolio

The firm's IP portfolio can be strengthened through acquiring external innovation or making innovation internally. Making innovation internally utilizes the firm's own research and development team to create innovation.

Generally, firms will choose to make innovation when organizational resources are high (which includes knowledge and financial resources), and the firm can efficiently make innovation internally (Cruz-Cázares, Bayona-Saez and Garcia-Marco, 2013). However, internal innovation creation can be challenging to maintain, as it is difficult to build on existing technologies that have already been explored by the firm (Cammarano, Caputo, Lamberti, Michelino, 2017).

For acquiring external innovation, it is crucial to realize the absorptive capacity of the firm. Absorptive capacity refers to the ability of the firm to use external innovation, transform it and apply it to the firm's products to create more value (Xie, Wang and Zeng, 2018; Hagedoorn and Ridder, 2012). In assessing the company's choices of what external innovation approach to use, it is imperative to determine how each selection of innovation can be absorbed by the firm to effectively assimilate the external innovation, gain knowledge from the unique properties and use this new learning to the firm's advantage. Absorptive capacity can be measured by knowledge ambiguity, the more ambiguous or confusing to understand an external innovation is to the firm then the more unlikely the acquisition will directly or indirectly aid the firm's innovation (Hagedoorn and Ridder, 2012). External innovation can also help firms expand their knowledge diversification to complementary products that can increase the value of core products (Chuang, Chang and Lin, 2015). With this, firms can focus on core product development while still learning new knowledge.

External innovation can also come from R&D collaboration. This type of collaboration is most effective when it is done between firms who belong to the same or complementary industries wherein knowledge is distributed among firms in the industry. R&D collaboration can result in high innovation as partner firms who have different but complementary knowledge could lead to the creation of a higher value product. Firms may also purchase or license external innovation. This is the best option for firms which needs to quickly use an already-existing technology or firms who do not have enough capabilities to innovate and create new technologies. Firms who depend too much on external innovation of this kind may experience a decrease in capabilities in the long run. (Cammarano, Caputo, Lamberti, Michelino, 2017).

4. CONCLUSIONS

Open innovation is one of the strategies that firms can utilize to commercialize IP assets, garner knowledge and create innovation. The results of open innovation could lead to an increase in competitive advantage and differentiation for the firm, which is essential in succeeding in Industry 4.0. However, OI requires careful planning before it can be executed. Intellectual property strategy is a crucial step in open innovation as it can make or break the success of the company's OI approach. This paper has compiled and synthesized various articles to create a basic framework. It is limited as to the limited number of articles that extensively discusses intellectual property concerns in open innovation. Synthesis has resulted in a basic framework for IP strategy based on a systematic literature review of related papers.

To create a sound IP strategy plan, the firm must recognize IP as an asset and conduct an internal IP audit to identify essential and non-essential IP. With this, the firm must determine its business model and corporate strategy to ensure that the open innovation approach is in-line with the firm's long-term goals. Consequently, firms must take precaution to safeguard IP in OI to protect the firm's interests and rights. Firms can engage in contracts, non-disclosure agreements or file for IP protection depending on the stage of collaboration to ensure that IP rights are protected and adequately allocated among parties. With this, firms can then utilize existing IP through licensing or open source options and strengthen the IP portfolio by acquiring more IP through a variety of ways such as acquisition, internal development or collaboration with external sources. The importance of IP is underscored in each step of the framework as IP creates the basis for firms to commercialize their creations and enables firms to participate in a knowledge market to engage external sources of innovation.

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