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## Effects of Japanese Firms Conceptual Model on Open Innovation and Performance

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### **Abstract:**

*The objective of this paper is to develop a conceptual model for open innovation practice in Japanese firms, based on models and frameworks from the literature. The study intends to present a model on open innovation at firm level analysis in performance, in which interactive process considers differed in terms of (1) research and development (R&D) strategies or activities; (2) the degree of new product's newness to the firm. The model attempts to reveal research gaps on the relationship between open innovation and firm performance in Japan, and might be the basis for comparative research. Recently, there has been increased research activities on open innovation with specific emphasis on large firms, mainly from US, Europe and UK, while Japan is lagging behind. We found the main models on open innovation were analyzed in-depth with the extent of open innovation adoption and the effect of open innovation activities. And have mostly been limited to theoretical considerations and case studies. Yet, there is no comprehensive conceptual and detailed analyzes about how open innovation practice in Japanese firms.*

**Keywords:** Conceptual model, open innovation, Japanese firms, R&D, Firm performance

### **1. Introduction**

Over the decade years, open innovation has received increasingly attention in scientific research (Huizingh,2011), as evidenced by its relevance to practice (Bughin, 2012; Chesbrough, 2012). As open innovation became popularized model for the management of innovation, the scientific community too started investigating the concept, first theoretically and classifies different dimensions of openness (Chesbrough, 2003a, b; Gassmann & Enkel, 2004; Helfat, 2006; Laursen & Salter, 2006; Chesbrough, 2007). Until recent time, studies on open innovation had mainly focused on large firms (van de Vrande *et al.*,2009a; Bianchi *et al.*, 2010). Due to the emphasis on managing knowledge flows of open innovation, existing studies tend to focus on the research and development (R&D) activities of firms. Quite a few large firms officially emphasize the importance of open innovation that reduce R&D expenses, expand innovation output and open up new markets. For example, on Procter & Gamble(P&G), adopted a policy of 'Connect & Develop' in order to innovate faster and at a lower cost than competitors (Bayus, 2013; Reeves & Deimler, 2011) and improve the attitude for initiatives that came from outside the own department (Dodgson *et al.*, 2006; Huston & Sakkab, 2006). Clearly, open innovation paradigms are often compared to traditional closed innovation approaches in which firms make all of their own choices and rely on their internal R&D resources when creating new products (Almirall & Casadesus-Masanell, 2010).

Past relevant literature offers that open innovation is being adopted in many countries including the UK (Laursen & Salter, 2006) and Korea (Lee *et al.*, 2010). Moreover, Chesbrough and Brunswicker (2013) found a significant increase in open innovation adoption based on the survey of large firms in the EU and the US.

Although the existing literatures have attested to the growing academic interest in open innovation and provide large-scale evidence regarding open innovation adoption, they are usually less based on purposively managed knowledge flows across organizational boundaries (Chesbrough & Bogers, 2014). Additionally, the analysis of determinants at a project level (Lichtenthaler, 2011; Barge-Gil, 2010) could help to link open innovation adoption behaviors with specific organizational processes and decision makers. However, the limited existing literatures provide few conceptual and detailed analyzes about open innovation of Japanese firms, and qualitative or quantitative-oriented studies have not been solely conducted, as Chesbrough (2014) suggested that in the area of open innovation, more region and nation should be explored in future research. Thus, it cannot be said that academic researchers or practitioners understood how Japanese firms carry out open innovation thoroughly, which means a significant gap is still available.

For the purpose of this study we address this research gap and to develop a conceptual model that how the implementation of open innovation instruments affects performance. In particular, we contributed to illuminate the importance of factors such as R&D and the

degree of new product's newness, which effect on the implementation of open innovation. Meanwhile, we considered the implementation of open innovation affected by different R&D strategies or activities (Bogers & Lhuillery, 2011). Moreover, this study filled the gap that under open innovation approaches, whether performance and R&D strategies or activities changes are conditioned by the degree of new product's newness.

The remainder of this paper contains three sections. We first introduce the background of research. In section 2, we develop hypotheses and conceptual model which are based on the results of literature review. In section 3, we conclude and present the paper avenues with implications and future research.

## 2. Theoretical Background and Hypotheses

### 2.1. Inbound Open Innovation Implementation and Performance

Open innovation is a complex multi-dimensional phenomenon that compels us to use different perspectives in order to better understand it (Vanhaverbeke & Cloodt, 2014). Chesbrough and Bogers (2014) further clarified and developed the conceptualization of open innovation, which defined it as a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model.

Since open innovation can be thought of as a two-dimensional construct, inbound versus outbound innovation (Gassman & Enkel, 2004; van de Vrande *et al.*, 2009; Lichtenthaler, 2009; Dahlander & Gann, 2010; West & Bogers, 2010). Many empirical evidences showed that inbound open innovation is critical to a variety of positive outcomes, and can be advantageous for firms' efforts to introduce process and product (Chesbrough, 2003a; Laursen & Salter, 2006; Dahlander & Gann, 2010; West & Bogers, 2014). According to Vega-Jurado *et al.*, (2009) examined 1,329 Spanish manufacturing firms in 2004, they indicated that external knowledge acquisition can improve firms' innovative performance. Similarly, Sisodiya *et al.*, (2013) suggested that firm should enhance the effects of inbound open innovation on firm performance to improve relational capability. Meanwhile, Wang *et al.*, (2015) use an ordinary least squares (OLS) regression model for the examined the mediating effects of inbound open innovation on new product performance. Moreover, Ahn *et al.*, (2015) based on survey data from 306 Korean innovative SMEs, have investigated both broad and intensive open innovation adoption can positively contribute to the enhancement of firm performance.

So far, it follows that inbound open innovation used significantly more frequent than outbound ones. Hence, this paper we propose a model with focus on 'inbound' as the implementation of open innovation in Japanese firms.

Hamaoka (2008) hypothesized on determiners of inbound open innovation performance in Japanese manufacturers, proposed a theoretical framework (see Figure 1.) and resulted in inbound open innovation is positive to the performance of open innovation. In order to understand open innovation, Hamaoka (2011) also tested it with questionnaire survey to Japanese manufactures, and compare the open innovation activities between Japanese and Korea firms. Additionally, Hamaoka (2012) revealed that performance of outbound open innovation is lower than that of inbound open innovation in Japanese firms, and performance of open innovation is determined by capability and internal system of firms.

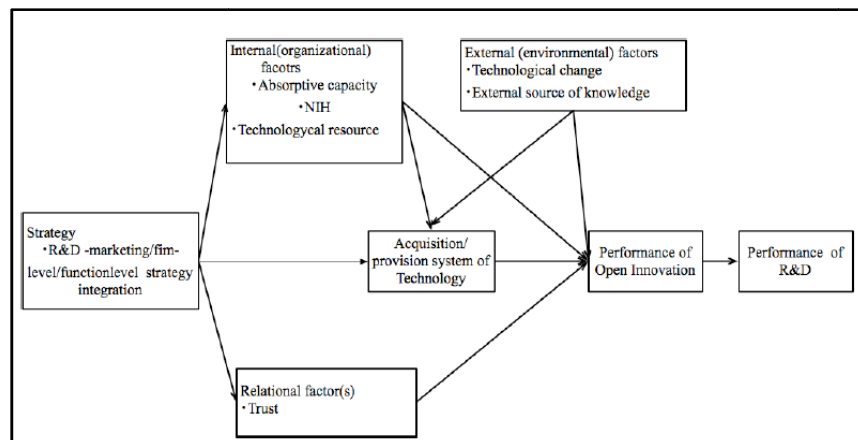


Figure 1: Antecedents and Consequences of open innovation in Hamaoka (2008)

Hung and Chou (2013) used data from 176 Taiwanese high tech manufacturing firms, explored how open innovation affects firm performance under environmental turbulence, which comprises technological turbulence and market turbulence, also investigated complex relationships between inbound and outbound with firm performance under different contextual conditions. Their research framework was shown in Figure2. They found that internal R&D investment, technological and market turbulence are positively moderates the effect of inbound open innovation on firm performance.

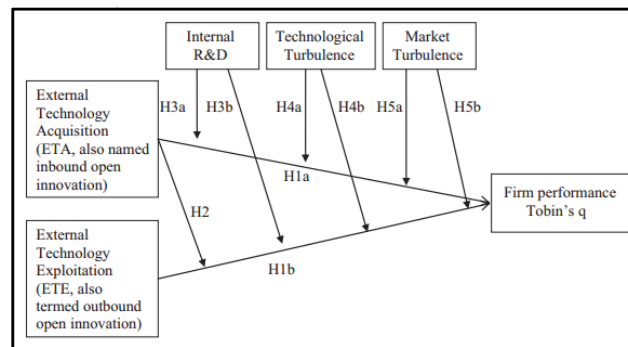


Figure 2: Model of open innovation in Hung and Chou (2013)

Despite both theoretical arguments and empirical research suggest that inbound open innovation is beneficial for the innovative performance. The performance of inbound open innovation is measured in complex ways. From all the previous considerations, there are mixed results on whether inbound innovation increases innovation performance or financial performance. Since new product performance is a multidimensional concept, it was measured as the degree to which a product financial performs well in the market relative to its major competitors in terms of sales, market share, ROI, profit, and overall success (Cooper 1988; Griffin & Page, 1993; Moorman, 1995; Kim *et al.*, 2012). Allen and Helms (2006) showed measures of firm performance generally include bottom-line, financial indicators as sales, profits, cash flow, ROE and growth. In other words, the measurement of new product performance or firm performance mainly refer to financial performance.

From the firm's perspective, the most critical performance issues typically including (1) desired product quality and design standards, (2) sales objectives in the marketplace, and (3) the time required to reach breakeven (Olson *et al.*, 1995).

Hence, in this study we comprised performance into two measures: R&D performance and financial performance. We choose R&D performance because at the firm level, R&D is closely related to product performance resulting from management of resources (Griffin & Page, 1996; Rouse & Boff, 1998), subsequent such as pertaining to promote the firm's competitiveness, customer satisfaction with product, or consequential whether the resulting product meets management's expectations concerning (Olson *et al.*, 1995). Meanwhile, models, frameworks and methodologies for measuring R&D performances have mostly focused at the firm level, with an economic or strategic focus (Secundo *et al.*, 2010).

Therefore, we hypothesized that in Japanese firms:

- H1: Inbound open innovation implementation is positively related to R&D performance.
- H2: Inbound open innovation implementation is positively related to firm performance.

### 2.2. Degree of product market, technological newness and inbound open innovation implementation

Laursen and Salter (2006) documented that product innovativeness enhanced firms to engage in inbound activities. Hung and Chou (2013) used data from 176 Taiwanese high tech manufacturing firms, confirmed the positive moderating effect of market and technological turbulence on the relationship between inbound open innovation and firm performance. Whereas, Morgan (2015) explicated that absorptive capacity helps mitigate the high degree of product newness, which negatively impacts NPD performance. Since, the relationship between degree of product market, technological newness and their implementation of inbound open innovation does not appear explicitly in previous open innovation research.

Therefore, we hypothesized that in Japanese firms:

- H3: Degree of product market and technological newness are positively related to inbound open innovation implementation.

### 2.3. Degree of product market, technological newness and performance

Regularly, highly innovative products are signified as having a high degree of newness (Kleinschmidt & Cooper's, 1991), notably as market and technological to the perspective of the firm (Garcia & Calantone, 2002). Studies (Olson *et al.*, 1995; Garcia & Calantone, 2002) suggested that successfully product innovativeness enhanced product performance. (Crepon, Duguet & Mairesse, 1998; Hult, Hurley & Knight, 2004; Thornhill, 2006) confirmed that technological innovativeness tends to be positively related to firm performance. Lapedra and Chiva (2006) who use newness of products and markets in their analysis of innovation outcomes. Thus, the newness of product innovation is regarded as a critical factor to promote the product innovation's performance. Furthermore, as we mentioned previously, from the firm's perspective, degree of product market, technological newness may affect R&D and financial performance.

Therefore, we hypothesized that:

- H4a: Degree of product market and technological newness are positively related to R&D performance.
- H4b: Degree of product market and technological newness are positively related to financial performance.

### 2.4. Degree of product market, technological newness and internal R&D management

(Kohli & Jaworski, 1990; Bacon *et al.*, 1994; Brockhoff, 2003; Callahan & Lasry, 2004) suggested that a higher degree of product newness, reduced innovation risks and more precision in resource spending. Loch and Christoph (2000) demonstrated that a new

market or new technology can be attacked by a task force led by R&D. Further, technological newness was related to a content of R&D in the products (Steenhuis & de Bruijn,2006).

Whereas growing interest explores consequences between R&D's level and product newness or firm performance (Olausson *et al.*, 2009; Stock & Reiferscheid, 2014), relatively little research of open innovation has examined the relationship between degree of product newness and internal R&D efforts. Therefore, we hypothesized that:

- H5a: Degree of product market and technological newness are positively related to internal R&D strategies.
- H5b: Degree of product market and technological newness are positively related to R&D activities.

### 2.5. Internal R&D management and inbound open innovation implementation

According to (Cohen & Levinthal,1990), their study proved that internal R&D activity plays a dual role, which facilitates its sourcing and leveraging of external knowledge to enhance R&D performance. In the other words, it does not only generate innovation, but also increases inbound open innovation. R&D activities strengthens the impact of inbound open innovation on innovation performance (Bianchi *et al.*, 2015). Firms with higher R&D capabilities are more receptive to absorb external resources (Zhou & Wu,2010). On the other hand, firms with lower R&D capabilities are less capable of converting externally acquired resources into products (Todorova & Durisin,2007; Sorescu *et al.*,2003). Laursen and Salter (2006) also focused on R&D capabilities as relevant for open innovation. In summary, firm with a high level of internal R&D management are more efficient in inbound open innovation implementation.

Though many studies also concerned the factors of R&D management as R&D structure, the role of R&D capacity. To address these issues empirically, this paper we focus on internal R&D activities and strategies as internal R&D management.

Therefore, we hypothesized that:

- H6a: Internal R&D strategies are positively related to inbound open innovation implementation.
- H6b: Internal R&D activities are positively related to inbound open innovation implementation.

### 2.6. Internal R&D management and performance

In the R&D marketing interface, different R&D projects require different actions being taken, which in turn affect firm performance (Ruekert & Walker, 1987). Traditionally, firms with internal R&D programs are more likely success in the new product development process (Veugelers & Cassiman's,1999).However, combination of internal and external R&D can increase firms' ability to engage in innovation and consequently enhance performance (Berchicci, 2013; Cassiman & Veugelers, 2006) as well. The literatures (Becker & Dietz, 2004; Schmiedeberg, 2008; Veugelers, 1997) have investigated that interaction between internal R&D activities and cooperation agreements are positively effect on firms' innovative performance. Becker and Dietz (2004) analyzed that in the German manufacturing industry, R&D collaboration complements internal resources and enhances product innovation implementation.

Considering previous studies argued a positive effect of R&D management on performance. Therefore, we hypothesized that:

- H7a: Internal R&D strategies are positively related to on R&D performance.
- H7b: Internal R&D activities are positively related to financial performance.

### 2.7. Proposed Conceptual Model

The model of this research shown in Figure 3 which is based on recent works in the literature on open innovation. In particular, authors contributed to illuminating the importance of factors such as R&D and the degree of new product's newness, which effect on the implementation of open innovation. Meanwhile, authors considered the implementation of open innovation affected by different R&D strategies or activities (Bogers & Lhuillery, 2011). Moreover, this study filled the gap that under open innovation approaches, whether performance and R&D strategies or activities changes are conditioned by the degree of new product's newness.

Our hypotheses showed in this section about the relationships between open innovation during R&D phases and NPD project success is also presented in Figure 3.

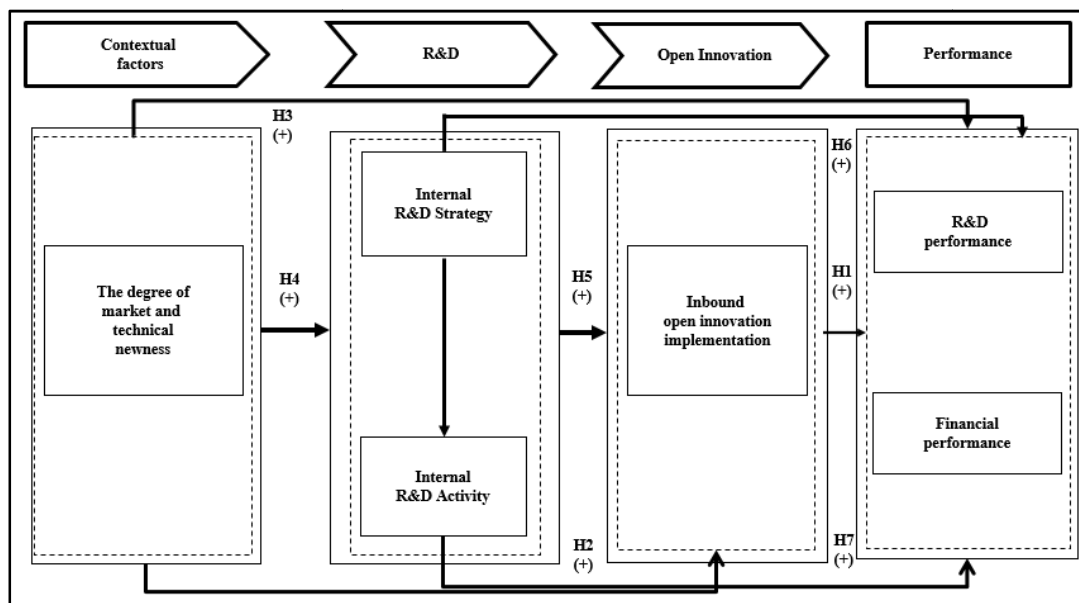


Figure 3: Conceptual model

### 3. Discussion

The purpose of this research-in-progress paper indicated the existing gaps as results of the extensive systematic literature review on open innovation, and contributed to extant literatures by proposing a conceptual model, theorized how inbound open innovation could enhance financial and R&D performance, which also emphasized on the influence of internal R&D strategies or activities and product market and technological newness.

The model draw together literature from diverse contexts and inbound open innovation practices are clearly explained. We argued that the proposed model can be used to analyze existing inbound open innovation of Japanese firms. Though our model is a first attempt, it is only a starting point on the path to concretely understanding the inbound open innovation implementation in Japanese firms. In examining how the components of the proposed conceptual model affect each other, already, work is underway to address these areas, we conducted our surveys in Japan. Future research we will analyze the collecting data to evaluate the hypotheses, presented in this study. Further, considering the time difference and the change in the performance of firms in Japan, future research will also address the differences and similarities in inbound open innovation applied in different periods in Japan.

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