



The Impact of Open Innovation in New Product Development Process

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ABSTRACT

Recently, one of the most debated topics in management literature is open innovation. However, there are still many questions about open innovation that are not answered. Effective management of innovation requires openness in multiple senses, including openness to ambiguity, openness for new ideas, and an open policy regarding the origin and destination of ideas for commercialization. Studies show that, firms following open innovation recognize the value of external inputs into the process of new product development and seek to utilize these inputs internally. Additionally, it is important to investigate several types of new product successes as open innovation may have influenced the success in different ways. Therefore, this study focuses on the four distinct stages of the new product process for measuring factors of new product development success: Planning, Development, Marketing and Commercialization. It is found that organizational structural dimensions play important role in the success of NPD process in open innovation environment. Subsequently, a conceptual framework is proposed.

Key words: NPD success, open innovation, organizational structure, product development.

INTRODUCTION

Open Innovation is defined as the purposive use of knowledge that exists in input and output of organizations for increasing the speed of internal innovation, and expanding of markets for external use of innovation (Chesbrough, 2003). Moreover, managements and scholars pay particular attention to open innovation as a new paradigm in recent years (Alguezaui & Filieri, 2010; Bahemia & Squire, 2010; HW Chesbrough & Appleyard, 2007; Chiaroni, Chiesa, & Frattini, 2011; Enkel, Gassmann, & Chesbrough, 2009). However, based on the increase of attention and interest on the concept among scholars and practitioners, there are still many areas where further investigation is needed (Chesbrough & Crowther, 2006). In today's competitive marketplace, product innovation is deeply appreciated as a key component of sustainable growth for most firms (McNally, Akdeniz, & Calantone, 2011).

On the other hand, product development has received a lot of attention within the strategy literature, and remains an important capability for a firm in improving its overall performance (Li & Atuahene-Gima, 2001; Vorhies & Morgan, 2005). New product development (NPD) is not always a successful process with some industries indicating failure rates to be 40% (Schmidt & Calantone, 2002) and others showing failure rates approaching 80% (Green, Barclay, & Ryans, 1995).

A problem, however, is that NPD is risky due to alarming failure rates, and the large amounts of venture capital required (Cooper, Edgett, & Kleinschmidt, 2004). Identifying factors contributing to new product success remains a vital managerial concern, not only because successful new products are a major source of improved financial and market performance but also because they may point to previously undiscovered business opportunities (McNally et al., 2011).

Hence, the purpose of this study is to evaluate the impact of open innovation on NPD success and to determine factors of organizational structure that affect this relation.

LITERATURE REVIEW

The competitive advantage of high technology firms is driven through innovation in new products. Hence, this is particularly important for high technology companies that are often subjected to limited market window opportunities and short product lifecycles. Furthermore, product is defined as anything that could respond to a request or need of a specific market and earn more profits (Kotler, 2010). Albeit, new opportunities are opened for companies by new products but the considerable risks of these new products should not be neglected. It is well-known in the literature that NPD, in general, is a highly challenging endeavor and is therefore, a topic of high interest for managers.

NEW PRODUCT DEVELOPMENT SUCCESS

The successful development of new products continues to be a critical business activity as companies, both large and small, strive to maintain or acquire competitive advantage. Nevertheless, unfortunately it is still hard to have successful new product development (Ayers, Gordon, & Schoenbachler, 2011). As a matter of fact, some factors make new product development (NPD) high-risk and difficult: increasing cost of research and development (R&D); rapid and radical development of technology, short life cycles of products, drastic competition, and high failure rates of new products (Calantone, Harmancioglu, & Droge, 2010; Rindfleisch & Moorman, 2001; Song & Noh, 2006). Moreover, turbulent and hostile environments make NPD more important and difficult. In this regard, there is a rich stream of literature focusing on the determinants of new product success (Droge, Calantone, & Harmancioglu, 2008). The low success rate of launched products is a concern, given that "developing successful new products and services is the lifeblood of today's acknowledged industry leaders" (Dorval & Lauer, 2004). In investigating the reasons for the low success rates, studies concluded that failed product innovators did not fully understand customer needs, designed products that cannot be repeatedly manufactured, and launched products without regard to the realities of those who will use the product (Dougherty, 1992). The success of NPD in any firm can be contributed to many different factors, which will be reviewed in this topic. Even with a conservative approach, the list of the significant factors is very long. For example, in an in-depth analysis of 19 studies narrowed to NPD and R&D projects, Balachandra and Friar (1997) identified 72 significant success factors, suggesting that varying contexts cause a major influence (Balachandra & Friar, 1997). Therefore, the conclusion is that the NPD literature on success factors seems to agree that certain factors will enhance the chances of success. Thus, according to the literature, new product development success is reviewed at the project level and firm level. Here, selected models and typical research will be revealed and discussed.

Cooper and Kleinschmidt (1995) developed five broad categories as success factors of NPD at the project level; each

of the categories are: (1) NPD process; (2) organization; (3) culture; (4) role and commitment of senior management and (5) strategy (Cooper & Kleinschmidt, 1995). In addition, Cooper and Kleinschmidt (2007) supported nine factors that distinguished the better performing businesses in which the first four factors are very strong way (Cooper, Edgett, & Kleinschmidt, 2004). These factors are: a high-quality new product process, a defined new product strategy for the business unit, adequate resources of people and money, R&D spending for new product development, high-quality project teams of new product, senior management committed to and involved in new products, climate and culture of innovation, the use of cross-functional project teams, and senior management accountability for new product results. According to literature, scholars have focused on the new product process as the key to a more successful new product programmer (Booz, Allen, & Hamilton, 1982; Cooper, 1983; Cooper & Kleinschmidt, 2007; Hopkins, 1980). Cooper and Kleinschmidt (1995) stated four points of view that have a favorable effect on new product financial success: (1) obvious definition of the product before development (2) high-quality preparatory work on the project (3) clear orientation of the NPD process to market demands, principally in the form of market research activity and observation of the competition; (4) the existence of a high-quality NPD process (Cooper & Kleinschmidt, 1995). Fundamentally, the results show that evaluation and selection of new ideas by exporters during the process is a vital function (Gerhard, Brem, & Voigt, 2008); development (Song & Parry, 1994) and market introduction (Ernst, 2002) have a positive effect on the success of new products (De Brentani, 1989; Hultink, Griffin, Hart, & Robben, 1997). In addition, some researchers studied about the new product process and exhibited what happens in the stages from idea to commercialization which are the key to success (Booz et al., 1982). The results of studies showed that firms that have a disciplined, step-wise new product process are more successful than those firms that have had the process in place for a longer time (Cooper & Kleinschmidt, 1986). These literature shows that process of new product development has an important role in the success of NPD. Thus, what happens in the process of new product development? What occurs in the process stages of a novel product? The identification of the original stage in the NPD process can help firms to make NPD a success. Hence, Khalil (2000) introduced four distinct stages for new product development that involves: planning, development, marketing, and commercialization.

OPEN INNOVATION

Open innovation is an expression that was promoted by Henry Chesbrough in 2003; this concept is about user innovation, cumulative innovation, know-how trading, mass innovation, and distributed innovation (Sisodiya, 2009). Thus, open innovation is a paradigm where a firm can use an external idea as well as an internal idea. On the other hand, close innovation is a traditional paradigm of innovation. In closed innovation, the innovating firm generates its own ideas and then develops them (Chesbrough, 2003). Table 1 shows a list of characteristics for both paradigms of innovation.

Table 1: Characteristics of Open and Closed Innovation (Chesbrough, 2003)

Open Innovation	Close Innovation
To work with expertise inside and outside the company	To work with the best people inside the company
Both external and internal R&D create significant value for company	Finding, developing, marketing and following up with internal R&D
Finding and using of inside and outside sources (idea, knowledge, technology and IP) and ability for having a better business model than competitors	Finding and using of ability and sources inside the company for having more advantage than competitors

In this regard, one of the controversial topics in innovation management is open innovation. A search on open innovation in Google Scholar provides over two million hits; Henry Chesbrough's 2003 book has collected more than 1,800 citations in just seven years (Google Scholar, July 2010), and surprisingly, a wide range of disciplines, including economics, psychology, sociology, and even cultural anthropology (Von Krogh & Spaeth, 2007) have shown an interest in it (Huizingh, 2010). The reason why it is important to study open innovation is firstly because open innovation may provide an opportunity for efficient use of resources to improve firm's performance. Secondly, even though open innovation has attracted a number of researchers, it has not yet been empirically tested. So, not only is it important to find out whether open innovation can provide firms with a competitive advantage, but it is also important to explore the mechanisms which enable firms to be successful while pursuing open innovation. While some firms have benefited by adopting open innovation philosophies, research must be performed to examine the extent to which open innovation can provide firms with a competitive advantage. The useful role of innovation for users in the last 24 years has been proven by Von Hippel (1988). For example, many leading companies are using innovation to develop their new products. On the other hand, vertical integration in the innovation process in a company is replaced by a network of collaborators working on innovation projects through open innovation. Thus, open innovation points out the significance of communities in the innovation process. On the other hand, the open innovation approach is an opportunity to create innovative diffusion and flexible strategies to gain acceptance by the client and create the industry standard (West & Lakhani, 2008). As it can be seen, models of open innovation have highlighted the interactive character of the innovation process, suggesting that firms rely heavily on their interaction with lead users, suppliers, and with a range of institutions inside the innovation system (Von Hippel, 2005). Given these points, the value of open innovation is now widely recognized. Hence, in the following section, the relation of open innovation and new product development literature will be reviewed.

RELATION OF OPEN INNOVATION IN NPD

The innovation can be a new product, a new service or a novel technology. Management of innovation is the process of bringing monetary value to technological knowledge and

creativity, and in recent years a particular model of doing so has been popularized: open innovation (Van der Meer, 2007). Open innovation is not a clear-cut concept; it comes in many forms and tastes, which adds to the richness of the concept but hinders theory development (Huizingh, 2010). Moreover, open innovation identifies the new product development performance where the internal R&D function can provide NPD's need solely, or it needs external sources such as the knowledge of individuals, customers' ideas and technology (Chiaroni et al., 2011; Trott, 2008). In addition, firms open their innovation process by obtaining knowledge from external environments and using other companies for technology commercialization that help to achieve higher profitability than internally focused organizations (Lichtenthaler & Lichtenthaler, 2009). Several attempts have been suggested in open innovation models that openness could stimulate innovation by combining a large and different pool of external sources, leading to increased product diversity and better matching of products and consumer preference (Boudreau, 2006; Chesbrough, 2003; Von Hippel, 2005). Regardless of the framework used to describe new product development for goods and services, for a specific company, or a context, they all include several common elements:

- The generation of innovative new ideas is very difficult since the development of a successful idea requires input from several different sources, including customers, competitors, suppliers, employers, and other industries. Therefore, the idea development part of an NPD process is also known as the "fuzzy front end", as shown in Figure 1.

- The process of NPD involves multiple and sometimes overlapping steps. At various stages of a new product (goods or services) development, the company needs to evaluate whether the idea should be dropped or developed further during the next phase.

- Furthermore, the NPD process requires participation and input from multifunctional teams. It is necessary for members of the marketing, engineering, operations, research and development, and corporate departments to share ideas early and often. Active collaboration ensures that the most promising ideas, considering multiple points of view, will be incorporated in the NPD, thereby increasing the chances of success (Boyer & Verma, 2009).

Thereupon, the innovation process is divided into three phases: the Fuzzy Front End (FFE), the new product development (NPD) process and commercialization. These three phases are shown in Figure 1 (Koen et al., 2002).

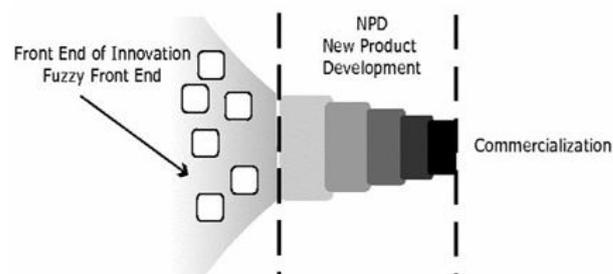


Figure 1. Three phases of innovation (Koen et al., 2002).

In this sense, the organizational setting of NPD activities has become increasingly important to both academics and managers (Lee & Souder, 2000). In addition, earlier studies indicated that organizational structure was significant as a determinant of NPD success but this is a theme that has not been adequately addressed by empirical research. In 2002, Howley showed that companies that are successful in NPD are likely to use outside advice in the NPD process, notably through retaining specialist consultancies (Howley, 2002). Hence, open innovation is a topic important in new product development research and practice.

Firms following open innovation recognize the value of external inputs to the process of new product development and seek to utilize these inputs internally. Sisodia (2009) has shown that it is possible to achieve a superior effect while following open innovation, but it is vital to explore the generalization of this success. Hence, open innovation can be studied in successful new product development through various perspectives. Besides, previous researches has shown that dimensions of organizational structure and context are key issues in the innovation process and play an important role in all stages of the innovation process (Sisodiya, 2009). Moreover, Lee and Souder (2000) stated that the new product development is a complex activity that is related to organizational structure and contextual factors; that its characteristics affect the NPD process (Lee & Souder, 2000). The following section describes the literature on organizational structure factors to provide a view of these subjects and how these factors aid open innovation as a moderating factor in the NPD success.

ORGANIZATION STRUCTURE

Organization structure provides a way for the organization to coordinate its activities and establish and pursue common goals despite diversity among individual members (Brockman & Morgan, 2003). In addition, organizational structure is the way responsibility and power are allocated, and work procedures are carried out among organization's members (Dewar & Werbel, 1979; Germain & Gitterman, 1996; Gerwin & Kolodny, 1992; McClain, Pichel, & Walton, 1985; Ruekert, Walker Jr, & Roering, 1985). Moreover, Daft (2001) provides a list of structural dimension that includes formalization, specialization, and standardization, hierarchy of authority, complexity, centralization, professionalism, and ratios of personnel. They create a basis for measuring and comparing organizations. Organizational structure has been characterized on a variety of measures that have been used to assess the structure's dimensions (Blackburn, 1982; Fredrickson, 1986). Markedly, three dimensions of structure; **centralization**, **formalization** and **complexity** have received more attention than any others (Aiken & Hage, 1971; Anderson, 1999; Daft, 2001; Daft & Lewin, 2008; Dewar & Werbel, 1979; Ettl, Bridges, & O'keefe, 1984; Kanter, 2003; Pierce & Delbecq, 1977; Simon, 1962; Thompson, 2003); each of these dimensions is also the dominant characteristic of a well-known structural type. These factors are discussed and also deemed in this study and are listed and described in Table 2.

Table 2: List of sub-dimensions for organizational structure factors

Dimension	Definitions	Literature
Dimension of organizational structure		
Formalization	The degree to which workers are provided with rules and procedures that deprive versus encourage creative, autonomous work and learning	Aiken and Hage (1971), Dewar and Werbel (1979), Ettl et al. (1984), Pierce and Delbecq (1977)
Centralization	The degree of authority to make a decision that refers to the hierarchical level.	Aiken and Hage (1971), Thompson (1961), Kanter (2003) Daft (2001)
Complexity	The degree of activities or sub systems in an organization that measures the 3 dimensions: vertical, horizontal and spatial	Daft (2008), Anderson (1999), Simon (1962)

Hence, according to Table 2, there are three selected variables; Formalization, Centralization, and Complexity, from the structure dimension as effective variables on the relation of open innovation and NPD success. Therefore, after the brief literature review of open innovation, NPD, organizational structure, the research framework and methodology will be described in the following section.

RESEARCH FRAMEWORK AND METHODOLOGY

According to the findings from the comprehensive review of existing reference in the literature of new product success and open innovation, a conceptual model has been designed as presented in Figure 3. Thus, in the proposed model, open innovation is expressed as an independent variable and the new product development success is managed as the dependent variable. Hence, this study is focused on the NPD process Stages (Planning, Developing, Marketing and commercialization). It is remarkable that for designing this model, a combination of models and theories that were mentioned in literature has been used. As shown, the research expects that open innovation impacts the success of NPD.

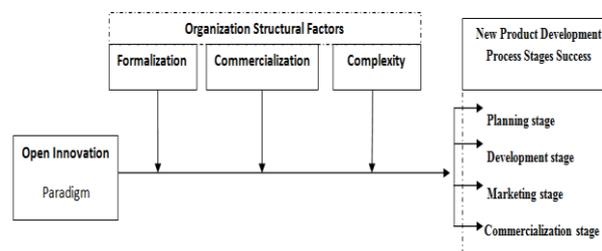


Figure 3: Conceptual Model

Importantly, the research argues that organization structure factors will moderate the relationship between open innovation and NPD success. In this relationship, based on the objectives, it deploys a quantitative method and using a questionnaire for data collection from companies in Technology Park of Malaysia (TPM) as the population. Moreover, sample size was selected through a stratified random technique which is a form of probability sampling.

CONCLUSION

Many studies have been conducted to identify new product success factors, but they did not pay any attention to the success of the four stages of the NPD process that affect the success of new product development. Moreover, little and most likely no previous study had tried to mention open innovation as the impact factor on new product success. Besides, there is a consensus among researchers that the NPD process is one of the important factors of NPD success. Thus, based on the systematic literature reviews, it is possible to design the organizational structure and contextual factors that complete the model. Hence, these factors may help firms to focus and use the open innovation paradigm; also, these factors affect the relation of NPD success and open innovation. This study is an attempt to provide a detailed

analysis on the impact of open innovation on the success of new product development and this impact is moderated with three factors of organization: Formalization, Centralization and, Complexity. In the meantime, the NPD process can be categorized subjectively into four main stages: planning, development, marketing, and commercialization. This synthesis model may be used for better understanding of open innovation that contributes in explaining the new product. It can also be used to develop a questionnaire in order to evaluate the impact of open innovation on new product development success. Since the proposed framework is highly conceptual, and the constructs have been based on several literatures, thus, the framework had to be validated empirically through an empirical method for example, by means of interview and survey questionnaire (Mixed method) from R&D managers of high-tech firms.

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