Synergy effects of innovation on firm performance*

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\textbf{A R T I C L E I N F O}

\textbf{Keywords:}
Synergy effects
Product innovation
Process innovation
Marketing innovation
Organizational innovation

\textbf{A B S T R A C T}

The synergy effects of product, process, marketing, and organizational innovation are examined with
consideration of the innovativeness levels and industrial categories. This study also investigates the effect of a firm's
strategic orientations, exploration and exploitation, on innovation activities. Results indicate that exploration
and exploitation orientations have positive impacts on product innovation and process innovation respectively.
Process innovation encourages both radical and incremental product innovation. In case of the moderating
effect of marketing and organizational innovation, there are some differences between high-tech and low-tech in-
dustry. For high-tech firms, the relationship between a new product and firm performance is increased with
the introduction of marketing innovation. In the case of low-tech firms, process innovation has direct and positive
impacts on a firm's performance with organizational innovation. The findings show that the synergy effects
of innovation exist and can be changed depending on the innovativeness levels and industrial categories.

\section{Introduction}

With the fast pace of technological change, the role of innovation on
a firm's survival has received a great deal of scholarly attention
(Rubera & Kirca, 2012; Rust, Ambler, Carpenter, Kumar, & Srivastava,
2004; Srinivasan, Pauwels, Silva-Risso, & Hansens, 2009; Tellis,
Prabhu, & Chandy, 2009) and managerial attention (Cheah, Lang,
Snowden, & Watts, 2014). However, there are warnings for firms not to
rely solely on new products for survival due to possible market failure
(Chiesa & Frattini, 2011; Simpson, Singaw, & Enz, 2006) and/or imita-
tion by competitors (Naranjo-Valencia, Jiménez-Jiménez, & Sanz-Valle,
2011). Therefore, much of the research has expanded its scope to include
different types of innovation such as process, organizational, and
marketing innovation and examined when their interrelationship is
effective in increasing firm performance. For example, Camisón and
Villar-López (2014) reveal that the adoption of organizational innovation
improves the firm's technical capabilities to develop new products and
processes that lead to their superior performance. Similarly, Piening and
Salge (2015) show that organizational capabilities that manage a wide range of innovation-related activities enable a firm to
increase the likelihood of process innovation activity and its profit
margins. In addition, the implementation of marketing innovation is proven to be effective in increasing firm performance (e.g., Gupta,
Malhotra, Czinkota, & Foroudi, 2016).

Given that the underlying assumption of the synergy effects is "more
is better" (Piening & Salge, 2015), understanding antecedents and consequences of the synergy effects can be the key for increasing
innovation capabilities, which are "the ability to continuously transform
knowledge and ideas into new products, processes and systems for the
benefit of the firm and its stakeholders" (Lawson & Samson, 2001).
Capabilities, complex bundles of skills and collective knowledge (Day,
1994), enable firms to effectively perform value-creating tasks in an
ever-changing environment (Eisenhardt & Martin, 2000; Kramnikov & Jayachandran, 2008; Teece, Pisano, & Shuen, 1997;
Yoo & Frankwick, 2012).

This study investigates the synergy effects among four different
types of innovation activities--product, process, marketing, and orga-
nizational innovation--on firm performance.

To start, we investigate the role of a firm's strategic orien-
tations--exploration and exploitation--as an antecedent of product
and process innovation activities. Understanding both strategic orien-
tations is important because they decide a firm's philosophy on in-
novation activities and innovation-based performance (Benner & Tushman,
2003; Moon, 2006; Song, Kim, & Kang, 2016; Yalcinkaya, Calantone, & Griffith, 2007). We then examine the synergy effects:
the effect of process innovation on product innovation, which should provide more resources for NPD through an increase in pro-
duction efficiency (Dehning, Richardson, & Zmud, 2007); the moder-
ating effect of marketing innovation between product innovation and
firm performance by assisting product commercialization activities

\textsuperscript{*} This study is partially supported by Korea University Business School Research Grant.

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http://dx.doi.org/10.1016/j.jbusres.2017.08.032
Received 21 November 2016; Received in revised form 23 August 2017; Accepted 25 August 2017
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innovation activities

2.1.1. The effect of exploration orientation on product and process innovation activities.

In this study, radical product innovation refers to “totally new products that involve considerable change in basic technologies and methods; revolutionary ideas that can create new market,” and incremental product innovation refers to “continuations of existing products, methods, or practices; generally minor improvements made with existing methods and technology” (Mohr, Sengupta, & Slater, 2009, 25p). Additionally, the industrial differences need to be considered in that the roles of innovation in firm performance (Rubera & Kirca, 2012) and the innovation patterns (Santamaria, Nieto, & Barge-Gil, 2009) vary between high-tech and low-tech firms. Thus, along with the innovativeness levels of product innovation, industrial differences in the synergy effects among different types of innovation activities are compared in this study.

The remainder of the paper is structured as follows. First, we provide the theoretical background and hypotheses development. Second, we introduce the methods and present the analysis results. Third, we discuss the findings leading to our conclusions and implications. Finally, limitations and future research directions are provided.

2. Theoretical background and hypotheses development

2.1. The antecedents of product and process innovation activities: Exploration and exploitation orientation

As the first step in investigating a firm’s innovation activities, we examine strategic orientations, which mirror a firm’s philosophy of how to conduct business through a deeply rooted set of values and beliefs that guide the firm’s attempt to obtain superior performance (Gatignon & Xuereb, 1997; Zhou, Yim, & Tse, 2005). This study considers the role of exploration orientation and exploitation orientation on innovation activities. In accordance with March (1991), exploration orientation is related to “the experimentation with new alternatives that have returns that are uncertain, distant, and often negative,” whereas exploitation orientation involves “the refinement and extension of existing competences, technologies, and paradigms.” This study investigates exploration and exploitation orientation as an antecedent to product and process innovation activities.

2.1.1. The effect of exploration orientation on product and process innovation activities

The pursuit of exploration orientation encourages a firm to invest its limited resources in new knowledge and capabilities in activities whose payoffs are uncertain but persist in the long-term (Uotila, Maula, Keil, & Zahra, 2009). Firms with such an orientation aim to enter new product market domains and meet future market demand (He & Wong, 2004). Similarly, to develop radical product innovation, a firm should employ new technologies to create a new market, and its possible risks and returns are higher than those that are obtained from incremental product innovation (Mohr et al., 2009). Introducing radical product innovation influences the market in the forms of market expansion, cannibalization, and destabilization (Aboulnasr, Narasimhan, Blair, & Chandy, 2008). Accordingly, seeking exploration orientation will increase the possibility of developing a radical product; in contrast, it will decrease the chance of developing an incremental product that assures relatively safe results in the short-term.

Moreover, the exploration orientation expands a firm’s search scope (March, 1991), and it thus brings new knowledge elements into the organization (Wu & Shanley, 2009). As the new knowledge from the expansion increases, the possibility of developing technological innovation also increases (Katila & Ahuja, 2002). Piening and Salge (2015) prove that the exposure to a unique and wide range of innovation related knowledge increases the effectiveness of process innovation activity. Therefore, the adherence of exploration orientation will cause firms to make changes in technologies that are related to process innovation activity such as production methods and logistics.

H1. A firm’s exploration orientation will have (a) positive impacts on radical product innovation activity and (b) negative impacts on incremental product innovation activity.

H2. A firm’s exploration orientation will have positive impacts on process innovation activity.

2.1.2. The effect of exploitation orientation on product and process innovation activities

Exploitation orientation, which focuses on measurable efficiency and variance reduction (Benner & Tushman, 2003), brings direct and immediate consequences to firms (March, 1991). Although the returns from radical product innovation are greater than those that are obtained from incremental product innovation (Srinivasan et al., 2009), such radical product innovation involves considerable changes in basic technologies and methods employed in mainstream industry (Mohr et al., 2009). However, incremental product innovation rarely deviates from the current product-market experience because there are only minor changes in technology (Atuahene-Gima, 2005). Thus, when a firm pursues exploitation orientation, the possibility of developing a radical product that involves higher risk and market uncertainty will decrease; in contrast, the chance of developing an incremental product that assures relatively safe results in the near term will increase.

In addition, to achieve greater efficiency and reliability, a firm with exploitation orientation invests resources into refining and extending existing knowledge, skills, and processes (Soosay & Hyland, 2008). Similarly, the underlying objective of process innovation is to acquire efficiency in the way in which a firm conducts its operations through repetition (Un & Asakawa, 2015). Therefore, as a firm becomes more exploitation-oriented, it will be more likely to introduce process innovation.

H3. A firm’s exploitation orientation will have (a) negative impacts on radical product innovation activity and (b) positive impacts on incremental product innovation activity.

H4. A firm’s exploitation orientation will have positive impacts on process innovation activity.

2.2. The effects of process innovation activity on product innovation activity

Utterback and Abernathy (1975)'s dynamic model, has long been utilized as a classical model to explain the evolution of product and process innovation. They argue that there are three evolutionary stages: the performance maximizing stage (product-oriented), the sales maximizing stage (process-oriented), and the cost minimizing stage (both product and process innovation become incremental with a decrease in the frequency). Although the model has contributed to establishing the interrelationship of product and process innovation, it is limited in that a chronological sequence of innovation ‘product then process’ is only considered and any simultaneous occurrence of radical and incremental product innovation at each stage is neglected (Durand, 1992; Martinez-Ros & Labeaga, 2009).
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