Technovation 30 (2010) 459–470

Contents lists available at ScienceDirect

Technovation

journal homepage: www.elsevier.com/locate/technovation

Exploring the impact of innovation strategy on R&D employees' job satisfaction: A mathematical model and empirical research

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ARTICLE INFO

Keywords:
Innovation strategy
Conflict
Organizational performance
Job satisfaction
Mathematical model
Empirical research

ABSTRACT

This study develops a mathematical model to examine the effect of innovation strategy on R&D employee's job satisfaction and to identify the optimal guidelines of innovation strategy, with conflict and organization performance being treated as the intermediary variables. The study further conducts an empirical survey to illustrate the contributions of this mathematical model. The results indicate that the product innovation has a greater influence on organizational performance, while the process innovation has a greater influence on conflict resolution among R&D employees. The mathematical and empirical results have provided an optimal guideline for determining the allocation of resources, which suggests that firms must focus on product innovation to gain the optimal R&D employee's job satisfaction. In addition, the types of innovation policies along with rivals' attitudes influence the advantages to be taken from a firm innovation strategy.

1. Introduction

In a highly competitive environment, innovation is critical to a firm obtaining a dominant position and gaining higher profits. Innovation is capable of revitalizing the organization in that it requires exploring and exploiting the firm's existing competencies (Hu and Hsu, 2008; Kaminski et al., 2008). Thus, it has become the principal method for adapting to a dynamic environment (Doloreux and Melancon, 2008; Hua and Wemmerlov, 2006; Roberts and Amit, 2003). Researchers in the fields of strategic management and organization theory have focused on the antecedents, consequences, and typologies of innovation. The issue of antecedents has been primarily concerned with the key factors or determinants leading to successful innovation (Nerkar and Roberts, 2004). As for the consequences of innovation, research has focused on addressing market acceptance, performance, and satisfaction (Hua and Wemmerlov, 2006). These studies have provided valuable contributions to the knowledge of innovation. Although numerous researchers have engaged in innovation-related studies (e.g., Hu and Hsu, 2008; Hua and Wemmerlov, 2006; Karniouchina et al., 2006; Nerkar and Roberts, 2004), they tended to investigate from the perspective of the firm. The perspective of the R&D employees, the critical element to the success of innovation, in studying the impact of innovation strategy on performance, has been less addressed.

Why do people engage in innovation activities? Both classical economics and transaction cost theory assume that people always act on the basis of their own interest (Williamson, 1991). That is, the R&D employee will engage in innovating only if those innovation activities can maximize his/her utility or satisfaction. Specifically, if the innovation activities are able to stimulate the R&D employee's job satisfaction, the employees will be inclined to devote themselves to innovation. Thus, the task of managers is to understand how to satisfy R&D employees to enhance innovation activities.

According to Bhoovaraghavan et al. (1996), product innovation and process innovation are the major facets of innovation strategy. Product innovation brings new products or services to meet market demands (Doloreux and Melancon, 2008), while process innovation is the operations technology that is new to the organization or changes the way products are made or delivered (Avermaete et al., 2003; Bhoovaraghavan et al., 1996). The impact of innovation strategy on R&D employees' job satisfaction should be considered from both the economic and non-economic psychosocial aspects (Geyskens et al., 1999). The non-economic psychosocial perspective examines the direct impact of conflict on affective response to the non-economic, such as whether the interactions with the exchange partner are fulfilling, gratifying, and easy (e.g., Lira et al., 2007; Rose et al., 2007). As for the economic perspective, Webb and Hogan (2002) suggested that the primary source of an employee's job satisfaction was

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0166-4972/$ - see front matter
doi:10.1016/j.technovation.2010.03.006

organizational performance. Therefore, the intermediary variables involving organizational performance and conflict are taken into account. Accordingly, the first purpose of this study is to evaluate the impact of product innovation and process innovation on organizational performance (i.e., economic aspect) and conflict (i.e., non-economic aspect), respectively. The second purpose is to evaluate the impact of organizational performance and conflict on R&D employees' job satisfaction. In sum, this article attempts to clarify the relationships between innovation strategy and R&D employees' job satisfaction. Conflict and organizational performance are both regarded as intermediary variables that may complicate but also help to identify the relationships between innovation strategy and an R&D employee's job satisfaction.

To accomplish these objectives, we developed a mathematical model to identify the optimal combination of product innovation and process innovation in order to gain optimal R&D employee job satisfaction under the given resources or R&D budget. Since constraints are usually required to derive the optimal solutions in the mathematical models, that may limit the explanation ability or application in real world settings, we conducted an empirical study with the participants from the R&D departments. Empirically testing the mathematical model would allow us to develop specific guidelines for determining the R&D budget allocation to maximize R&D employee's job satisfaction.

2. Literature review and hypotheses development

2.1. Innovation to organization performance

The relationships among innovation, competition, and the persistence of superior profits have been of great interest to researchers (e.g., Avermaete et al., 2003; Doloreux and Melancon, 2008; Sawers et al., 2008). Avermaete et al. (2003) claimed that product innovation, process innovation, organizational innovation, and market innovation were all domains of innovation. Organizational innovation and market innovation deal with the changes in the organizational structures and moves to exploit new territorial markets or new market segments within existing markets. Product innovation can be seen as the degree that any goods, service or idea is perceived by someone as new (Avermaete et al., 2003). Comparatively, process innovation is defined as any operations technology that is new to the organization that adopts it, or a change in the way products are made or delivered (Avermaete et al., 2003; Bhoovaraghavan et al., 1996). Most scholars have proposed that a firm's product innovation and process innovation have a positive effect on its performance and/or competitive position (e.g., Doloreux and Melancon, 2008; Hua and Wemmerlov, 2006; Kaminski et al., 2008; Mansury and Love, 2008; Nerkar and Roberts, 2004). Other studies further suggested that organizational performance is determined by product innovation and process innovation (e.g., Karniouchina et al., 2006; Roberts and Amit, 2003). Organizational performance must include both strategic performance and financial performance (Zou and Cavusgil, 2002). Strategic performance signifies a firm's market share and competitive position relative to major rivals, whereas financial performance involves the firm's efficiency in terms of its cost position, sales growth, and profitability in the market. Roberts and Amit (2003) proposed that sustaining high profitability might result when a firm repeatedly introduces valuable innovations. Avermaete et al. (2003) further proposed that product innovation and process innovation could be seen as technology-related innovations. The emphasis of this study is only placed on product innovation and process innovation, in that they are technology-related innovations that are more related to R&D employees' satisfaction. Previous studies examining the role of innovation in R&D management have only focused on product innovation and process innovation (e.g., Bhoovaraghavan et al., 1996; Ornaghi, 2006).

Although empirical evidence supports that product innovation and process innovation can be advantageous to a firm in improving its competitive position relative to its rivals, as well as its profitability in the market, the impacts of product innovation and process innovation on organizational performance are different. Nerkar and Roberts (2004) pointed out that the development of a firm depended on its ability to introduce new products over time and that the success of new products correlated with competitive advantage and financial performance. Customers should be comfortably raising their willingness and reserve price to purchase the product when they perceive higher attractiveness from new offers. Therefore, product innovation has a significantly positive effect on the seller's organizational performance, such as market share and profitability, in the market.

In other words, process innovation should enhance the efficiency of product and delivery, thus creating the advantage of reducing production cost. Although literature proposes that process innovation can also enhance organizational performance (e.g., Karniouchina et al., 2006; Roberts and Amit, 2003), the product innovation should be a primary way to enhance the firm's strategic performance and financial performance in the competitive environment, as discussed. Process innovation has greater impact on production cost but lower influence on firm's sales growth or market share than product innovation. Therefore, the following hypothesis is developed.

H1. *Product innovation has greater influence on organizational performance than does the impact of process innovation on organizational performance.*

Conflict: Conflict represents the level of tension, frustration, and disagreement in relationships when an employee perceives that another is engaged in behavior that is preventing or impeding him/her from achieving his/her goals (Geyskens et al., 1999). Academic researchers have discussed conflict from three major perspectives: relationship conflict, task conflict, and process conflict (e.g., Jehn and Mannix, 2001; Song et al., 2006). Relationship conflict refers to emotional conflict or affective conflict which represents an awareness of interpersonal incompatibilities (Jehn and Mannix, 2001). This type of conflict can be characterized by anger, annoyance, distrust, fear, frustration, tension, and other forms of negative effect (Jehn and Mannix, 2001). Task conflict is defined as the level of perceived or recognized disagreements among the employees or group members concerning the ideas and opinions related to the tasks being performed (Lira et al., 2007; Rose et al., 2007). Rose et al. (2007) proposed that task conflict focuses on disagreements over the means of achieving specific ends. This type of conflict consists of disagreements about task issues such as goals, money or property settlements, viewpoints, ideas, and opinions (Jehn and Mannix, 2001). Process conflict, which is similar to the construct of distributive conflict, pertains to the process rather than the content of tasks and is defined as an awareness of controversies over aspects of how task accomplishment will proceed (Jehn and Mannix, 2001). This type of conflict concerns the issues of duty, responsibility, and resource delegation, or the means to accomplish specific tasks (Jehn and Mannix, 2001). Most studies believe that moderate levels of task conflict are functional, whereas relationship conflict is dysfunctional (e.g., Jehn and Mannix, 2001; Song et al., 2006).

Several studies have proposed a positive association between innovation, including product innovation and process innovation,