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Does the use of knowledge integration mechanisms enhance product innovativeness?☆

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ABSTRACT

This study draws upon the perspectives of organizational learning and environmental contingency to investigate how the use of knowledge integration mechanisms affects product innovativeness under different levels of technological turbulence, market turbulence, and competitive intensity. Based on a sample of 102 high-tech product projects, hierarchical moderated regression analyses reveal that product innovativeness is related to knowledge integration mechanisms in a curvilinear manner under different levels of competitive intensity, market turbulence, and technological turbulence. Specifically, under a low level of competitive intensity, market turbulence and technological turbulence, the relationship between knowledge integration mechanisms and product innovativeness is an inverted U-shape. By contrast, under a high level of competitive intensity, market turbulence, and technological turbulence, product innovativeness is related to knowledge integration mechanisms in a U-shaped manner.

1. Introduction

Managing product innovation has become a significant area of focus in industrial marketing management (Hutt & Speh, 2010). In practice, product innovation usually requires the use of knowledge integration mechanisms in industrial markets (Mohr, Sengupta, & Slater, 2010; Zhang, Di Benedetto, & Hoenig, 2009). Thus, understanding the influence of knowledge integration mechanisms on product innovation outcomes is imperative. Extant studies have examined the effects of knowledge integration mechanisms on product innovation performance (e.g., De Luca & Atuahene-Gima, 2007; De Luca, Verona, & Vicari, 2010; Helfat & Raubitschek, 2000; Koch, 2011) and made contributions to the marketing and innovation literature. In essence, product innovation performance in these studies is described as a new product's market or financial performance. Past literature has suggested that product innovativeness, as market and financial performance, is a key feature of product innovation outcome (McNally, Cavusgil, & Calantone, 2010; Salavou & Avlonitis, 2008). Although product innovativeness has been regarded as a performance dimension in assessing the influence of knowledge utilization in high-tech new products (Molina-Castillo, Jimenez-Jimenez, & Munuera-Aleman, 2011; Tsai, Hsieh, & Hultink, 2011), past research has paid little attention toward examining the effects of knowledge integration mechanisms on product innovativeness. Thus, more research is needed for investigating how knowledge integration mechanisms affect product innovativeness.[1]

The use of knowledge integration mechanisms for new product development in essence is a process of organizational learning. In the process, a product development team would most likely prefer to develop greater competence by exploiting existing technological knowledge bases because they yield more immediate returns than to explore novel technologies that are new to the team (Levinthal & March, 1993). The greater returns associated with exploiting existing technologies encourage KIMs to focus primarily on such exploitation (Levinthal & March, 1993; March, 1991). Path dependency and the reciprocal positive feedback between experience and competence increase the likelihood of the use of knowledge integration mechanisms falling into a learning trap. This makes the use of knowledge integration mechanisms for exploring new technologies less attractive and potentially less rewarding (Ahuja & Lampert, 2001). As such, our first research question arises: Does the effect of knowledge integration mechanisms

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[1] Knowledge creation, knowledge development, and knowledge sharing are also the important constructs in new product development. However, today, developing a new product, particularly for high-tech products, usually needs to input a variety of knowledge. Knowledge is fragmented throughout a firm, making it difficult to identify and apply; therefore, integrating individual specialized knowledge and applying it to new products and services are imperative (Grant, 1996; Hislop, 2003). Thus, the use of knowledge integration mechanisms is directly related to product innovation performance and has been discussed in extant research (e.g., De Luca & Atuahene-Gima, 2007; Grant, 1996).

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on product innovativeness vary with their use, i.e., Is product innovativeness related to knowledge integration mechanisms in a curvilinear manner? Furthermore, the use of knowledge integration mechanisms for product innovation is embedded with the exploration of novel technologies as well as the exploitation of existing technologies. Previous research has suggested that the exploration of novel technologies can help development teams reduce the risk of falling into a learning trap (Ahuja & Lampert, 2001). An organization's willingness to explore novel technologies for product innovation is likely to depend on the opportunities or threats arising from environmental changes (Eisenhardt & Martin, 2000; Gebauer, 2011; Kane & Alavi, 2007; Teece, Pisano, & Shuen, 1997). In other words, environmental context may affect the innovativeness effects of knowledge integration mechanisms. Therefore, the second research question in this study is: Does environmental context affect the knowledge integration mechanisms–innovativeness relationship, required to be investigated in the aforementioned question?

To answer the two research questions above, this study investigates the influence of knowledge integration mechanisms and environmental context on the relationship between knowledge integration mechanisms and product innovativeness. Our research advances the industrial marketing literature in two ways. First, this study extends the literature related to knowledge integration mechanisms–performance relationship by posing a contingency viewpoint. Although the importance and role of knowledge integration mechanisms in developing new industrial products has been emphasized in the marketing literature (e.g., De Luca & Atuahene-Gima, 2007; Enz & Lambert, 2012; Garrett, Buisson, & Yap, 2006; Hirunyawipada, Beyerlein, & Blankson, 2010), these studies do not reveal whether the use of knowledge integration mechanisms has an impact on its influence on product innovativeness. Second, this study also extends the perspective with regard to the moderating role of environmental context in business-to-business research. Environmental context has been examined as a moderating role in linking new product performance and its antecedents in marketing literature (e.g., Land, Engelen, & Brettel, 2012; Molina-Castillo et al., 2011); however, its impact on the moderating role of knowledge integration mechanisms in the knowledge integration mechanisms–innovativeness relationship remains unclear. Furthermore, extant industrial marketing literature has paid little attention to the role of environment context while investigating the barriers of high product innovation (e.g., Bessant, Öberg, & Trifilova, 2014; Sandberg & Aarikka-Stenroos, 2014; Story, Daniels, Zolkiewski, & Dainty, 2014). This study also enriches the current research findings on the issue.

The remainder of this paper is organized as follows. Section 2 presents theoretical background and research hypotheses. Section 3 addresses the research methods and Section 4 reports the analyses and discussion of the results. Section 5 concludes with theoretical and managerial implications, limitations, and provides direction for future research.

2. Theoretical background and research hypotheses

Knowledge resides in organizational members; therefore, integrating individual specialized knowledge is imperative for developing new products and services (Grant, 1996). Knowledge integration for product innovation can be conducted in formal or informal processes (Jansen, Tempelaar, van den Bosch, & Volberda, 2009). In line with the literature, this study is limited to the former. Existing empirical studies center knowledge integration mechanisms on formal processes (e.g., De Luca & Atuahene-Gima, 2007; De Luca et al., 2010; Koch, 2011; Zhou & Li, 2012) as integration mechanisms used in formal processes are easily identified in new product development (Hislop, 2003). Another consideration behind our focus is that ideas from knowledge sharing in informal ways are usually further analyzed and discussed in formal meetings while implementing new product initiatives (Enberg, Lindkvist, & Tell, 2006). Moreover, previous literature suggests that informal mechanisms of knowledge integration do not directly affect knowledge creation (Moreno-Luzón & Lloria, 2008).

Knowledge integration in formal processes and structures has strategic implications. First, the use of formal mechanisms allows organizational members to articulate knowledge (Zollo & Winter, 2002). By articulating knowledge in face-to-face meetings, team members can analyze past experiences to ensure that individuals express their opinions that challenge each other's viewpoints (Argyris & Schon, 1978). Team members become more aware of the performance implications of their actions and increase understanding of these causal links (Zollo & Winter, 2002). Hence, knowledge residing in individuals is articulated through collective discussions and performance evaluation processes. Second, the use of formal mechanisms enables team members to codify their understandings of performance implications of routines by using written tools, such as memos or formal reports (Zollo & Winter, 2002). These tools can serve as guidelines or directions to coordinate the development of new routines. Furthermore, codifying knowledge can help team members further recognize and understand the causal link between decisions and expected performance outcomes. Documentation can force clarification of action–outcome relationships (Lechner & Floyd, 2007), interrupt the automatic dependence on past experience, and bring newly gained insights into new routines that become better anchored within the group (Eisenhardt, Furr, & Bingham, 2010; Lechner & Floyd, 2007). Group members will have a better understanding of why certain processes succeed or fail by writing a manual or a set of written directions for product innovation (Zollo & Winter, 2002). In addition, formal processes essentially represent the routine storage as a procedural memory because they encode historical inferences and guide individuals and groups as quasi-automatic (Eisenhardt & Santos, 2002).

Based on the aforementioned knowledge, this study further draws upon the perspectives of organizational learning and environmental contingency to argue the linkages between knowledge integration mechanisms and product innovativeness. The conceptual framework of this study is illustrated as Fig. 1. In this study, we posit that the effects of knowledge integration mechanisms on product innovativeness vary with the increasing use of knowledge integration mechanisms and that the increasing turbulence of environmental context affects the knowledge integration mechanisms–innovativeness relationship. We present the framework to guide the development of research hypotheses. Specific hypotheses concerning these relationships are detailed in the rest of this section together with their underlying rationale.

2.1. Knowledge integration mechanisms

Knowledge integration mechanisms refer to the formal processes and structures that ensure firms to synthesize, integrate, reconfigure, and use different types of knowledge among team members (De Luca & Atuahene-Gima, 2007; Eisenhardt & Martin, 2000; Zahra, Ireland, & Hitt, 2000). These processes and structures, such as regular information-sharing meetings and analysis of successful and failed project reviews, enable team members to understand what has been learned and to articulate knowledge (Zahra et al., 2000; Zollo & Winter, 2002), to combine their varied skills and functional backgrounds, to transfer and recombine resources within the firm (Eisenhardt & Martin, 2000), and to exploit knowledge effectively.

By the use of knowledge integration mechanisms, team members can share and codify their specialized knowledge and facilitate more rapid diffusion of newly gained knowledge within the organization. These mechanisms also allow each of the team members to build concrete experiences with others so as to create a common experience base and language that facilitate team members to reach common frames of reference and gain integrated efficiency (Atuahene-Gima, 2005). As a result, team members can effectively integrate and exploit the ideas that challenge existing cause–effect relationships; thus, may