



Supplier integration in new product development: Computer mediated communication, knowledge exchange and buyer performance

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ABSTRACT

In new product development (NPD), the buyer–supplier relationship is changing. Suppliers are becoming an integral part of the design team. This study investigates the effectiveness of computer-mediated and face-to-face communication channels on knowledge exchange between buyer and supplier firms, and ultimately buyer NPD and market performance. Open innovation literature and media richness theory are used to develop hypotheses which are then empirically tested using data collected from 157 R&D project managers from U.S. manufacturing firms. To date, empirical studies on the link between supplier integration and buyer performance show conflicting results. Structural equation modeling found a significant positive link between knowledge exchange and NPD performance, measured both in terms of effectiveness and efficiency, and a significant positive link between effective and efficient NPD and market performance. A surprising finding is that contrary to media richness theory, email can perform like face-to-face communication transmitting rich information and having a positive relationship to knowledge exchange between buyer and supplier. It was also found that with face-to-face communication, knowledge exchange fully mediates the relationship with effective NPD while with email communication knowledge exchange fully mediates the relationship with efficient NPD. Video conferencing was found to have no significant effect on knowledge exchange and the effect of web-based tools was significant and negative. The implications of these findings in theory and practice are discussed.

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1. Introduction

New product development (NPD) is increasingly important to a firm's profitability and competitiveness. A successful new product can offer a sustainable competitive advantage and, in some cases NPD is the key driver of a firm's overall success (Loch, Stein, & Terwiesch, 1996). Developing successful new products can be particularly difficult in today's marketplace: competitive pressures are building, consumer tastes are rapidly changing, technological changes are accelerating and product life cycles are becoming shorter (Menon, Chowdhury, & Lukas, 2002). Consequently manufacturers are trying to introduce new products to the market quickly. But faster product development is not always better (McNally, Akdeniz, & Calantone, 2011). This has led to innovation processes becoming more networked, i.e. involving a greater number of external partners (Utterback et al., 2006). The spread of NPD roles across boundaries is often referred to as open innovation.

Open innovation is the use of external ideas as well as internal ideas. That is external ideas or innovations are brought into a firm's own innovation process (Chesbrough, 2003). It acknowledges that not all good ideas come from inside the firm. In the context of NPD,

it represents extending the concept of cross-functional teams beyond company boundaries (Ragatz, Handfield, & Scannell, 1997). Proctor & Gamble is an example of a firm that saw the value of open innovation. In the past decade, P&G has moved from a strategy based on internal R&D, an invent-it-ourselves model, to a revised innovation model called Connect & Develop where the company collaborates with external sources (Huston & Sakkab, 2006).

Open innovation can mean partnering with customers, suppliers, universities or others. There is an extensive research stream on integrating customers into the NPD process (for example Carbonell, Rodríguez-Escudero, & Pujari, 2009; Fuchs & Schreier, 2011; Fuller & Matzler, 2007) but the area of supplier integration has not received as much attention (Gassmann, Enkel, & Chesbrough, 2010). This despite the fact that research shows 69% of knowledge sources comes from suppliers (Enkel, Gassmann, & Chesbrough, 2009) and that the most important and successful external source of ideas is suppliers (Laursen & Salter, 2006; Un, Cuervo-Cazurra, & Asakawa, 2010). Returning to the case of P&G, when the firm adopted Connect & Develop they realized their suppliers were an important source of innovation. As a result, there has been a 30% increase in collaboration projects with them (Huston & Sakkab, 2006).

NPD is a knowledge creation and sharing process (Iansiti & MacCormack, 1997; Souder, Sherman, & Davies-Cooper, 1998). When integrating suppliers into the NPD process, a continuous flow of information

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is required to ensure the best possible outcome (Sivadas & Dwyer, 2000). Therefore as open innovation advances, and supplier integration increases, the question of how knowledge is exchanged between buyer and supplier becomes an important empirical question (Argote, McEvily, & Reagans, 2003).

Communication is achieved through channels. Daft and Lengel (1986) define communication channels – or media – in terms of varying degrees of media richness. Media richness is the capacity to convey information effectively. Different types of channels range from low media richness (e.g., a written report) to high media richness (e.g., face-to-face meeting). It would follow then that sharing knowledge through effective communication may in fact depend on the type of communication channel that is utilized. As significant as this might be, empirical research investigating specific communication channels that enable effective communication in networks is sparse (with the exception of Montoya, Massey, Hung, & Crips, 2009; Oke & Idiagbon-Oke, 2010; Vickery, Droge, Stank, Goldsby, & Markland, 2004). Media richness, while a well defined construct, does not specifically address computer-mediated communication (CMC) channels that are prevalent in NPD today (McIvor & Humphreys, 2004). Furthermore, findings regarding the impact of supplier integration in NPD are mixed and must be better understood (Wagner, 2012), therefore there is a need to identify any critical success factors, such as how best to communicate knowledge.

To summarize, in the context of new product development the buyer–supplier relationship is changing (Wagner, 2010). This is highlighted in the open innovation literature, namely suppliers are becoming an integral part of the design team. One of the biggest hurdles to successful supplier integration is effective communication. In the context of supplier integration into the NPD process, the objective of this research is to better understand the effectiveness of different types of CMC (video conferencing, web-based tools, and email) channels with regard to knowledge exchange and performance.

This research contributes to literature in a number of ways. It extends a topic that is not well researched, supplier-integrated open innovation. And while open innovation is generally studied in the context of the electronics industry, this study differentiates itself by studying the US manufacturing industry. It also investigates CMC in terms of media richness. And finally, it looks to overcome contradictory results and confirm findings that partnering with suppliers through open innovation benefits the buyer, both in terms of the buyer's NPD process and ultimately market performance.

The remainder of the paper is organized as follows. The next section will review the relevant literature on new product development, open innovation and communication channels. Hypotheses will then be developed based on assumptions made in open innovation literature and media richness theory. Subsequently methodology including data collection, construct measurement, and analysis steps using structured equation modeling is discussed. Empirical results will be presented followed by a discussion of findings. Finally, theoretical and managerial implications, research limitations, and directions for future research will be discussed.

2. Background

2.1. Open innovation and supplier integration

New product development (NPD) primarily operated under a paradigm of closed innovation during the 20th century, namely a belief that successful innovation required control, a firm's boundaries are closed, and NPD processes should be internally focused. As described by Chesbrough (2003), this paradigm was challenged by employee mobility, shrinking product life cycles, and increasingly knowledgeable customers and suppliers. Additionally, Chesbrough suggested that suppliers' offerings became equal or superior in quality to what a company could achieve internally. More recently, NPD has

undergone a paradigm shift, moving towards a new model of open innovation (Lindegaard, 2010), or using external ideas as well as internal ideas, and internal and external paths to market. More formally, open innovation has been defined as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” (Chesbrough, Vanhaverbeke, & West, 2006, pg. 1).

Open innovation has been regarded as relevant primarily in high-tech industries, and most research has remained in that context. However current trends see open innovation moving from high-tech industries to low-tech, from large firms to small and mid-sized firms, and from products to services (Gassmann et al., 2010). A survey found that many open innovation concepts are already in use in a much wider range of industries (Chesbrough & Crowther, 2006) and a recent roundtable of open innovation leaders concluded that experience in open innovation is building across an ever-widening range of industries and enterprise types (Perkins, 2012).

The primary drivers of adopting open innovation are (1) speeding innovation efforts, (2) shedding costs, and (3) ensuring higher returns on investments in innovation (Perkins, 2012). Beyond these goals, open innovation can introduce both risks and benefits to the NPD process (Littler, Leverick, & Bruce, 1995). Benefits may include enriching a firm's own knowledge base, leveraging NPD on a partner's budget, introducing a greater sense of urgency for internal groups to act on ideas and technology and, over time, creating a more innovative culture. Innovating with partners also allows executives to become familiar with other ways of getting things done and evaluate their practices in light of other real-world examples. Risks may include higher coordination costs, loss of control, higher complexity, and the potential loss of know-how (Enkel et al., 2009; Gronlund, Sjodin, & Frishammar, 2010; Lindegaard, 2010).

Open innovation partners can include customers, lead users, suppliers, universities, and other knowledge institutions (von Hippel, 1988). Partnering with suppliers is sometimes referred to as co-creation, co-development, or vertical open innovation. This upstream side of open innovation can have a strong impact on innovation, but has not received adequate research attention (Gassmann et al., 2010).

Partnering with capable suppliers, like open innovation in general, can introduce risks and benefits to the NPD process. It can support the ability to apply a firm's own R&D investments in a wide variety of areas in less time than it would take if the company had to perform every function in the value chain on its own. Therefore a firm can move faster and cover more potential market opportunities. But at the same time external suppliers are available to all competitors therefore any competitive advantage obtained is not sustainable (Chesbrough, 2003; Kessler, Bierly, & Galapakrishnan, 2000).

Supplier integration in NPD does not necessarily improve NPD outcomes per se. Research is fragmented and empirical findings regarding performance benefits differ significantly (Johnsen, 2009). Hagedoorn (2002) found that suppliers' early integration into the innovation process significantly increased innovation performance. Additional studies find that supplier integration can lead to shorter time to market, reduced costs, higher quality, and better performance for radical new products (Lawson, Petersen, Cousins, & Handfield, 2009; Petersen, Handfield, & Ragatz, 2003; Ragatz et al., 1997; Song & Di Benedetto, 2008; Wagner, 2012). For example, Ragatz, Handfield, and Petersen (2002) empirically test the benefits associated with supplier integration into NPD and found a significant positive relationship between integration strategies and project outcomes, specifically cycle time, quality and cost reduction.

Conversely, empirical studies also find no or negative effects of supplier integration in NPD on performance (Kessler et al., 2000; Littler, Leverick, & Wilson, 1998). In Hong and Hartley's (2011) study, encouraging suppliers to communicate did not have any effect on product development performance. Eisenhardt and Tabrizi (1995) found that supplier involvement accelerated NPD only in mature industry

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