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## Industrial Marketing Management



# Influences of cross-functional collaboration and knowledge creation on technology commercialization: Evidence from high-tech industries

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## ABSTRACT

Technology commercialization (TC) contributes to maintaining the competitive advantage of high-tech firms, but although researchers have established that product innovation and new product development are enhanced by cross-functional collaboration and organizational knowledge activities, this may not be the case for TC. Drawing on the knowledge-based view and the influence of cross-functional collaboration, the main goal of this study is to unravel the relationships among cross-functional collaboration, knowledge creation and TC performance in the high-tech industry context. Empirical findings from our survey of 203 marketing and R&D managers and employees in Taiwanese high-tech companies indicate that cross-function collaboration reveals fresh opportunities for creating knowledge and commercializing technologies. Our results also suggest that knowledge creation plays an important role in TC performance by partially mediating the relationship between cross-functional collaboration and TC performance. The contributions of this study provide new insights into industrial marketing literature by proposing a cross-functional collaboration-enabled TC model that takes into account the effect of knowledge creation.

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## 1. Introduction

High-tech firms have increasingly focused on technology commercialization (TC) as a means of maintaining their competitive advantage over the past two decades (Galbraith, DeNoble, & Ehrlich, 2012; Jolly, 1997; Lin, Lee, & Hung, 2006; Zahra & Nielsen, 2002). From a process perspective, technology commercialization is defined as “the process that begins with imagining a techno-market insight, incubating the technology to define its commercializability, demonstrating it contextually in products and process, promoting the latter’s adoption, and ultimately sustaining commercialization (Jolly, 1997, p. 3).” From an organizational capability perspective, TC can be viewed as the ability to absorb and re-adapt a new technology for use in production and marketing (Kim, Lee, Park, & Oh, 2011). According to a report from Oracle, in most high-tech companies 10–20% of their annual revenue is invested in new product development activities, and a significant percentage of the company’s market value is based on how many new technologies are on the path to commercialization (Goyal, 2006). Successful TC enables high-tech firms to meet their customers’ needs,

get ahead of their competitors and increase their profits, but to maximize the effectiveness of TC these firms need to begin by developing a good theoretical understanding of the factors that impact the commercialization of new technologies.

Although the literature on investigating the relationship between cross-functional collaboration and NPD or product innovation is abundant (e.g., De Luca & Atuahene-Gima, 2007; Lin, Hsing, & Wang, 2008; Song & Thieme, 2006), previous findings might not be directly applicable to the particular context of commercializing new technologies due to the natural differences in objective, time scale, stakeholders, and nature of demand between NPD and TC (Jolly, 1997). For example, Jolly (1997) examines perspectives such as object, time scale, nature of demand, and marketing challenges to explain the differences between NPD and TC, but notes that the TC process involves a tighter focusing of technical ideas or inventions on specific objectives than either NPD (Jolly, 1997; Kodama, 1992). As the TC process begins with basic scientific or technical research, often involving the awarding of patents, it can take a long time to realize the value of the products (Jolly, 1997). Product innovation and NPD, on the other hand, focus on the development of entirely new products that exploit existing products, or modify existing products in a new application (Atuahene-Gima, 2005). TC not only emphasizes product innovation, but also converts basic scientific or technical research into feasible and salable products (Jolly, 1997). This insight provides an excellent opportunity for industrial marketing researchers to investigate the impacts of

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cross-functional collaboration on TC since there is a paucity of research in this domain (Aggarwal & Hsu, 2009; Zahra & Nielsen, 2002).

Moreover, recent studies (e.g., Baraldi, Ingemansson, & Launderg, 2014; Boehm & Hogan, 2013; Medli & Törnroos, 2014) have focused on the TC context, and underscored that integrating insights from two or more organizations for commercializing a technology will gain different advantages from an objective, which is likely to result in increasing firms' benefits of commercialization and helping maintain its long-term competitive edge. This applies especially to high-tech industries, where the innovation process and product life cycle times are shorter than those of traditional manufacturing industries. Surprisingly, the relationship between CFC and TC has not been empirically tested. Following this logic, we examine the impact of CFC, specifically R&D and marketing collaboration on TC performance in the context of high-tech industries.

In addition to the impact of CFC, knowledge is one of the most important resources supporting a firm's primary activities (Grant, 1996), particularly those related to TC (Frishammar, Lichtenthaler, & Rundquist, 2012). Organizational knowledge creation is embedded in the commercialization process and thus directly affects TC performance (Frishammar et al., 2012; Mir & Rahaman, 2003). In order to facilitate this process, organizations need to develop a knowledge creation mechanism, which is often achieved through a collaborative working environment (Samaddar & Kadiyala, 2006). This path has not been studied explicitly in the literature, so to address this gap in the research we sought to answer the following research question: does cross-functional collaboration affect the technology commercialization performance of high-tech manufacturers through knowledge creation?

To answer this research question, we empirically examined the direct effect of cross-functional collaboration and knowledge creation on TC and then went on to test the mediating role of knowledge creation. The next section reviews the existing literature and develops the hypotheses guiding this research. Section 3 describes the research methodology, and we present the data analysis and discuss our results in Section 4. Finally, Section 5 assesses the contributions of this study and considers the implications for management scholars and practitioners.

## 2. Research model and hypothesis development

In order to understand the keys to improve technology commercialization performance, we anchored our theoretical treatment in the knowledge-based view (KBV) and the influence of CFC. KBV not only considers knowledge as a strategically significant resource of a firm, but also emphasizes the importance of knowledge creation for the production of goods and services, as well as for gaining a competitive advantage (Grant, 1996; Kogut & Zander, 1992). TC comprises the entire process of transferring a new idea or technology into salable goods (Jolly, 1997) and thus includes product conception and definition from new technologies, product design and prototyping tests, and product manufacturing and marketing (Zahra & Nielsen, 2002), all of which are associated with knowledge creation in an organization (Jolly, 1997; Mir & Rahaman, 2003). Knowledge creation has been

described as a spiral process of socialization, externalization, combination and internalization that creates knowledge (Nonaka & Konno, 1998; Nonaka & Takeuchi, 1995).

However, an effective knowledge creation is not likely to be achieved by a formal hierarchy and structure under central control (Rylander & Peppard, 2004). Instead, effective organizational knowledge creation can result from the synthesis of different individuals' views from the different functional units, for example, which is a collaborative organizational learning process (De Luca & Atuahene-Gima, 2007; Grant, 1996). Previous studies have indicated that the significant effect of cross-functional collaborations on product innovation performance is through knowledge integration activities (De Luca & Atuahene-Gima, 2007). Integrating these insights, we propose that cross-functional collaboration actually follows dual paths to affect TC (Fig. 1). In the first path, cross-functional collaboration directly influences TC performance, while in the second, cross-functional collaboration indirectly impacts TC performance through knowledge creation.

Four types of TC performance outcomes are included in the new conceptual framework proposed here: the number of new products, speedier introduction of new products, future market potential, and effective use of patents and know-how. These measurements for TC are derived from the expected outcomes of the TC process (Jolly, 1997). The number of new products refers to how many of the firm's new products are gaining acceptance in various markets (Jolly, 1997). The speedier introduction of new product refers to the ability to shorten the time required for the TC process, thus allowing the firm to introduce new products more quickly than its competitors (Zahra & Nielsen, 2002). The future market potential refers to the exciting, preferably unique, technology-based ideas that are linked to a future market's needs (Jolly, 1997). The effective use of patents and know-how refers to the extent to which an organization can realize the idea, exploit its commercial potential, and plan ways to take it further (Jolly, 1997). These performance outcomes are considered to be simultaneously involved in the construct of TC performance in this study. Fig. 1 presents the new conceptual model.

### 2.1. Effect of cross-functional collaboration on technology commercialization

Cross-functional collaboration refers to a team consisting of members who are from about the same hierarchical level but from different work areas who come together to accomplish a specific task (Robbins, 2001); typical examples are research & development (R&D)–marketing collaborations and R&D–manufacturing collaborations. The existing literature has clearly demonstrated that the effects of collaboration mechanism such as science-to-business collaborations (Boehm & Hogan, 2013), inter-organizational interactions regarding action, result, and personal (Baraldi et al., 2014), and diverse networks (Aarikka-Stenroos, Sandberg, & Lehtimäki, 2014) are all known to be important to the success of TC performance. In this study, we focus on studying the cross-functional collaboration and examining their effects on TC performance. More specifically, we examine the impact of CFC regarding organizational behavior factors, largely because most of the

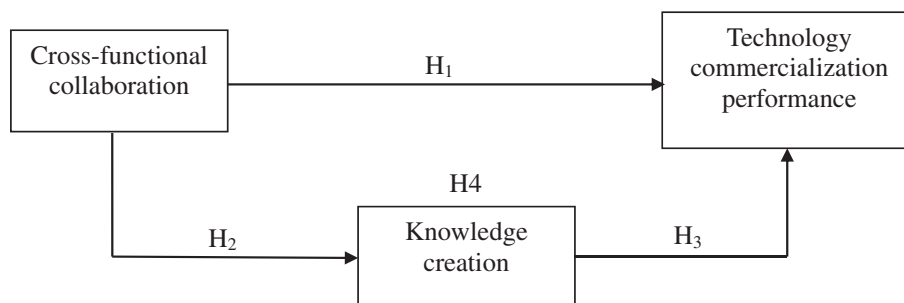


Fig. 1. Research model.

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