IT-based product innovation strategies for small firms

Abstract

Purpose

This study connects the theoretical concepts of strategic orientation and information technology (IT)-based product innovation strategy to suggest that several key factors can help small firms to develop IT-based product innovation strategies.

Design

With data from 245 useable questionnaires (response rate 25.18%) from UK-based small firms in the high-tech industry, the research model was tested and validated.

Findings

Findings show that *information technology support for core competencies* mediates the relationship between strategic orientation and IT-enabled product innovation (ITEPI). Specifically, by distinguishing the different types of strategic orientation and information technology support for core competencies, the study finds that IT support for market access competency (ITMA) mediates the market orientation–ITEPI relationship, while IT support for functionality-related competency (ITFR) mediates the technology orientation–ITEPI relationship. Academic implications arising from the findings are discussed and managerial propositions provided.

Originality

This study offers a fresh theoretical angle from which to understand the factors that contribute to IT-enabled product innovation (ITEPI). More specifically, we argue that

strategic orientation reflects managers' focus to pursue certain activities, and that ITEPI serves as organizational activity. Further, this study also extends relevant research in the field of strategy, IT and innovation. It provides a more nuanced picture of how strategic orientation affects ITEPI.

Keywords – Resource-based view; strategic orientation; information technology-based product innovation strategy; IT-enabled product innovation; IT support for core competencies.

INTRODUCTION

For many small firms, a product innovation strategy is a key element for survival (De Jong & Vermeulen, 2006; Roper, 1997). Adopting a product innovation strategy suggests that firms engage in activities that generate product innovations, including the development of novel and meaningful products that attract customers' attention (e.g., Aubert *et al.,* 2008; Majchrzak and Malhotra, 2013). However, in comparison to large firms, small firms lack critical organizational resources; they not only have limited organizational resources for marketing activities (i.e. advertising, promotion, customer services, etc.) for the purpose of acquiring and maintaining customers (Carson, 1990; O'Donnell, Gilmore, Carson & Cummins, 2002), but also for other activities (i.e. R&D, product innovation, etc.) (Freel, 2000; Hannan & Freeman, 1984). The managers of small firms therefore face an important challenge, which is how they can stimulate firms' product innovation activities in spite of the limitations in organizational resources (Love and Roper, 2015; Lowry and Wilson, 2016; Molla, 2013).

In this research, we propose that one effective way to address this challenge is to use information technology (IT) to support product innovation activities (e.g., Snihur and Wiklund, 2019). We refer to such organizational activity as *IT-based product innovation strategies*. The current research is an endeavor to improve our understanding of the factors that help small firms to develop IT-based product innovation strategies. Previously, researchers have predominantly paid particular attention to the critical role of various types of strategic orientation that can play an important role in promoting the use of IT in developing business strategy (e.g., Doherty *et al.,* 2010; Wang and Ahmed, 2009). This is because a strategic orientation reflects a firm's deeply rooted belief and values that direct its strategic focus and actions (Chen, Chen & Zhou, 2014; Kim, Im & Slater, 2013).

Despite the abundance of studies on strategic orientation and the use of IT, the research streams related to the 'strategic orientation-IT' relationship are largely disconnected (e.g. Bruque & Moyano, 2007; Nguyen, Newby & Macaulay, 2013). For example, past literature in IT-based product innovation strategy has been divided into two major streams of work. One stream explores the processes whereby firms incorporate IT in their product innovation and develop new products, while the other looks at how various antecedent conditions impact such processes. To the best of our knowledge, no previous studies have combined these two streams of research. Furthermore, research addressing IT-based product innovation strategy from the perspective of small firms is scarce (e.g. Dibrell, Davis & Craig, 2008), even though product innovation activity is a key element for small firms' survival (De Jong & Vermeulen, 2006; Roper, 1997).

The resource-based view (RBV), or resource-based theory, is one of the oldest and most influential theories in the field of information systems, strategy and operations management for several reasons. From the original resource-based view of the firm that suggests a firm's competitive advantage is derived from its valuable tangible or intangible assets (Barney, 1991), RBV has given rise to more prominent spin-off aspects by considering not only its assets but also the possession of the organisation's capabilities as its key source of sustainable competitive advantage. As a result, IT/IS scholars who adopt different aspects of RBV (i.e. the resource-based view of the firm) tend to define a company's capability. RBV also attempts to explain that organization sustainable competitive advantages stem from resources that are rare, valuable and hard to duplicate. It suggests that each firm has a distinct set of resources and capabilities, and some capabilities will impact more on financial performance than others (Song *et al.,* 2007). It is crucial for small firms to consider what a firm can or cannot do from a resource-based stance as small companies do not have the room to fail in the real life business arena.

To address these deficiencies in the literature, we develop a theoretical framework that explains the connections between strategic orientation and an IT-based product innovation strategy. Consequently, the research presented here makes several important contributions.

First, we build on the insights from the resource-based view. Our study offers a novel theoretical angle from which to connect strategic orientation and the IT-based product strategy literature. Second, we add to the growing body of literature that specifically investigates the link between strategic orientation and the development of IT-led business strategy by undertaking a more nuanced, multi-dimensional investigation (e.g. Borges, Hoppen & Luce, 2009; Chan, Huff, Barclay & Copeland, 1997). Finally, we extend research on small firms' IT strategy (e.g. Bergeron & Raymond, 1992; Dibrell, Davis & Craig, 2008) by identifying and investigating the factors that motivate small firms to engage in activities that use IT to support product innovation. This organizational activity allows small firms to remain competitive in the marketplace in spite of resource limitations (Dibrell, Davis & Craig, 2008; Levy, Powell & Yetton, 2002).

LITERATURE REVIEW

A great deal of research attention has focused on understanding IT-based product innovation strategy (see Table 1). One stream explores how firms incorporate IT in their product innovation processes (Bartel, Ichniowski & Shaw, 2007; Bendoly, Bharadwaj & Bharadwaj, 2012; Chen, 2007; Dougherty & Dunne, 2012). Commonly, this steam of research aims to inform scholarship and to provide empirical evidence of the impact of IT on product innovation and new product development (e.g., Benitez *et al.*, 2018; Chen *et al.*, 2015; Cui *et al.*, 2018; Mikalef and Pateli, 2017). For example, Zammuto, Griffith, Majchrzak, Dougherty and Faraj (2007) suggest that firms can use software to quickly recombine components in

new and innovative ways to develop new products and services. Pavlou and El Sawy (2006) find that the effective use of IT functionalities by business units can support new product development capabilities. More recently, Kawakami, Barczak and Durmuşoğlu (2015) suggest that both IT tool use and replacement frequency can influence new product development task proficiency, which improves new product development performance.

The second stream looks at antecedents of the use of IT in product innovation. Barczak and colleagues (e.g. Barczak, Hultink & Sultan, 2008; Barczak, Sultan & Hultink, 2007; Kawakami, Durmuşoğlu & Barczak, 2011) have conducted a number to studies to identify and examine different factors (i.e. strategic factors, management factors, etc.) as antecedents of the deployment of specific IT tools to support product innovation. Other studies such as Tallon (2011) suggest that spillover effects of IT business value that strategic alignment in IT support supplier-relations and IT support production and operations will lead to product and service enhancement. Much of the work around antecedents tries to predict the extent to which firms' internal business routines or external environment conditions can encourage firms to incorporate IT usage in their product innovation processes. In general, these two research streams shed light on the use of IT firms' strategies to support product innovation activities.

"Insert Table 1 Here"

Strategic orientation describes the organizational processes and decision-making style that direct and influence firms' strategic direction (Gatignon & Xuereb, 1997; Kim, Im & Slater, 2013). Research has shown the relationship between strategic orientation and IT-based strategy (Chan, Huff, Barclay & Copeland, 1997; Hsieh, Lai & Shi, 2006; Luo & Seyedian, 2003; Voola, Casimir, Carlson & Agnihotri, 2012; Wang & Ahmed, 2009). In particular, Clark, Cavanaugh, Brown and Sambamurthy (1997) describe the impacts of entrepreneurial orientation on firms' change-readiness IT capabilities. Celuch, Kasouf and Peruvemba (2002)

suggest a connection between perceived learning orientation and assessed information system capabilities, while Chaston, Badger, Mangles and Sadler-Smith (2003) and Jayachandran, Sharma, Kaufman and Raman (2005) postulate that relationship-based business orientation promotes firms to employ IT to enhance their relationship management processes. More recently, Ordanini and Rubera (2010) suggest that innovative orientation affects the performance of IT innovators after the application of e-commerce. Trainor, Rapp, Beitelspacher and Schillewaert (2011) find that market and technology orientations lead to the development of e-marketing capability, while Kim, Basu, Naidu and Cavusgil (2011) advocate that customer orientation has a positive impact on the technical capabilities of customer relationship management. To summarize, the research focus in this subject area is on studying how different types of strategic orientation influence the usage of IT in business processes, which facilitates the development of IT-based business strategy.

Despite interests in understanding strategic orientation and IT-based product innovation strategy, these two groups of research interests are still divergent. We argue that both groups should in fact closely connect with one another, based on a number of reasons. (1) First, an abundance of studies has shown the strong connections between strategic orientation and product innovation (e.g. Gatignon & Xuereb, 1997; Kim, Im & Slater, 2013). In other words, scholars generally agree that managers can improve firms' product innovation performance by implementing strategic orientation. (2) Second, our review of the literature above (and see Table 1) shows that researchers have identified evidence regarding the relationship between strategic orientation and IT-based business strategy development. IT-based product innovation strategy can be considered as a specific type of IT-based business strategy whereby firms apply IT to support the planning and implementation of product innovation processes (Banker, Bardhan & Asdemir, 2006; Barczak, Hultink & Sultan, 2008;

Nambisan, 2013). However, to the best of our knowledge, no studies have attempted to link these two streams of literature.

In terms of the research context, for years, scholars have largely directed their research efforts toward understanding the importance of using IT to support major economic activities performed by the firms. A close examination of relevant literature reveals a consensus that IT can be considered an important resource that can yield an advantage for firms (e.g. Dehning & Stratopoulos, 2003; Dong, Xu & Zhu, 2009; Wang, Liang, Zhong, Xue & Xiao, 2012). This is particularly true for small firms; prior studies suggest that small firms often lack an abundance of resources to carry out complex business tasks in comparison with large firms (Freel, 2000; Hannan & Freeman, 1984). Several scholars have advocated the adoption of IT by small firms to develop IT-based business strategies to overcome a lack of effectiveness and efficiency when performing complex tasks (e.g. Bruque & Moyano, 2007; Caldeira & Ward, 2003; Nguyen, Newby & Macaulay, 2013). Dougherty and Dunne (2011, 2012) and Nambisan (2013) have suggested that product innovation activities are becoming increasingly complex tasks that are difficult for a single firm (or even a large firm) without network partners or IT support to carry out.

Brown and Eisenhardt (1995), Brown and Duguid (1998) and DeSanctis and Jackson (1994) note that the key value of *IT-enabled* resources is conceptually related to the notion of synergy, in which the effectiveness of a cohesive group is greater than the sum of the effects of its parts. Thus, such resources allow firms to integrate existing resources for greater operational performance. Studies by Nevo and Wade (2010) and Chen *et al.* (2010) distinguished firms' operations to extract synergy from IT-enabled resources as supply-side (emergent synergy), which emphasizes its generation from existing resources, and demand-side (potential synergy), which focuses on developing the synergy to be derived from future investment in new IT-enabled resources. It supports IT-enabled innovations and the generation of new strategic opportunities through IT-related investment.

Despite acknowledgement of the importance for small firms to develop IT-based business strategies, few studies have investigated IT-based product innovation strategy (a type of IT-based business strategy) from the perspective of small firms. It seems likely that small firms that have adopted IT to facilitate the engagement of other complex business tasks also attempt to use IT to support product innovation activities which are critical for small firms' survival (De Jong & Vermeulen, 2006; Roper, 1997). Furthermore, research on small firms consists of works describing the influence of strategic orientation on firms' product strategy development (Kollmann & Stöckmann, 2014; Salavou, Baltas & Lioukas, 2004) as well as IT adoption (Bruque & Moyano, 2007; Caldeira & Ward, 2003). Combining the above discussions, it appears plausible to assume that small firms' strategic orientation will have a significant influence on their IT-based product innovation strategy. However, the connection between strategic orientation and IT-based product innovation strategy in the small-firm setting may prove more complex, and it is this relationship that forms the focus of our study.

THEORETICAL FRAMEWORK

The theoretical framework of our study consists of a chain of effects leading from *strategic orientation* (i.e. market and technology orientation) via IT support for core competencies, namely *IT support for market access competency* (ITMA) and *IT support for functionality-related competency* (ITFR) to *IT-enabled product innovation* (ITEPI). Figure 1 presents an overview of our framework and specific constructs.

"Insert Figure 1 Here"

We develop our framework based on the insights drawn from the resource-based view (RBV). The RBV describes how firms' behaviors are the outcome of their decision-makers' (i.e. managerial) resource focus (Mathews, 2002; Verona, 1999). As the study focuses on the

critical resources of IT and the subsequent decision making involved with this, the RBV approach is deemed appropriate. More specifically, managerial focus is critical to explain why firms allocate resources and efforts to pursue certain organizational activities, but not others (Chen, Chen & Zhou, 2014; De Clercq & Zhou, 2014; Ocasio, 1997). From the perspective of the RBV, we consider strategic orientation as the independent variable in our framework. Gatignon and Xuereb (1997) define strategic orientation as the organizational processes and decision-making style that direct and influence firms' strategic direction. It reflects a firm's deeply rooted beliefs and values that direct its strategic focus and actions (Chen, Chen & Zhou, 2014; Kim, Im & Slater, 2013). In this research, we focus on two types of strategic orientation – *market* orientation and *technology* orientation – which prior studies have found to be closely related to product innovation (e.g. Kim, Im & Slater, 2013) and IT-based strategy (e.g. Trainor, Rapp, Beitelspacher & Schillewaert, 2011). Market orientation is defined as firms' strategic focus of acquiring, disseminating and responding to market intelligence (Kim, Im & Slater, 2013; Kohli & Jaworski, 1990). Technology orientation, on the other hand, is defined as firms' strategic focus of developing technologically superior products (Zhou & Li, 2010; Zhou, Yim & Tse, 2005). In line with the resource-based view, market orientation reflects the focus of managers in the processing of market information and organizing resources to respond to it accordingly (Kohli & Jaworski, 1990; Slater & Narver, 1995), while technology orientation reflects the focus of managers to develop and use new and sophisticated technologies to nurture new product concepts (Gatignon & Xuereb, 1997; Zhou & Li, 2010).

In our framework, we identify both dependent variable and mediators belonging to the mechanisms of firms' IT-based product innovation strategy. The dependent variable in our framework is IT-enabled product innovation (ITEPI). Relevant literature suggests that IT can be used to directly improve the performance of the task-based business operations (Dehning

& Stratopoulos, 2003; Tallon, Kraemer & Gurbaxani, 2000). Product innovation activities can be considered as one of the major economic activities to which firms can apply IT to support their plans and implementation (Banker, Bardhan & Asdemir, 2006; Durmuşoğlu & Barczak, 2011; Nambisan, 2013). We define ITEPI as the use of IT at its core to enable and enhance product innovation activities (Tallon, 2011; Tallon, Kraemer & Gurbaxani, 2000). According to the RBV, Day (1994) describes that firms constantly operate across key competitive aspects to integrate resources via internal accumulation or collection of information from the external market. In other words, organizational activity (e.g., product innovation) arises from the input of resourceful processes (Verona, 1999). This means that once managers turn their focus to a certain organizational activity, they will then select corresponding resources accordingly. Organizational activity (product innovation), thus, is considered as the dependent variable in the resource-based view model. In this research, we propose that ITEPI represents the ultimate organizational activity triggered by firms' strategic orientation. We base this statement on the importance of digitalization and IT within small firms, as noted by recent studies (e.g., Benitez *et al.*, 2018; Cui *et al.*, 2018).

The mediator in our framework is IT support for core competencies. Firms can use IT to enhance their internal competencies for the purpose of improving their competitiveness in the marketplace (Ravichandran & Lertwongsatien, 2005; Wang, Liang, Zhong, Xue & Xiao, 2012). Wang, Liang, Zhong, Xue and Xiao (2012, p. 334) refer to this concept as IT support for core competencies and define it as "the extent to which information system are used to enhance and develop a firm's competencies". In this research, we focus on two types of IT support for core competencies – ITMA and ITFR. ITMA is defined as the extent to which IT can be used to process customers' information and respond to this information in the marketplace (Wang *et al.*, 2012), while ITFR is defined as the extent to which IT can be used to increase the speed of their business processes (Ravichandran & Lertwongsatien, 2005;

Wang, Liang, Zhong, Xue & Xiao, 2012). In this case, ITMA could either be a low-level activity (e.g., which kind of customer information, which kind of response) or a very high level (e.g., listen to what the customers say they want) whereas ITFR focuses on the speed (rather than effectiveness) of business processes. We choose these two types of IT support for core competencies because firms' abilities to process market information and increase the speed of business processes have a great influence on product innovation processes (Evanschitzky, Eisend, Calantone & Jiang, 2012; Ottum & Moore, 1997). According to the RBV, firms' resources, including their possession (or the development) of certain resources, play an important role (Ocasio, 1997; Ocasio & Joseph, 2005) in specific organizational activities. Both ITMA and ITFR are organizational competencies, which can be viewed as firms' resources. In line with the RBV, we contend that ITMA and ITFR play important roles in connecting strategic orientation (managerial focus) and ITEPI (organizational activity).

Hypotheses Development

According to the RBV, managerial focus determines how firms allocate their resources and efforts to certain activities (De Clercq & Zhou, 2014; Ocasio, 1997; Ocasio & Joseph, 2005). Following this logic, we expect to find a relationship between strategic orientation and IT support for core competencies. In particular, we hypothesize that market orientation can lead to ITMA. Market orientation reflects firms' deeply rooted beliefs and values of developing and responding to market information (Kohli & Jaworski, 1990; Slater & Narver, 1995). ITMA refers to firms' competencies in using IT to support market-accessing activities (i.e. customer enquiries, analyzing customer information, and identifying potential customers) (Ravichandran & Lertwongsatien, 2005; Wang, Liang, Zhong, Xue & Xiao, 2012). Prior studies suggest that managers in market-oriented firms focus on the activities related to the acquisition and analysis of market intelligences (Jaworski & Kohli, 1993; Kohli & Jaworski,

1990). When managers focus their attention on these market orientation-related activities, they will be more motivated in finding ways – such as the use of IT – to improve its implementations. Thus, they are more likely to engage in activities that use IT to support the access of market information (Borges, Hoppen & Luce, 2009; Wade & Hulland, 2004). When firms repeatedly apply their knowledge and skills to engage with, and adopt, an approach of trial and error on specific activities, they will develop a deeper understanding of how to perform these activities effectively and efficiently (Bharadwaj, 2000; Vorhies, Harker & Rao, 1999). Such deeper understanding can be described as organizational competencies in performing certain activities. Therefore, it is logical to suggest that high market-oriented firms will be more likely to develop competencies in using IT to facilitate customer inquiries, analyze customer information, and identify potential customers. In other words, market-oriented firms are able to develop ITMA.

Similar logic can also be used to explain the link between technology orientation and ITFR. Technology orientation reflects managerial responsiveness of using technology to develop superior products (Kim, Im & Slater, 2013; Zhou & Li, 2010). ITFR refers to firms' competencies in increasing the speed of critical processes (Ravichandran & Lertwongsatien, 2005; Wang, Liang, Zhong, Xue & Xiao, 2012). Firms that are technology-oriented are likely to commit great efforts to engage in new product development processes, which often require close interactions and speedy business processes (Chen, Damanpour & Reilly, 2010; Menon, Bharadwaj, Adidam & Edison, 1999); thus, the use of IT allows firms to increase the speed of business processes (Bharadwaj, 2000; Wade & Hulland, 2004). When firms regularly use IT to improve the speed of business processes because they go out of their way to allocate greater efforts to activities that promote new product development using the superior technology, they are more likely to acquire a deeper understanding of how to perform these

activities effectively and efficiently for such purposes. Such deeper understanding reflects firms' ITFR. As such, technology-oriented firms are more likely to develop ITFR.

We also expect positive ITMA-ITEPI and ITFR-ITEPI relationships for two reasons. The first reason relates to the use of IT as a tool to improve business functions and achieve specific objectives. In line with the RBV, ITEPI reflects the organizational activity of using IT to support product innovation (Tallon, 2011; Tallon, Kraemer & Gurbaxani, 2000). Therefore, it seems reasonable to assume that ITMA affects ITEPI. The benefits arising from employing IT to enhance firms' competence to study and respond to their customers' needs might influence how firms incorporate IT into their product innovation and new product development processes to better serve their customers. For example, Lu and Ramamurthy (2011) suggest that firms' capacity to use IT can improve their ability to respond quickly to changes in the marketplace and accordingly adjust their operations to cope with these. The better firms can understand the needs of their customers, the more likely they will choose to incorporate IT in their product development and innovation processes. This is because comprehensive customer insights allow firms to customize and develop meaningful products to address customers' exact needs (Slater & Narver, 1995; Zhou, Yim & Tse, 2005). Such product innovation processes are often very complex (i.e. more complex product design) and require the use of IT to support their implementation (Banker, Bardhan & Asdemir, 2006; Bartel, Ichniowski & Shaw, 2007). Therefore, firms with high ITMA are more likely to have greater ITEPI.

For a similar reason, we also predict that ITFR can enhance ITEPI. The use of IT allows firms to serve their customers better through increasing the speed of their business processes (Wang, Liang, Zhong, Xue & Xiao, 2012). Firms with faster business processes become better equipped to develop sophisticated products equipped with the latest technologies (Bendoly, Bharadwaj & Bharadwaj, 2012; Chen, 2007). In order to take

advantage of their faster business processes, we argue that firms are more likely to adopt and incorporate IT in their product development processes. This is due to the fact that the development of sophisticated products involves very complex processes and the use of IT allows firms to achieve better control over such processes (Banker, Bardhan & Asdemir, 2006; Bendoly, Bharadwaj & Bharadwaj, 2012; Pavlou & El Sawy, 2006; Zammuto, Griffith, Majchrzak, Dougherty & Faraj, 2007).

A second reason relates to learning how best to use IT to support business processes. It applies to both the ITMA-ITEPI and ITFR-ITEPI relationships. When firms have greater competencies to align better with their customers or increase the speed of business processes by utilizing IT, their competencies in using IT to perform other specific activities will also increase. This is because when firms repeatedly apply their IT-related knowledge and skills to support business processes, they will gain both general and specific competencies in using IT for such purposes (Bharadwaj, 2000; Lu & Ramamurthy, 2011; Ravichandran & Lertwongsatien, 2005). Even though some competencies (i.e. specific IT competencies) in using IT to improve a particular business function may not be transferable from one situation to another, firms will still acquire more understanding (i.e. general IT competencies) of how to use these technologies to support business processes (Bharadwaj, 2000; Wade & Hulland, 2004), which in turn should help to improve the IT use in other activities. Following this reasoning, we can assume that firms' emphasis on ITMA and ITFR may also be highly motivated, and they may be capable of using IT to support product innovation processes (such as ITEPI). Accordingly, based on the above, we suggest that both ITMA and ITFR can lead to ITEPI.

Combining the preceding arguments, we hypothesize that ITMA plays a mediation role in the market orientation-ITEPI relationship and that ITFR plays a mediation role in the technology orientation-ITEPI relationship. More specifically, market orientation and

technological orientation affect ITEPI through ITMA and ITFR, respectively. These hypotheses are in line with the RBV, which indicates that the linkage between managerial focus and organizational activity often requires that either existing resources be deployed or that new resources be acquired or developed (Ocasio, 1997; Ocasio & Joseph, 2005). From this perspective, we argue that translating managerial actions – such as the focus of managers to create superior customer value (market orientation), and technologically superior products (technology orientation) to organizational activity of incorporating IT in product innovation (ITEPI) – requires firms to develop specific IT support for core competencies (resources). These include using IT to support market access (ITMA) and to increase the speed of business processes (ITFR). Thus, ITMA and ITFR should function as critical intermediate mechanisms that connect strategic orientation and ITEPI.

Our hypotheses are specifically applicable in the situation of small firms. Small firms often practice strategic management by engaging in different types of strategic orientation (Covin & Slevin, 1989; Pelham, 2000). As such, small firms can direct firms' resources to fulfill specific strategic objectives. In this research, we argue that when small firms practice market and technology orientations, they are more likely to use IT to support product innovation processes (ITEPI) because both market and technology orientations are highly related to product innovation activities in small firms' settings (Covin & Slevin, 1989; Laforet, 2008; Pelham, 2000). However, small firms often lack the abundance of resources (i.e. human capital) to engage in complex tasks such as product innovations (Freel, 2000; Hannan & Freeman, 1984). In order to compete with each other and with larger firms, one way to overcome this limitation is to adopt and use IT to support business processes (Dibrell, Davis & Craig, 2008; Levy, Powell & Yetton, 2002; Nguyen, Newby & Macaulay, 2013). For small firms that focus on creating superior customer value (market orientation), and technologically superior products (technology orientation), they will be highly motivated to

develop competence in using IT to support, and increase, the speed of the critical business processes involved in gaining market intelligence. These will ultimately lead to the use of IT to support product innovation, because they not only improve small firms' understanding of customer insights and capacity to use sophisticated technologies to develop new products, but also increase small firms' ability to use technologies as tools to create business value (Bergeron & Raymond, 1992; Dibrell, Davis & Craig, 2008; Nguyen, Newby & Macaulay, 2013; Salavou, Baltas & Lioukas, 2004). Thus, we formally state:

> ***H 1****: Information technology support for market access competency mediates the relationship between market orientation and information technology-enabled product innovation.*
>
> ***H2****: Information technology support for functionality-related competency mediates the relationship between technology orientation and information technology-enabled product innovation.*

RESEARCH METHOD

Data Collection and Measurement

We collected survey data from UK-based small firms in the high-tech industry, defined as an industry that use technologically advanced methods and the most modern equipment. This particular sector was chosen because the firms in this sector are more active in using information systems to enhance their business practices (Aral & Weill, 2007; Dehning, Richardson & Zmud, 2007). We approached a marketing company and searched for contact information for UK-based small firms in the High-Tech industry. From this we randomly selected 1000 organizations. We obtained their details from a marketing company and sent out four waves of emails to increase the response rate. Among them, 27 firms had either ceased trading, or had been purchased by other larger firms - therefore, we removed them from our sample. Of the 973 firms that received the survey, 245 useable questionnaires were returned, indicating a response rate of 25.18%. Table 2 shows the sample details.

"Insert Table 2 Here"

We adopted the procedure proposed by Armstrong and Overton (1977) to assess non-response bias. This procedure focuses on comparing early and late respondents' answers to the survey questions. If no significant differences are observed between early and late respondents' answers, then the effects of nonresponse bias are minimal. In practice, we divided the survey responses into 4 (1 = earliest and 4 = latest) groups according to the date of reception. Afterward, we performed a t-test to compare responses which were represented by the 1 and 4 groups. There were no significant differences between early and late respondents' answers for all five variables presented in our framework. As a result, we conclude the probability of nonresponse bias is minimal.

We measured market orientation, technology orientation, ITMA, ITFR, and ITEPI by adapting and modifying the measurements from existing studies (see Appendix A). We tested our questionnaire and further refined it based on the comments obtained from a pilot test, to enhance the validity. Based on Hair, Black, Babin and Anderson (2010) suggestions, our factor model exhibits adequacy fit (X^2 = 173.181; df = 94; X^2/df = 1.842; p = .000, CFI = .958; RMSEA = .059). The findings from our confirmatory factor analysis (CFA) demonstrate reasonable fit and no interpretational confounding from the measures.

We employed firm size, firm age, business offer, competitive intensity, market uncertainty, and technology uncertainty as control variables in our study. According to prior studies on IT-based product innovation strategy, these variables have the potential to influence the use of IT in the product innovation processes (Barczak, Hultink & Sultan, 2008; Kawakami, Barczak & Durmuşoğlu, 2015; Kim, Basu, Naidu & Cavusgil, 2011; Nambisan, 2013). Annual revenue figures were used to assess the size of the firm. Given that firms sometimes hesitate to reveal their exact revenue figures, we created seven interval scales (see Appendix A) to improve the response rate. Firm age is measured as the natural logarithm of

the number of years since establishment. We assessed the firm's business (main business) offer using a dummy variable (0 = service and 1 = product). Finally, we assessed the *competitive intensity* using a single-item Likert scale (1~5) measurement – "competition in our industry is cutthroat", *market uncertainty* – "our customers' perceptions changes all the time in our industry" and *technology uncertainty* – "the technology used in developing new products in our industry was rapidly changing", adapted and modified from relevant literature.

Validity and Reliability

We calculated the composite reliability (CR) and the average variance extracted (AVE) to assess the validity and reliability of our measurements (Fornell & Larcker, 1981; Hair, Black, Babin & Anderson, 2010). We find that all of the CR values are greater than .700 and the AVE values are greater than .500 (see Table 4). We also find that the square root value of the AVE for each construct is greater than all of its correlations with the other constructs (Chin & Marcoulides, 1998). Together, the validity and reliability of our measurement are established. Furthermore, we calculated the variance inflation factor (VIF) to assess the level of multicollinearity (O'Brien, 2007). Our results suggest that multicollinearity is not a serious issue in this study because all the VIF values are below 10 (Hair, Black, Babin & Anderson, 2010; O'Brien, 2007).

"Insert Table 4 Here"

Both of our independent and dependent variables are assessed by a single source. To reduce the potential common method variances (CMV) we followed the procedural remedies suggested by Podsakoff, MacKenzie and Podsakoff (2012) to organize the data collection process. Furthermore, we used two statistical remedies to detect the possible CMV. First, we performed Harman's single-factor test (Podsakoff, MacKenzie & Podsakoff, 2012). Second,

we performed CFA marker variable techniques (Richardson, Simmering & Sturman, 2009; Williams, Hartman & Cavazotte, 2010). We used organizational memory (three items: a sample item is "we make strong efforts to preserve information") adapted and modified from Tippins and Sohi (2003) as the marker variable. Our results show that that CMV is not a concern for this study.

FINDINGS AND ANALYSIS

Table 3 illustrates the summary statistics as well as the correlation matrix. Unsurprisingly, a high correlation exists among the two dimensions of IT support for core competencies (ITMA and ITFA), as is consistent with the suggestions in the literature (Ravichandran & Lertwongsatien, 2005; Wang, Liang, Zhong, Xue & Xiao, 2012). Although we acknowledge that such relationship may cause potential multicollinearity during the data analysis, we are confident however that this is not an issue for this study based on two reasons. First, the VIF value is 1.875, which is significantly below the recommended level of 10 (Hair, Black, Babin & Anderson, 2010; O'Brien, 2007). Second, we theorize the effects of ITMA and ITFR on different outcomes and examine their effects on different regression analyses. Therefore, there is a low likelihood of these two variables overlapping with each other to explain unique variance in the dependent variable (ITEPI).

"Insert Table 3 Here"

Hypothesis 1 posits that ITMA mediates the relationship between market orientation and ITEPI, while hypothesis 2 predicts that ITFR mediates the relationship between technology orientation and ITEPI. Following Hayes' (2013) suggestions, we first examine the effect of the independent variable on the mediator. We find that the effects of market orientation on ITMA ($\beta = .177$, $p < .001$) and the effects of technology orientation on ITFR ($\beta = .418$, $p < .001$) are positive and significant to satisfy condition 1 (Model 1 and Model 2).

Second, we examine whether the effect of the mediator on the dependent variable is significant when accounting for the effect of the independent variable (Hayes, 2018). We also find that the effects of ITMA ($\beta = .319$, $p < .001$) on ITEPI (Model 3), and the effects of ITFR ($\beta = .466$, $p < .001$) on ITEPI (Model 4) are positive and significant. Finally, we calculate the indirect effects employing a bootstrap analysis with 10000 samples. We find that the indirect effects between market orientation and ITEPI through ITMA ($\beta = .056$), and the indirect effects between technology orientation and ITEPI through ITFR ($\beta = .195$) are positive and significant, with a 95% confidence interval which does not include zero, which satisfies condition 3. Thus, hypotheses 1 and 2 are supported.

DISCUSSION

Theoretical Implications

This study offers a fresh theoretical angle from which to understand the factors that contribute to ITEPI. In this research, we employ insights of the resource-based view that highlights the connections between managerial focus and organizational activity (Ocasio, 1997; Ocasio & Joseph, 2005)) to explain the relationship between strategic orientation and IT-based product innovation strategy. More specifically, we argue that strategic orientation reflects managers' focus to pursue certain activities, and that ITEPI serves as organizational activity. According to the RBV, managerial focus is critical to explaining why firms choose to direct their attention and energy to perform certain organizational activities (Chen, Chen & Zhou, 2014; De Clercq & Zhou, 2014; Ocasio, 1997). Therefore, we build on the RBV to investigate the mediation effects of IT support for core competencies on the strategic orientation-ITEPI relationship. As such, the results of this study demonstrate how the application of the RBV can provide a new theoretical perspective from which to explain the

connections between strategic orientation and IT-based product innovation strategy (Harmancioglu *et al.*, 2009; Yu *et al.*, 2014).

This study also extends relevant research in the field of strategy, IT and innovation. It provides a more nuanced picture about how strategic orientation affects ITEPI. Prior studies in the field have focused either on understanding the influences of strategic orientation on IT usage or on the incorporation of IT in product innovation processes (see Table 1). In this research, we not only connect these two streams of literature but also explore the mediating role of IT support for core competencies which can be considered as a type of antecedent of its use in product innovation (see Table 1) that has not previously been studied in this context. We find that ITMA mediates the market orientation-ITEPI relationship, while ITFR mediates the technology orientation-ITEPI relationship. These findings extend strategy and innovation literature (Table 1) by suggesting that managers' focus on strategic orientations does not automatically lead to ITEPI. Instead, different types of strategic orientation will motivate firms to develop corresponding IT support for core competencies which, in turn, affects ITEPI. Therefore, our work also adds to the IT literature (e.g. Bharadwaj, 2000; Dehning & Stratopoulos, 2003; Ravichandran & Lertwongsatien, 2005; Wang, Liang, Zhong, Xue & Xiao, 2012) regarding the function of IT-related capabilities to provide a basis for transforming managerial strategic intention into actual business strategy involving the use of IT (Yu *et al.*, 2019).

Furthermore, we also make a contribution to the small firms' IT strategy literature by examining our hypotheses using survey data gathered from UK-based small firms in the high-tech industry. We identify and investigate the factors that lead small firms to engage in IT-related activities to support product innovation. The research implication is that small firms can pursue certain types of strategic orientation (market and technology orientations) that will lead to the development of corresponding IT support for core competencies (ITMA and

ITFR), which subsequently enhances their ability to incorporate IT into their product innovation activities and realize more IT-related benefits. Thus, we shed fresh light on the IT-led strategy in the field of small business management (e.g. Bergeron & Raymond, 1992; Dibrell, Davis & Craig, 2008; Levy, Powell & Yetton, 2002; Nguyen, Newby & Macaulay, 2013; Pelham, 2000).

Managerial Implications

In terms of managerial implications, this study offers an important illustration of the acts of pursuing both market and technology orientations as critical antecedent conditions for an IT-based product innovation strategy. One critical challenge small managers face is how to capitalize on the firm's IT resources to engage in product innovation activities. Our findings suggest that the pursuit of market and technology orientations are viable means to achieve such objectives. These strategic orientations reflect the firm's deeply rooted beliefs and values that direct its focus towards creating superior customer value and developing technological superiority, respectively (Kim, Im & Slater, 2013; Trainor, Rapp, Beitelspacher & Schillewaert, 2011). To cultivate *market* orientation, we recommend that small firm managers support an organizational culture in favor of monitoring customer preference and feedback by freely sharing customer information within the firm (across different departments) and then taking appropriate actions to respond to it. To cultivate *technology* orientation, we recommend that small firm managers establish organizational processes that focus on acquiring the latest technologies, and then assimilating and utilizing these within the business practices. The presence of market and technology orientations allow the firm to realize the potential IT-based business value in supporting product innovation.

Furthermore, our findings also suggest that ITMA mediates the market orientation-ITEPI relationship, while ITFR mediates the technology orientation-ITEPI relationship. As a

result, small firm managers must understand that the impacts of market and technology orientations on ITEPI are neither automatic nor simple. It is not sufficient to simply promote market and technology orientations. Small firm managers need to devote considerable time and effort in utilizing IT to enhance firms' capacity of acquiring and analyzing market information (i.e. ITMA) and speeding up the firms' business processes (ITFR) (Yu *et al.*, 2019). More specifically, small firm managers can use the IT system to obtain and analyze customer data (e.g., service requests, browsing histories, etc.) and support the firm's actions (e.g., customized service) to satisfy customer needs. Small firm managers can also use the IT system to increase the speed of the firm's research and development (R&D) processes (e.g., investigate the choices of material, parts, production details, etc.) and product delivery (e.g., calculate the most time-saving delivery routes). These repetitive activities enable firms to develop corresponding IT support for core competencies for market accessing (ITMA) and improving functionality-related activities (ITFR), which contributes to the use of IT to improve product innovation processes (Snihur and Wiklund, 2019). In other words, by integrating IT in their decision making, small firms' managers can foster ITEPI through the pursuit of market and technology innovation (Benitez *et al.*, 2018). Given that small firms' managers face a lack of resources, the importance of combining both market and technology orientations (Laforet, 2008; Martin, Martin & Minnillo, 2009; Salavou, 2005) and the adoption of IT to improve business processes (Bruque & Moyano, 2007; Caldeira & Ward, 2003) becomes even more imperative.

Limitations and Future Research Opportunities

We acknowledge a number of limitations that suggest future research possibilities. First, the cross-sectional design of our study does not allow any definite conclusions to be drawn about the causal relationships among the variables over time. Therefore, we acknowledge that a set

of relationships among the variables in our study occurs simultaneously, rather than being a purely causal relationship (Holbert & Stephenson, 2002), as suggested by the literature. Future researchers might employ a longitudinal research design to empirically confirm this causality. Second, we only investigate two types of strategic orientation (market and technology orientations). This precludes the assessment of other types of strategic orientation such as entrepreneurial orientation, learning orientation, customer orientation, and others, which have been identified by prior scholars for their influence on firms' adoption of IT as a strategic tool. Future research should examine the influence of other types of strategic orientation towards IT-based product innovation strategy. For example, our research model could be developed and extended further to test the direct relationship between strategic orientation and IT-enabled product innovation to facilitate a more detailed comparison. In addition, researchers might use a knowledge-based view (KBV) to develop an extended model with other variables that are relevant for knowledge-intensive firms. Finally, we choose small firms as our empirical context to develop our theory. Furthermore, we collect data from a single industry – the high-tech industry, and a single country – the UK. Even though we believe that the results of our findings can be replicated in small firms in different industries or countries, and in large firms where the engagement of strategic orientations and use of IT to enhance product innovation are part of normal business processes, we still need to recognize that the generalizability of our findings might remain limited to firms within a specific firm size, industry, and country context. Future studies on the size of the firms, industries or countries other than our setting could help to generalize our findings and expand the research parameters.

Despite these limitations, this research contributes to our understanding of the important connection between strategic orientations and IT-based product innovation strategy in small

firms' settings and offers managerial implications for small firms' managers who wish to adopt IT-based product innovation strategies.

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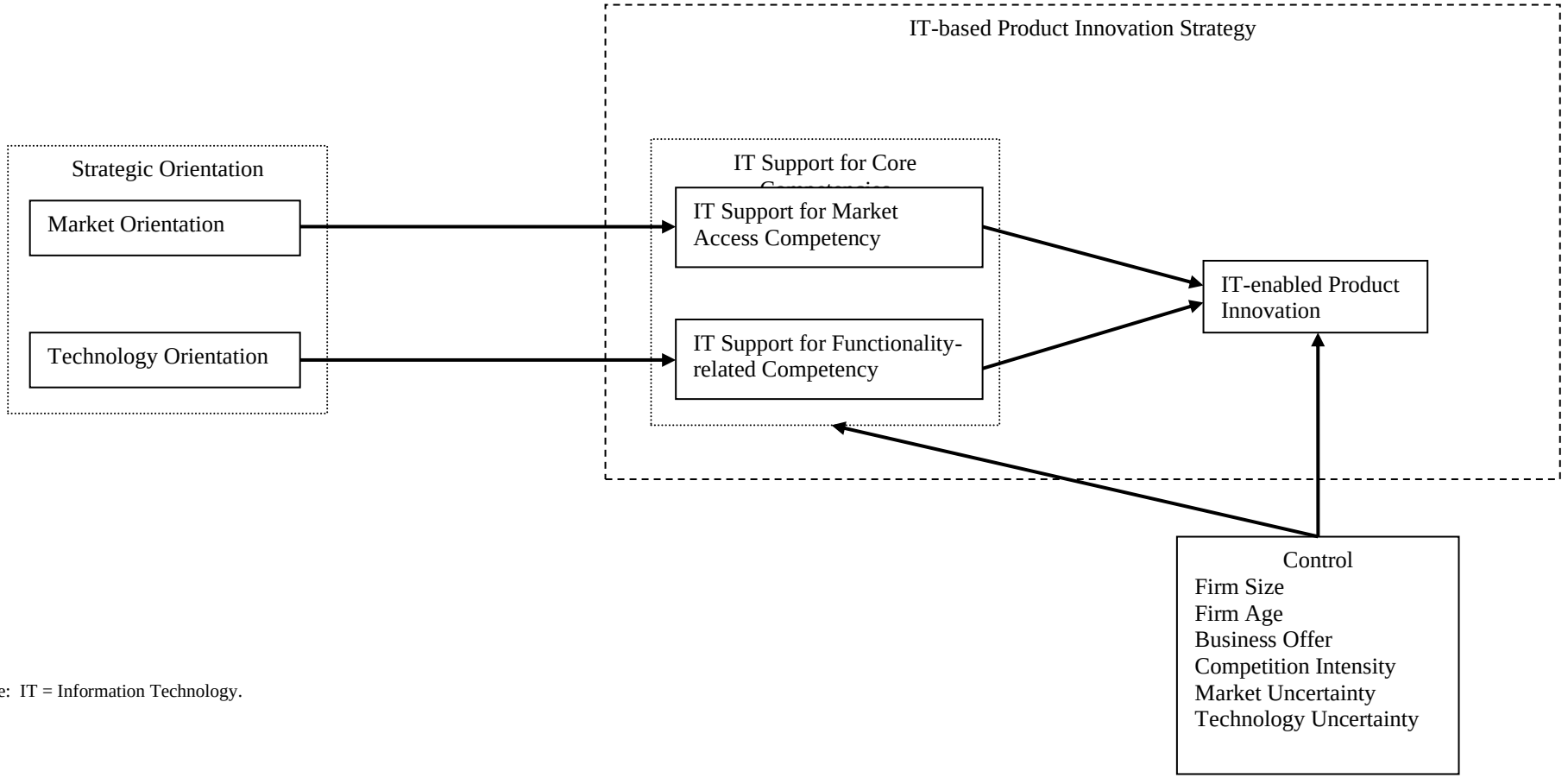
FIGURE 1. Theoretical Framework



Note: IT = Information Technology.

TABLE 1
Literature Review

Authors	Strategic Orientation and IT-based Strategy	Antecedents of using IT in Product Innovation	Incorporate IT in Product Innovation Processes	Context
Chan, Huff, Barclay and Copeland (1997)	Fit between business strategic orientation and information system strategic orientation improves the impacts of the information system.	-----	-----	Mixed firms
Clark, Cavanaugh, Brown and Sambamurthy (1997)	A highly skilled IT workforce with an entrepreneurial orientation toward leveraging technological knowledge into business applications enables firms to develop change-readiness IT capabilities.	-----	-----	Large firms
Celuch, Kasouf and Peruvemba (2002)	Connection between perceived learning orientation and assessed information system capabilities.	-----	-----	Mixed firms
Chaston, Badger, Mangles and Sadler-Smith (2003)	Firms that adopt a relationship market orientation tend to have established knowledge management systems and be involved in e-commerce.	-----	-----	Mixed firms
Luo and Seyedian (2003)	Customer orientation strategy is related to satisfaction with Internet storefronts.	-----	-----	E-commerce customers
Jayachandran, Sharma, Kaufman and Raman (2005)	Customer relationship orientation can lead to relational information processes and customer relationship performance, while customer relationship management technology performs a supportive role.	-----	-----	Managers from large firms
Banker, Bardhan and Asdemir (2006)	-----	-----	Collaboration software on product design and development is associated with substantial cost savings, improvements in product design quality, design turnaround time, greater design reuse, and lower product design documentation and rework costs.	Large firms
Hsieh, Lai and Shi (2006)	Information orientation could also significantly influence e-business adoption.	-----	-----	Small-medium firms
Pavlou and El Sawy (2006)	-----	-----	The effective use of IT functionalities by business units can support new product development capabilities.	Product managers from mixed firms
Bartel, Ichniowski and Shaw (2007)	-----	-----	The adoption of IT promotes product customization and innovation.	Plant level
Barczak, Sultan and	-----	Project risk, existence of a champion, and IT embeddedness positively affect the extent of IT usage for	-----	PDMA members from

Hultink (2007)		new product development.		mixed firms
Chen (2007)	-----	-----	Information technology can improve cross-functional team interaction, which leads to new product development performance	Medium-large firms
Zammuto, Griffith, Majchrzak, Dougherty and Faraj (2007)	-----	-----	Using software to quickly recombine components in new and innovative ways to develop new products and services.	Conceptual

Note: IT = Information Technology; N/A = Not Applicable; Mixed firms = includes different sizes of firm; PDMA = The Product Development and Management Association.

TABLE 1
Literature Review (Continued)

Authors	Strategic Orientation and IT-based Strategy	Antecedents of Using IT in Product Innovation	Incorporate IT in Product Innovation Processes	Context
Barczak, Hultink and Sultan (2008)	-----	The effects of IT infrastructure, IT embeddedness, new product development process formalization, colocation, outsourcing of new product development projects, and length of time on the job on the extent of IT usage in new product development varies by country.	-----	Mixed firms
Dibrell, Davis and Craig (2008)	-----	Strategic emphasis placed on product and process innovation positively impacts IT investment.	-----	Small-medium firms
Wang and Ahmed (2009)	External pressure and perceived benefits are predictors of e-commerce adoption. The strategic orientation of family businesses will function as a moderator in such a process.	-----	-----	Small-medium firms
Ordanini and Rubera (2010)	The firm's innovative orientation is positively associated with the performance of IT innovators after the application of e-commerce.	-----	-----	Small-medium firms
Durmuşoğlu and Barczak (2011)	-----	-----	The positive effect of these IT tools in different phases of the new product development process.	Large firms
Kawakami, Durmuşoğlu and Barczak (2011)	-----	Strategic factors, market environment factors, development process factors, organizational factors, and technology-human interaction factors are likely to influence IT usage for product development.	-----	large-sized firms
Kim, Basu, Naidu and Cavusgil (2011)	Customer orientation has a positive impact on customer relationship management technological capabilities.	-----	-----	Mixed firms
Tallon (2011)	----	Strategic alignment in IT support supplier-relation and IT support production and operations will lead to product and service enhancement.	-----	Large firms
Trainor, Rapp,	Market and technology orientations lead to the development of e-marketing capability.	-----	-----	Mixed firms

Beitelspacher and Schillewaert (2011)				
Bendoly, Bharadwaj and Bharadwaj (2012)	-----	-----	The effects of both internal and external coordination on market intelligence and supply-chain intelligence are moderated by the firm's information system capability, which improves new product development performance.	Large firms
Dougherty and Dunne (2012)	-----	-----	Digitalization creates a new form of knowledge that provides essential complementary insights for complex product innovation.	Product managers from mixed firms
Voola, Casimir, Carlson and Agnihotri (2012)	Market orientation influences the e-business adoption.	-----	-----	Mixed firms
Nambisan (2013)	-----	-----	Different roles that IT plays to either trigger or enable innovation process and impacts.	Conceptual
Kawakami, Barczak and Durmuşoğlu (2015)	-----	An executive champion for IT and global engagement are predictors of both IT tool use and replacement frequency while organizational innovativeness contributes only to IT tool replacement frequency.	Both IT tool use and replacement frequency have a positive effect on new product development task proficiency, which improves new product development performance.	Medium-large firms

Note: IT = Information Technology; N/A = Not Applicable; Mixed firms = includes different sizes of firm; PDMA = The Product Development and Management Association.

TABLE 2
Sample

Firm Age	Number of Firms
Less than 10 years	122
11 years ~ 20 years	93
More than 21 years	30
Firm Size	
Less than £200,000	105
£200,001-£400,000	33
£400,001-£600,000	31
£600,001- £800,000	15
£800,001-£1,000,000	15
£1,000,001 ~ £2,000,000	17
More than £2,000,001	29
Business Offer*	
Product	56
Service	189

Note: *The sample is obtained from single industry context (high-tech industry).

TABLE 3
Descriptive Statistics

	1	2	3	4	5	6	7	8	9	10	11
1. Firm Size	---										
2. Firm Age	.306*	---									
3. Business Offer	.009	.079	---								
4. Competitive Intensity	-.049	.055	.062	---							
5. Market Uncertainty	.048	.043	.140*	.303*	---						
6. Technology Uncertainty	-.051	-.018	.247*	.147*	.192*	---					
7. IT Support for Market Access Competency	.109	.057	.293*	.171*	.198*	.348*	**.856**				
8. IT Support for Functionality-related Competency	.057	.023	.289*	.151*	.186*	.404*	.654*	**.737**			
9. Market Orientation	.047	.001	.061	.319*	.364*	.308*	.323*	.387*	**.709**		
10. Technology Orientation	.135*	.047	.265*	.144*	.188*	.441*	.419*	.552*	.544*	**.727**	
11. IT-Enabled Product Innovation	-.038	.044	.177*	.097	.129*	.285*	.398*	.571*	.326*	.437*	**.775**
Mean	2.873	2.347	0.771	3.657	3.155	4.110	4.444	4.024	3.467	3.748	3.888
Standard Deviation	2.163	0.671	0.421	1.074	1.020	0.914	0.692	0.766	0.816	0.785	0.756
Composite Reliability	---	---	---	---	---	---	.892	.776	.751	.816	.816
Average Variance Extracted	---	---	---	---	---	---	.733	.543	.503	.529	.600

Notes: N = 245; *p < .05.
IT = Information Technology.
Average Variance Extracted (AVE) square root is shown in bold on the correlation matrix diagonal.
Firm size is measured as annual revenue: 1 = Less than £200,000; 2 = £200,000-£400,000; 3 = £400,000-£600,000; 4 = £600,000- £800,000; 5 = £800,000-£1million; 6 = £1million-£2million; 7 = More than £2 million
Firm age is measured as natural logarithm (number of years since establishment).
Business offer is measured as a firm's main business offer: 0 = service; 1: product.

TABLE 4
Data Analysis

	Model 1	**Model 2**	**Model 3**	**Model 4**
Outcome Variable:	ITMA	ITFR	IT-enabled Product Innovation	
Control Variables:				
Firm Size	.035(1.794)†	.004(.189)	-.033(-1.533)	-.038(-1.955)†
Firm Age	.007(.114)	-.013(-.204)	.064(.944)	.067(1.081)
Business Offer	.357(3.670)***	.228(2.279)*	.096(.869)	-.029(-.292)
Competitive Intensity	.035(.887)	.033(.830)	-.030(-.691)	-.010(-.255)
Market Uncertainty	.018(.430)	.031(.729)	-.017(-.361)	.010(.232)
Technology Uncertainty	.168(3.599)***	.142(2.838)**	.090(1.701)†	.008(.166)
Predictor:				
Market Orientation	.177(3.205)**		.205(3.304)**	
Technology Orientation		.418(7.099)***		.181(2.830)**
Mediator:				
IT Support for Market Access Competency (ITMA)			.319(4.468)***	
IT Support for Functionality-related Competency (ITFR)				.466(7.274)***
Constant	2.562(9.501)***	1.501(5.354)***	1.423(4.081)***	1.281(4.375)***
Model Statistics				
F-Value	10.415	18.719	8.696	16.528
P-Value	.000	.000	.000	.000
R-Square	.235	.356	.228	.359
Statistic Inference				
Model 1 and Model 3: Indirect Effect = .056* BLLCI (.206) ~ BULCI (.108)		**Model 2 and Model 4:** Indirect Effect = .195* BLLCI (.129) ~ BULCI (.280)		

Notes: N = 245; *** p < 0.001; ** p < 0.010; * p < 0.050; † p < 0.100.
Standardized Coefficients are reported with t-value in parentheses.
Bootstrap N = 10000; BLLCI = bootstrap lower-level confidence interval; BULCI = bootstrap upper-level confidence interval.

APPENDIX A
Measurement and Factor Loading

Measurement	Loading*
IT support for core competencies (Ravichandran & Lertwongsatien, 2005; Wang, Liang, Zhong, Xue & Xiao, 2012)	
IT Support for Market Access Competency	
We use information systems to enhance our responsiveness to customer service requests	.811
We use information systems to provide necessary information to customers	.875
We use information systems to help to satisfy customer needs	.881
IT Support for Functionality-related Competency	
We use information systems to increase the speed of our research on new products	.566
We use information systems to increase the speed of our new product development	.805
We use information systems to increase the speed of our product delivery	.812
Strategic Orientation (Kim, Im & Slater, 2013; Slater & Narver, 1995; Zhou, Yim & Tse, 2005)	
Market orientation	
Our business objectives are driven primarily by customer satisfaction	----
We constantly benchmark ourselves with our competitors	.714
We regularly share information concerning competitors' strategies within our business	.749
We rapidly respond to competitive actions that threaten us	.661
Technological orientation	
Our business unit uses sophisticated technologies in its new product development	.622
Our business unit uses the latest technologies in new product development	.712
Our products are at the leading edge of the industry standard	.749
Our business unit uses systematic scanning for new technologies inside and outside the industry	.812
IT-Enabled Product Innovation (Tallon, 2011)	
The use of IT in our business decreases the cost of designing new products	.695
The use of IT in our business reduces the time-to-market for new products	.893
The use of IT in our business supports product innovation	.721

***** Factor loadings are standardized; IT = Information Technology

--- delete due to low fit