



# The role of ICT and innovation in enhancing organizational performance: The catalysing effect of corporate entrepreneurship



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## ABSTRACT

Information and communication technologies (ICT)-based innovations and applications have become major drivers of enhanced organizational performance, economic growth, and social change. However, although the body of research that is pertinent to this area has substantially grown, the importance of complementary factors such as corporate entrepreneurship in enhancing the impact of technological innovation on organizational performance has yet to be addressed. This paper develops and tests a framework that depicts and examines the nature of the relationship between ICT-adoption/use and organizational performance in the Lebanese market, taking into consideration the impact that corporate entrepreneurship may have on this relationship. PLS is used to test the proposed relationships along with the significance of the mediation effect of corporate entrepreneurship. A multigroup analysis is also deployed to examine the impact of ICT-use level on the model. The proposed model is proven to be fit, the hypotheses are supported, and the implications are discussed.

## 1. Introduction

Over the past three decades, the research has shown that organizations initiate corporate entrepreneurship to add to their body of knowledge to facilitate increased revenues (Mcgrath, Venkataraman, & MacMillan, 1994), improved profitability (Zahra, 1993), enhanced competitiveness (Kuratko, Covin, & Garrett, 2009), and innovativeness (Ferreira et al., 2015) as an important potential growth driver (Burgelman & Doz, 2013; Morris, Kuratko, & Covin, 2011; Soriano & Huarng, 2013). This warrants a deeper understanding of corporate entrepreneurship in organizational settings, especially the role it plays in enabling ICT and innovation to be well integrated into an organization's resources and strategies and consequently drive organizational performance to higher levels.

The rapidly changing business environment has led to increased reliance on ICTs to attain and maintain competitiveness, improve profitability, and succeed in today's dynamic market (Shamsuzzoha et al., 2012; Stanimirovic, 2015). This has been a driver of innovation-related activities, all of which tend to be technology-based (Siegel, 2011) and are designed to obtain better efficiency and higher performance (Consoli, 2005; Ferreira et al., 2015; Igun, 2014). However, despite the wide adoption of ICT by organizations in various sectors, several survey reports have found that many projects fail. In 2012, Gartner reported that fewer than 30% of information systems projects such as Business Intelligence meet their business objectives (Saran,

2012) and that 55 to 75% of enterprise resource planning (ERP) projects encounter failure in meeting their intended objectives, with 74.1% of them exceeding costs and 50% not realizing enough benefits (Jacobs, 2012). More recently, according to a study by KPMG, 70% of businesses suffered project failures during 2014, and 50% failed to achieve their intended goals (Amankwah-Amoah, 2016; Erel, 2014).

The above outcomes drive us to question the proper use of the adopted ICT in organizations. According to Kusumaningtyasa and Suwartob (2015) ICT adoption is defined as the “willingness to take the new innovation related to computer and internet”. In fact, the usage of ICT is defined by Blurton (2002) as the “diverse set of technological tools and resources used to communicate and to create, disseminate, store, and manage information”. Accordingly, Manochehri, Al-Esmail, and Ashrafi (2012) state that to benefit from ICT adoption, organizations should provide needed infrastructure and hire skilled ICT personnel. In other words, the necessary means to make effective use of the adopted ICT should be available for it to contribute positively to organizational performance.

The above suggestions draw attention to the importance of having certain complementary factors in an organization to enable better use of ICT and accordingly reaping its benefits towards creating innovative business opportunities and achieving competitive advantage. In this regard, entrepreneurs' ideas and actions are needed to capture the business opportunities made possible by ICT and the resulting innovations; thus, entrepreneurs need to be proficient in the language of

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technology, i.e., in matching technological potential with market changes, new customer needs, emerging problems, and possible opportunities.

This finding sheds light on the importance of examining the extent to which innovation and entrepreneurship can enhance the role played by ICT in galvanizing organizational performance. The previous studies have examined the relationship between ICT adoption and/or use and innovation. The previous research has also studied the role played by corporate entrepreneurship in enhancing organizational performance. While the importance and value of entrepreneurial strategies and actions have been highlighted (Covin & Miles, 1999; Mortara, Napp, Ford, & Minshall, 2011), understanding how corporate entrepreneurship interacts with organizational resources, such as ICT and innovation, has yet to be addressed. This could be attributed to the fact that corporate entrepreneurship has the necessary elements needed by organizations to achieve higher performance and productivity in the rapidly changing global economy (Kuratko & Audretsch, 2013). The previous studies have also examined the relationship between innovation and entrepreneurship (Rosenbusch, Brinckmann, & Bausch, 2011; Zhao, 2005) and reported the importance of entrepreneurial strategies in the achievement of competitive advantage (Roaldsen & Borch, 2011). However, to the best of the authors' knowledge, there is a lack of studies integrating, in the context of a holistic framework, the impact of ICT and ICT-based innovations on organizational performance, taking into consideration the role of corporate entrepreneurship in this relationship.

Taking the Lebanese market into consideration, the purpose of this research is threefold. Drawing on a sound theoretical framework, the first purpose of the study is to propose a holistic and integrated model that explains the relationship between ICT adoption and/or use and organizational innovation levels on one hand and organizational performance on the other. This is important because different companies have different ICT investment strategies, ICT resources, diffusion levels, and innovation capacities (Anaya, Dulaimi, & Abdallah, 2015; Coltman, Tallon, Sharma, & Queiroz, 2015). The second purpose is to examine the role that corporate entrepreneurship may play in the above relationship. This is crucial as it will allow the identification of the means to eliminate or mitigate the impact of the pitfalls that may hinder the efforts to capitalize on the opportunities made possible by ICT capabilities and innovation. Incorporating corporate entrepreneurship into the model is based on a synthesis that will draw upon a review of both the theoretical and empirical research pertinent to ICT, innovation, and corporate entrepreneurship. The third purpose is to assess the impact of ICT on this relationship. The significance of this purpose stems from the fact that technology adoption, i.e., investing in and purchasing IT, cannot be equated with technology use (Lanzolla & Suarez, 2012). Rattner (2014) contends that adopting technology for the mere sake of its adoption is a waste of resources. The author reported case examples of social entrepreneurs successfully using information and communication technologies that helped them to create social impact.

Emphasizing a holistic and dynamic framework linking ICT adoption and/or use, innovation and corporate entrepreneurship to a firm's competitiveness level makes this study useful for academicians, government analysts, ICT developers and strategists, as well as information and innovation specialists. To begin, academicians can use the framework as a foundation for assessing the contribution of each of the four factors that enhance organization performance. Moreover, the flexibility of the model allows it to be used as an integrated tool, or it can be deployed to examine certain selected relationships. In addition, the study can facilitate the understanding of companies' different performance and competitiveness levels. The model will further help ICT managers and decision makers to consider the various challenges and opportunities posed by the new computing models, including wireless and mobile computing, cloud computing, and social media (Buyya, Ranjan, & Calheiros, 2009). Finally, ICT designers and developers will find the study useful in supporting firm strategy-technology fit as it

allows for examination of the impact of every innovation and/or ICT strategy or tool on a company's competitiveness objectives. With the aforementioned purpose in mind, the study addresses the following questions:

- What is the relationship between ICT adoption and/or use and innovation level on one hand and a firm's corporate entrepreneurship and performance on the other?
- How does innovation affect the ICT adoption and/or use—performance relationship?
- How does corporate entrepreneurship affect the ICT adoption and/or use -and -innovation relationship with organizational performance?
- How does ICT use affect the relationships among ICT adoption, innovation, corporate entrepreneurship, and organizational performance?

The remainder of the paper is organized as follows: The previous studies examining ICT adoption and/or use, corporate entrepreneurship, and organizational performance are reviewed. The theoretical frameworks underlying our proposed model and hypothesis are discussed. Next, we describe the research methodology used and present the results of the data analysis. This is followed by a presentation of a discussion about the results. Finally, the study conclusion, limitations as well as implications and recommendations for future research and practice are presented.

## 2. Theoretical framework

Two theoretical frameworks underpin this research as follows: (1) the dynamic capabilities view (DCV) (Teece, Pisano, & Shuen, 1997), and (2) the theory of Innovation Translation. The dynamic capabilities view endeavours to find sources of value creation and realization – i.e., capabilities – in rapidly changing environments, thus driving a company to better allocate resources and achieve a sustainable competitive advantage (Eisenhardt & Martin, 2000; Teece et al., 1997). Teece et al. (1997) define dynamic capabilities as ‘the ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments’. The dynamic capabilities view attempts to explicitly show how resources can be developed, integrated, and released within a firm using a process approach; it acts as a buffer between firm resources and the changing business environment. Dynamic resources help a firm adjust its resource mix, thereby maintaining the sustainability of its competitive advantage, which otherwise might quickly erode.

The applicability of this view to the information systems research stream has been demonstrated by several researchers (Braganza, Brooks, Nepelski, Ali, & Moro, 2017; Daniel & Wilson, 2003; Wade & Hulland, 2004). Wade and Hulland (2004) considered information systems (IS) to be resources with many features that are pertinent to dynamic capabilities. This stems from the fact that ICT and IS can profoundly support organizations operating in dynamic and rapidly changing markets and conditions. The dynamic capabilities view has been used by many studies examining the contribution of ICT to firm value (e.g., Cepeda & Vera, 2007; Kindstrom, Kowalkowski, & Sandberg, 2013; Rohrbeck, 2010; Tian, Wang, Chen, & Johansson, 2010). ICT helps in the generation, integration, development, and enhancement of key resources over time. E-business, E-commerce, new production methods, new services, new business models, and effective ways for better supply-chain management, customer relationship management, and decision support are some of the many ways that ICT manifests its dynamic capabilities features. This conforms to the theory of innovation (Schumpeter, 1934), which holds that organizations can achieve economic gains and attain competitive advantage by introducing successful innovations and innovatively managing their resources (Davicik & Sharma, 2016). This can be accompanied by a steady

learning process (Gomez, Cespedes-Lorente, & Valle-Cabrera, 2005) and the seizing of new opportunities (Kogut & Zander, 1992), acquiring knowledge from all reachable resources (Prahalad & Hamel, 1990), and thus making appropriate decisions.

The above discussion applies well to the current study. Today, ICT and innovation play a very important role in seizing different opportunities to accomplish a firm's action plans and strategic objectives, including operational excellence, introducing new products and services, and customer intimacy (Treacy & Wiersema, 1993). These are opportunities that, if well planned and managed, can enhance a firm's performance and move it forward.

Informed by Actor Network Theory (Callon & Latour, 1981; Latour, 1992), the theory of Innovation Translation (Law, 1992) emphasizes the core issue, namely, translation. Singleton and Michael (1993) define innovation translation as “the means by which one entity gives a role to others” (p. 229). Viewing technological changes as socio-technical projects, the theory involves both human and non-human entities as the main actors (Law, 1987). As a translation, innovation moves across space and time in the hands of people who utilize it in different ways for different purposes (Latour, 1996). Depending on how people use and react to such innovation, the innovation is either modified, accepted as-is, or dropped. Accordingly, the adoption of the innovation comes as a consequence of the actors' reactions to it and how they shape it after ‘translation’ into a form that is appropriate for use by the potential adopter (Tatnall & Davey, 2007). Tatnall (2009) argues that innovation translation theory should be given a more important role in any research related to the successful adoption of an information system by an organization. Additionally, in his work, Tatnall (2011) concludes that innovation translation theory better explains in detail how individuals and specific organizations adopt technological innovations. The previous IS research has examined the process of innovation in various contexts. Examples include the process of information system curriculum innovation (Tatnall & Davey, 2001), the effect of product innovation on the financial performance of cell phone firms in Kenya (Muchoki, 2013), the role that the dynamics of the innovation process have in the humanitarian sector (Tusiime & Byrne, 2011), and the human and social issues involved in organizational decision-making, which offers a suitable approach to innovation modelling in organizations (Underwood & McCabe, 2012).

The theory fits well with the current study's objective as innovations continuously change, providing adopters with a vast array of opportunities. The adopters within their decision-making realm and entrepreneurial spirit make use of such opportunities (González et al., 2017; Mortara et al., 2011) to enhance their organization's value and competitiveness level. Based on the above discussion, the conceptual model of the study can be depicted as follows (Fig. 1).

The model is referred to as the IIE model, which corresponds to the ICT use, Innovation level, and Entrepreneurial behaviours (Corporate Entrepreneurship) in an organization. The figure shows a Venn diagram of two entities: ICT and ICT-based innovations. The intersection of the two diagrams reveals the opportunities made possible through ICT use and the innovations adopted in the organization. Managers with entrepreneurial spirit seize such opportunities, manage resources, and deploy ICT resources and innovations to foster the organization's growth and competitive advantage.

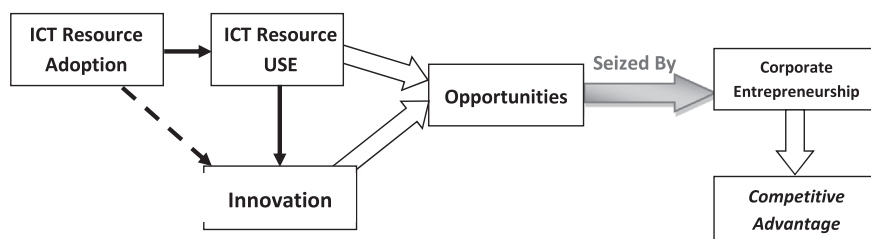


Fig. 1. ICT-innovation-entrepreneurship (IIE) model.

Examining the body of literature shows that the previous studies about entrepreneurship have been conducted at the individual firm and macro levels. A summary of this literature, as presented by Wennekers and Thurik (1999), is depicted in Fig. 2.

As shown in the figure, economic growth and competitiveness are associated with essential entrepreneurship elements (decision making, opportunity recognition and creation, actions and investments). Our research is pertinent to the firm level, and we adapted the figure to include three factors that are pertinent to this study: ICT adoption and/or use, innovation, and firm performance.

### 3. Literature review and hypotheses

Firm-level studies provide evidence of the benefits of ICT use (Brynjolfsson & Saunders, 2010). ICT helps firms gain market share and raise overall productivity (Bayo-Moriones & Lera-López, 2007; Cardona, Kretschmer, & Strobel, 2013; Tran, Zhang, Sun, & Huang, 2014). Moreover, ICT may help a firm introduce new products and services, be more customer oriented, and respond better to market changes – in other words, to innovate (Hall, Lotti, & Mairesse, 2013; Koellinger, 2008; Tran et al., 2014; Van Ark & Piatkowski, 2004). In addition, the use of ICT may contribute to efficiency in operations and inventory management as well as to the integration of activities and thus lead to productivity improvement (Igun, 2014; Liao, Tseng, & Ho, 2015).

Moreover, studies at the firm level reveal an important explanation of the relationship between ICT use and performance. Technology adoption is only important if it truly leads to performance improvements and, as such, we argue that the proper criteria by which to judge whether an ICT investment has been successful rest not simply in determining whether an organization adopts a technology, but whether the technology application (i.e., use) actually improves performance. ICT by itself cannot contribute to significant performance improvement or sustainable competitive advantage if organizational resources and work processes are not improved or changed to enable ICT to promote organizational performance (Brynjolfsson & Saunders, 2010; Koellinger, 2008). Thus, in conformity with the dynamics capabilities view of the firm, ICT contributes to organizational performance through its use to enhance efficiency and innovation (Cofriyanti & Hidayanto, 2013; Melville, Kraemer, & Gurbaxani, 2004; Yu, Dong, Shen, Khalifa, & Hao, 2013). Brynjolfsson (1993) found that ICT enhances performance through its innovative use and application. Hence, we posit the following hypotheses:

#### ICT use

H1a. ICT use is positively related to Organizational performance.

H1b. ICT use is positively related to innovation.

H3a. Innovation mediates the relationship between ICT use and Performance.

#### ICT adoption

H2a. ICT adoption is positively related to Organizational performance.

H2b. ICT adoption is positively related to innovation.

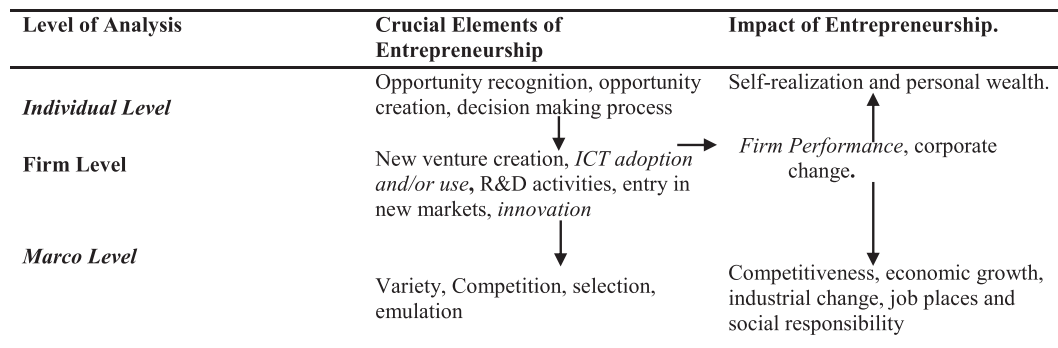


Fig. 2. Entrepreneurship-individual, firm, and macro level. Source: Adapted from Wennekers and Thurik (1999).

**H3b.** Innovation mediates the relationship between ICT adoption and Performance.

**H4.** ICT use moderates the above relationships.

In examining the relationship between innovation and corporate entrepreneurship, the concept of change cannot be ignored. Change is a constant factor in business environments. It enables opportunities to emerge and the well-being of industries and firms to be promoted (Schumpeter, 1934). Technology is an agent of change (Markus & Robey, 1988), and as such, IT – a general purpose technology – creates opportunities that can be seized by and from which organizations with corporate entrepreneurship can benefit (Cassia, Minola, & Paleari, 2011). This applies to organizations in both technology-adopting and technology-producing businesses.

Over the past two decades, several changes and developments have been generated by technological advancements and scientific inventions and discoveries. Accordingly, technology is considered one of the main factors that foster entrepreneurship (Dosi, 1982). This is because ICT provides a vast array of opportunities that can be taken and developed by entrepreneurial organizations (OECD, 2003; Stam & Garnsey, 2007). Examples of such opportunities include e-business, internet-of-things services, virtual offices, effective customer relationship management, efficient supply-chain management, continuous communication with internal and external stakeholders, and better access, management, and controlling of resources. Still another example is that ICT enables the testing of different situation and decision-making scenarios, learning, the generating of effective business plans, accessing databases, and enhancing communication and social networking. As these opportunities increase, strong and dynamic corporate entrepreneurship is also needed to seize the benefits of ICT by integrating them into organizational strategies and creating the right corporate culture for ICT adoption, use, and innovation diffusion. With this in mind, the following hypotheses can be posited:

**H5a.** ICT adoption is positively related to entrepreneurship.

**H5b.** ICT use is positively related to entrepreneurship.

With regard to innovation and corporate entrepreneurship, the two can be related. Innovation can be defined as a process that enhances an organization's value chain and value web through the development of new products, services, work procedures, solutions, and methods of commercialization (Covin & Slevin, 1991; McFadzean, O'loughlin, & Shaw, 2005). If it is well managed and supported, technological innovation can contribute to higher levels of economic output and help to create and develop new goods and services. The research in the area of innovation at the firm level has reported the importance of corporate entrepreneurship in exploiting innovation opportunities (Covin & Miles, 1999; Mortara et al., 2011) and promoting growth and development (Naudé & Szirmai, 2013). Without corporate entrepreneurship efforts, an organization's innovation capacity will be neither well exploited nor

enhanced (Thornberry, 2001; Zahra, 1995). Accordingly, the two concepts of innovation and corporate entrepreneurship are strongly related (Mortara et al., 2011). Amit, Glosten, and Muller (1993) state that innovation and corporate entrepreneurship must be linked to each other because, in a business environment, an innovation process that is associated with resource deployment for wealth production is pivotal in the apprehension of entrepreneurship. Corporate entrepreneurship is in fact needed to foster innovation and enhance its contribution to a firm's competitive advantage. The relationship between innovation and corporate entrepreneurship can be better understood and conceptualized by using Miller's (1983) entrepreneurial dimensions. The main dimensions are innovativeness, risk taking, changes in technology, and proactiveness.

To begin, innovativeness is a crucial dimension of corporate entrepreneurship (Miller, 1983). In fact, both innovativeness and entrepreneurship indicate innovation in products, services, markets, business processes, and business models (Mortara et al., 2011). This presents beneficial new opportunities that should be taken by the organization's entrepreneurs. Another dimension is risk taking. Change entails risk, and innovation implies change (Mortara et al., 2011). Innovation implies change, and change entails risk (Mortara et al., 2011). While entrepreneurs are expected to be characterized by high risk-propensity levels (Brockhaus, 1980), they are nevertheless motivated to achieve high profits and growth. Accordingly, risk assessment and management are needed (Norton & Moore, 2006) to better use innovations and reap their benefits. A third dimension is technological change. Organizations aiming at sustainable competitive advantage appreciate the value of relevant technological changes and invest in them.

These changes present opportunities, challenges and a certain level of risk (Mortara et al., 2011) that require corporate entrepreneurship's management to obtain better performance levels. Finally, there is the proactiveness dimension, which is described by Miller (1983) as opportunity seeking by responding to the market ahead of the competition. An innovative company is a proactive company that makes use of innovations to initiate strategies for new products, services, and business models to outperform the market competition. Thus, a strong relationship between innovation and entrepreneurship can be assumed:

**H6a.** Innovation is positively related to entrepreneurship.

**H6b.** Innovation mediates the relationship between ICT use and entrepreneurship.

**H6c.** Innovation mediates the relationship between ICT adoption and entrepreneurship.

Finally, the literature that is pertinent to entrepreneurship implies a positive relationship between entrepreneurship and economic growth (Baumol & Strom, 2007; Holcombe, 1998). This is expected as we are living in a digital age and a global economy, where competition among

**Table 1**  
Relationships and supporting theories.

Relationships	Supporting theory	Hypothesis derived
ICT → performance	Dynamic capabilities	<b>H1a:</b> ICT use is positively related to Organizational performance. <b>H2a:</b> ICT adoption is positively related to Organizational performance.
Entrepreneurship → performance	Dynamic capabilities	<b>H7:</b> Corporate entrepreneurship is positively related to organizational performance.
ICT → innovation → performance	Dynamic capabilities	<b>H3a:</b> Innovation mediates the relationship between ICT use and Performance. <b>H3b:</b> Innovation mediates the relationship between ICT adoption and Performance.
ICT → entrepreneurship → perf.	Dynamic capabilities	<b>H8:</b> Corporate Entrepreneurship mediates the relationship between ICT and performance.
Innovation → entrepr. → perf.	Dynamic capabilities	<b>H9:</b> Corporate Entrepreneurship mediates the relationship between Innovation and performance.
ICT use as moderator for all relationships in IT adoption model	Dynamic capabilities	<b>H4:</b> ICT use moderates the above relationships
ICT → corp. entrepreneurship	Innovation translation	<b>H5a:</b> ICT adoption is positively related to entrepreneurship. <b>H5b:</b> ICT use is positively related to entrepreneurship.
Innovation → corp. entrepreneurship	Innovation translation	<b>H6a:</b> Innovation is positively related to entrepreneurship.
ICT → innovation → entrepreneurship	Innovation translation	<b>H6b:</b> Innovation mediates the relationship between ICT use and entrepreneurship. <b>H6c:</b> Innovation mediates the relationship between ICT adoption and entrepreneurship
ICT → innovation	Innovation translation	<b>H1b:</b> ICT use is positively related to innovation <b>H2b:</b> ICT adoption is positively related to innovation.

organizations and economies has become knowledge-based (Naudé & Szirmai, 2013). The connection between economic growth and entrepreneurship stems from the fact that organizations with corporate entrepreneurship, which is supported by ICT, innovation atmosphere, and innovation opportunities, recognize that ideas that are developed earlier can become the basis for a new process, good, or service. According to Holcombe (1998), entrepreneurship is the main driver of economic growth, as entrepreneurial insights act as the basis for other entrepreneurial insights, thus propelling the growth process. In a similar vein, Desoto (1989) viewed entrepreneurship as a powerful means for transferring technology and new ideas into an economy, thus enhancing its competitiveness (Desoto, 1989, as adapted from Burnham, 2006). Burnham (2006) and Kuratko and Menter (2017) contended that this is only possible when it is enabled by supportive institutional policies and laws, as regulatory hurdles may make it extremely difficult to launch a new business or idea. This may be the answer to the question of why asymmetry is observed in innovation absorptive capacity and hence economic growth and competitiveness across countries, that is, the great divide between developed and developing countries with regard to the more efficient use of existing knowledge and available technologies (Parente & Prescott, 1999). At the firm level, studies have reported a direct relationship between entrepreneurship and performance (Chen, Wang, Nevo, Benitez-Amado, & Kou, 2015; Knight, 1997; Zahra, Jennings, & Kuratko, 1999). The impact of corporate entrepreneurship as a strong enabler for the development of new businesses or the renewal of existing ones has also been recognized by researchers (Chen et al., 2015; Sharma & Chrisman, 2007; Zahra, 1991). In fact, there has been a plethora of definitions of corporate entrepreneurship in scholarly articles. Echols and Neck (1998) view corporate entrepreneurship as a means to promote entrepreneurial spirit and behaviour within an organization. Other researchers (e.g., Berghman, Matthyssens, Streukens, & Vandenbempt, 2013) consider it to be responsible for the stimulation of innovation capacity within an organization. This is realized by examining potential opportunities, the proper acquisition and management of resources, and introducing new products and services. Entrepreneurial strategies can be a panacea for organizations aiming at achieving high performance levels and sustained competitive advantage (Ismail, 2012; Roaldsen & Borch, 2011).

**H7.** Corporate entrepreneurship is positively related to organizational performance.

Entrepreneurial strategies incorporate the processes and actions that examine and exploit opportunities that make innovative use of resources to achieve enhanced performance (Roaldsen & Borch, 2011).

Examples of such strategies may include new business process redesign, new relationships with various stakeholders, and the renewal of business platforms. Kuratko et al. (2009) described it as “a vision-directed, organization-wide reliance on entrepreneurial behaviour that purposefully and continuously rejuvenates the organization and shapes the scope of its operations through the recognition and exploitation of entrepreneurial opportunity” (p. 5). These strategies enable performance improvement and the achievement of sustained competitive advantage (Roaldsen & Borch, 2011). Accordingly, we can assume that ICT adoption and/or use and innovations contribute positively to organizational performance if the opportunities they make possible are appropriately exploited through entrepreneurial strategies, actions, and behaviours; i.e., corporate entrepreneurship. This paves the way for stating the following hypotheses:

**H8.** Corporate Entrepreneurship mediates the relationship between ICT and performance.

**H9.** Corporate Entrepreneurship mediates the relationship between Innovation and performance.

**H10.** Corporate entrepreneurship and innovation have a double mediation effect on the relationship between ICT use and Performance.

Based on the above, the research model can be depicted as follows:

To summarize, the proposed relationships, the underpinning theory for the stated relationship, and the corresponding hypotheses are listed in the following table (Table 1).

## 4. Methodology

### 4.1. Survey and data collection

This study employs a correlational design to examine the relationships among IT adoption and/or usage, innovation, and corporate entrepreneurship and to explore the potential causal impact of each of these factors on organizational performance. To examine these relationships, a survey instrument was designed, and measurement scales were developed and tested. For the pilot study stage, a draft questionnaire was constructed. The content validity of the scale was pre-tested, checked and improved with the help of five academics and two experts from the industry. The finalized questionnaire was then used to test the aforementioned hypotheses. The measurement scales in the used questionnaire consisted of items representing the respondents' attitudes and opinions about the ICT adoption and/or use, innovation level, corporate entrepreneurship, and performance in their

organizations. All items measuring these attitudinal variables used five-point Likert scale response formats (1 for Strongly Disagree, 5 for Strongly Agree).

Organizational performance measures can use both financial and nonfinancial measures, including profitability, market share, sales growth, overall performance, and stakeholder satisfaction (Lumpkin & Dess, 1996). Another useful performance measure is the “overall performance”, incorporating elements such as the organization's goals, objectives, and stakeholder satisfaction (Kirchhoff, 1977). In this study, a seven-item scale is used to measure performance. The respondents are asked to assess the performance of their organization relative to their competitors (McDougall, Covin, Robinson, & Herron, 1994). The ICT adoption and use scale has been used and validated in many research works such as Davis, Bagozzi, and Warshaw (1989), Rogers (1995), and Agarwal and Prasad (1998). More recently, Edmunds, Thorpe, and Conole (2012), Sangrà and González-Sanmamed (2010), and Aleke, Ojiako, and Wainwright (2011) deployed the ICT use scale in their agriculture- and education-related research. An eight-item scale based on the scale of measuring based on Gatignon, Tushman, Smith, and Anderson (2002) was used to measure the innovation orientation. Finally, corporate entrepreneurship was measured using a scale based on Zahra (1996). The items of the subscales are listed in Table 2 along with the results of the construct loadings and reliability. The results indicate that the scale and its subscale items have high loadings (> 0.5) and high reliability (Cronbach's  $\alpha > 0.7$ ) (Hair, Black, Babin, Anderson, & Tatham, 2006).

#### 4.2. Sample

To conduct the study, the target population was identified. It

consisted of employees and managers, both middle and senior level, working in organizations that had adopted ICT. These employees and managers were knowledgeable about the adopted and used ICT in their organization, the innovation orientation and entrepreneurial behaviours. A convenience sampling procedure was followed. The potential respondents were contacted by telephone or email and asked to participate. A total of 850 questionnaires were distributed with a cover letter that ensured the anonymity of answers and that included a brief explanation of the research. Out of the returned questionnaires, 374 were found to be usable, yielding a response rate of 44.0%.

The non-response bias was checked by contacting 18 non-respondents and asking their reasons for not participating in the study. A busy schedule was identified as the main reason. In addition, the demographics values were used to conduct a Chi-square ( $\chi^2$ ) test to allow for a comparison between those who responded early (within the first two weeks) and those who responded late (contacted several times and responded after 75 to 90 days). The test was not significant, indicating that those who responded late (having some of the non-respondents' characteristics) did not significantly differ from those who responded early. This provides additional evidence with regard to the non-response bias.

The sample was primarily male (63.6%) and relatively young (10.2% with age range of < 25 and 47.3% of 25–35). The sample consisted of 33.4% senior level managers and 27.8% middle managers. The average years of experience were 11.8 years, and the average number of years spent in the company was 7.6 years. Further, the majority of the respondents (40.4%) worked in organizations in the financial services industry followed by technology (16%), accounting (7.8%), commerce (6.1%), and hospitality (5.9%). Such a cross-industry sample fits the study purpose as companies in various sectors are

**Table 2**  
Factor loadings and reliability scores for ICT adoption, ICT use, innovation, corporate entrepreneurship, and performance items.

Construct	Items	Factor loadings	Cronbach
Information technology use (ICTUSE)	ICTUSE1 Frequent user of organization's ICT and IS	0.647	0.816
	ICTUSE2 I consider myself a frequent user of my organizations information technology and systems	0.889	
	ICTUSE3 ICT integration in work processes	0.803	
	ICTUSE4 Use ICT and IS capabilities	0.863	
Information technology adoption (ITADOP)	ITADOP1	0.664	0.757
	ITADOP2	0.704	
	ITADOP3	0.822	
	ITADOP4	0.780	
Innovation atmosphere (INVATM)	INVATM1 Pursuit of novel knowledge	0.773	0.883
	INVATM2 Search for latest technology	0.793	
	INVATM3 Investigation in various directions	0.799	
	INVATM4 Exploration of new areas	0.791	
	INVATM5 Discovery	0.779	
	INVATM6 Breakthrough improvements	0.838	
Innovation opportunities (INVOPR)	INVOPR1 Opportunities for product innovation are abundant in our industry	0.802	0.853
	INVOPR2 Opportunities for technological innovation are abundant in our industry	0.754	
	INVOPR3 High R&D spending in industry	0.811	
	INVOPR4 High R&D spending in company	0.849	
	INVOPR5 Our products/services require the adoption of new and different methods and procedures	0.753	
Corporate entrepreneurship (CENTRP)	CENTRP1 Dramatic changes in products and service mix over the past three years	0.771	0.884
	CENTRP2 Emphasis on major innovations in products and services over the past three years	0.844	
	CENTRP3 Tendency for high risk projects over the past three years	0.706	
	CENTRP4 Introduced new products and services over the past three years OR This company has emphasized taking bold, wide-ranging action in positioning itself and its product (services) over the past three years	0.784	
	CENTRP5 Strong commitment to research and development (R&D), technological leadership, and innovation	0.851	
	CENTRP6 Followed strategies that allow it to exploit opportunities in its external environment	0.825	
Organizational performance (PRFM)	PRFM1 Performance better than rivals	0.745	0.901
	PRFM2 High efficiency levels in operations	0.843	
	PRFM3 Productivity is high	0.885	
	PRFM4 Organization's market constantly growing	0.748	
	PRFM5 Employee satisfaction level is high in our organization	0.708	
	PRFM6 Customers are satisfied	0.750	
	PRFM7 Overall, company performance is high and improving	0.902	

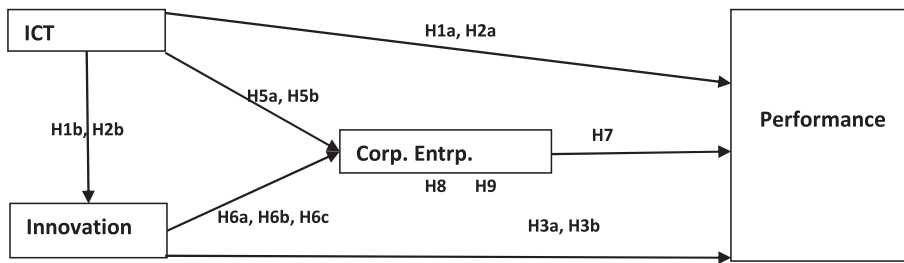


Fig. 3. Research model.

deploying ICT, using innovation in their processes, and seizing opportunities to be more customer-oriented and market-responsive. Finally, 80.7% of the responding companies had > 50 employees.

5. Results

5.1. Measurement instrument and construct measures

The scale consists of four parts including the demographics. The first part includes 8 items to measure the adoption and usage of ICT. These eight items fall under two categories of ICT adoption (ICTADP) and ICT usage (ICTUSE). The second part of the questionnaire involves 11 items that measure the firm's innovation level. Six items address innovation atmosphere (INVATM), and the others address innovation opportunities (INVOPR). Hence, the innovation construct (INNOV) is presented as a higher-order, multidimensional construct. To transform the construct INNOV into a first-order latent variable, a parcelling scheme was followed (Bagozzi & Edwards, 1998; Coffman & MacCallum, 2005). The weighted sum composite scores for parcelling were used as the indicators of the first-order latent construct (DiStefano et al., 2009; Landis et al., 2000). In this case, assigning items to a parcel is based on existing theory and rational judgement. Moreover, the third part of the questionnaire includes 6 items that measure the entrepreneurial orientation of the organization (CENTRP), and the fourth part of the survey consists of 7 items that measure the performance of the organization (PRFRM).

The model depicted in Fig. 3 was examined through PLS-SEM using

SMART-PLS software. A reflective scheme for all the latent constructs (i.e., ICT adoption, innovation level, corporate entrepreneurship, and organizational performance) in the model was used on the full unstandardized dataset. Finally, a centroid scheme was also indicated for estimating inner weights.

5.2. Outer model analysis

The measurement model was first analysed by examining the convergent and discriminant validity of the five first-order latent constructs (ICTUSE, INNOV, CENTRP, and PRFRM). As most factor loadings were above the threshold of 0.7 (Fig. 4), the convergent validity of all five constructs was supported. As such, > 50% of the variance in the observed variable can be explained by the underlying construct (Hulland, 1999). Furthermore, a bootstrap test indicated that all indicators significantly reflect on their latent constructs. In addition, all average variance extracted (AVE) values exceeded the required 0.5 threshold (Table 3). Hence, the constructs explained > 50% of the indicators' variance. Finally, the composite reliability for all of the first-order reflective constructs were robust and well above 0.8 (Table 3), indicating high-scale reliability. In addition, these results support the factors' unidimensionality and reflective scheme. Finally, discriminant validity is supported as the average shared variance of a construct and its indicators (diagonal values that are indicated bold in Table 3) exceed the shared variance with other constructs (values below or to the left), see Fornell and Larcker (1981).

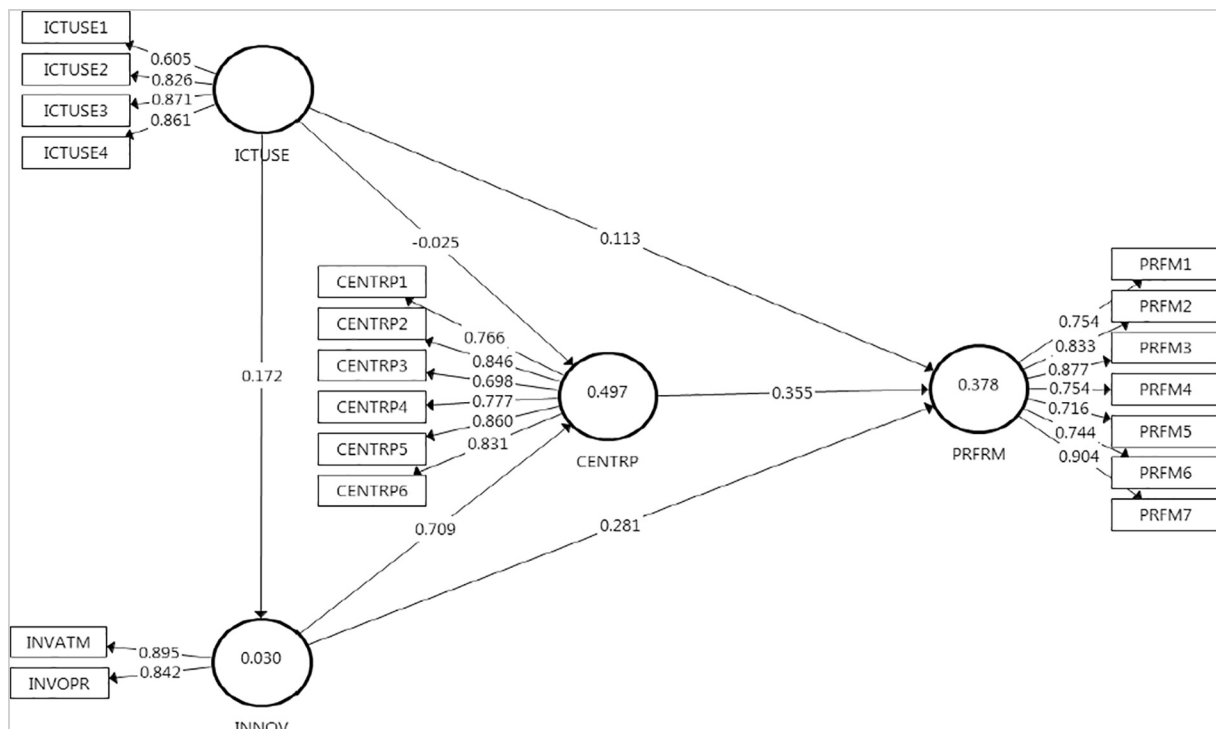


Fig. 4. Structural model – path coefficients.

**Table 3**  
Construct reliability and discriminant validity.

	Composite reliability	Average variance extracted (AVE)	Discriminant validity				
			ITADOP	CENTRP	ICTUSE	INNOV	PRFRM
ITADOP	0.832	0.555	<b>0.730</b>				
CENTRP	0.913	0.637	0.262	<b>0.798</b>			
ICTUSE	0.873	0.637	0.303	0.097	<b>0.798</b>		
INNOV	0.860	0.755	0.412	0.704	0.172	<b>0.869</b>	
PRFRM	0.925	0.641	0.299	0.564	0.196	0.551	<b>0.800</b>

**Table 4**  
Path coefficients and indirect effects.

	Original sample	Sample mean	Standard deviation	T Statistics	p values
CENTRP → PRFRM	0.355	0.355	0.057	6.264	0.000
ICTUSE → CENTRP	- 0.025	- 0.019	0.052	0.484	0.628
ICTUSE → INNOV	0.172	0.179	0.058	2.969	0.003
ICTUSE → PRFRM	0.113	0.120	0.043	2.643	0.008
INNOV → CENTRP	0.709	0.709	0.027	26.467	0.000
Indirect effects					
ICTUSE → CENTRP	0.122	0.127	0.043	2.866	0.004
ICTUSE → PRFRM	0.083	0.088	0.031	2.706	0.007
INNOV → PRFRM	0.252	0.252	0.042	5.972	0.000

5.3. Inner model analysis and path estimates

The second step of the analysis considered the inner model. In particular, the R<sup>2</sup> results of the tested model demonstrated that an acceptable part of the variance of the corporate entrepreneurship and performance constructs can be explained by the model (R<sup>2</sup> = 0.497 and 0.378 for CENTRP and PRFRM constructs, respectively). These results agree with Chin's (1998) proposed threshold, thus the homological validity of the model is satisfactory.

In examining the structural model, the path coefficients among ICTUSE, INNOV, CENTRP and PRFRM constructs were computed. The significance of the path coefficients were determined using bootstrapping with 5000 iterations of resampling (Davison & Hinkley, 1997). Fig. 4 depicts the results of both the inner model and the bootstrapping results that are presented in Table 4.

The path coefficients (Fig. 4) showed that use of ICT had significant positive effects on both innovation and performance ( $\beta = 0.172$ , p-value = 0.003 and  $\beta = 0.113$ , p-value = 0.008) but not on corporate entrepreneurship when innovation is taken into account ( $\beta = - 0.025$ , p-value = 0.628). Hence, hypotheses H1a and H1b were supported but not H5b. For innovation, it was found to have a significant positive effect on corporate entrepreneurship ( $\beta = 0.709$ , p-value = 0.000 and  $\beta = 0.281$ , p-value = 0.000), supporting hypothesis H6a. Finally, support for H7 was also found as corporate entrepreneurship positively and significantly affects performance ( $\beta = 0.355$ , p-value = 0.000). Moreover, the indirect effects results supported the mediating effects of innovation on the relationship between use of ICT and corporate entrepreneurship ( $\beta = 0.122$ , p-value = 0.004), corporate entrepreneurship on the relationship between innovation and performance ( $\beta = 0.252$ , p-value = 0.000), and innovation and corporate entrepreneurship on the relationship between use of ICT and performance ( $\beta = 0.083$ , p-value = 0.007). These results support hypotheses H3a, H6b, H9, and H10 and are further discussed in the conclusion and discussion section.

5.4. The ICT adoption model

The ICT adoption model depicted in Fig. 5 was also examined through PLS-SEM using SMART-PLS software.

The inner model analysis revealed that an acceptable part of the

variance of the performance constructs can be explained by the model (R<sup>2</sup> = 0.497, 0.374 and 0.170 for CENTRP, PRFRM and INNOV constructs, respectively). These results agree with Chin's (1998) proposed threshold, thus, the nomological validity of the model is satisfactory.

Examining the structural model, the path coefficients among the ITADOP, INNOV, CENTRP and PRFRM constructs were computed. The significance of the path coefficients were determined using bootstrapping with 5000 iterations of resampling (Davison & Hinkley, 1997). Fig. 5 depicts the results of both the inner model and the bootstrapping, and the results are presented in Table 5.

The path coefficients (Fig. 5) showed that IT adoption had direct significant positive effects on both innovation and performance ( $\beta = 0.412$ , p-value = 0.000 and  $\beta = 0.099$ , p-value = 0.032) but not on corporate entrepreneurship ( $\beta = - 0.034$ , p-value = 0.525). Hence, hypotheses H2a and H2b were supported but not H5a. The results indicate that innovation has a significant positive direct effect on corporate entrepreneurship ( $\beta = 0.718$ , p-value = 0.000), supporting hypothesis H6a.

Additionally, the results supported hypothesis H7 as corporate entrepreneurship was found to have a significant positive influence on performance ( $\beta = 0.357$ , p-value = 0.000). Moreover, the indirect effects results supported the mediating effects of innovation on the relationship between adoption of ICT and corporate entrepreneurship ( $\beta = 0.296$ , p-value = 0.000), corporate entrepreneurship on the relationship between innovation and performance ( $\beta = 0.256$ , p-value = 0.000), and innovation and corporate entrepreneurship on the relationship between adoption of ICT and performance ( $\beta = 0.200$ , p-value = 0.000). These results support hypotheses H3b, H6b, H8 and H9 and are further discussed in the conclusion and discussion section.

5.5. IT use effects on the ICT adoption model: multi-group analysis

To further examine the ICT adoption model depicted in Fig. 5, multi-group analysis was employed to test for differences in the significance of the path coefficients. Based on the bootstrapping results from two groups, High ICT Use and Low ICT Use, Smart-PLS software generated the path coefficients along with their significance, see Table 6.

The two groups of ICT Use were identified through the standard score generated by factor analysis. Companies with a standardized score of < 0.5 constitute the Low IT Use group (n = 144), while companies in the High IT Use group (n = 132) were selected base on a score of > 0.5. The remaining companies were not considered to distinguish between the two groups.

In most cases, the results show differences in the path coefficient relative to the two groups. However, changes in the significance of both the direct and indirect effects of ITADOP on PRFRM were detected. The p-values of path coefficients with different significance are highlighted in bold in Table 6. IT adoption had significant direct positive effects on performance for the Low IT Use group but not the High IT Use Group ( $\beta = 0.206$ , p-value = 0.022 and  $\beta = 0.040$ , p-value = 0.640). Similarly, IT adoption had significant indirect positive effects on performance for the Low IT Use group but not the High IT Use Group ( $\beta = 0.214$ , p-value = 0.003 and  $\beta = 0.161$ , p-value = 0.053). The results



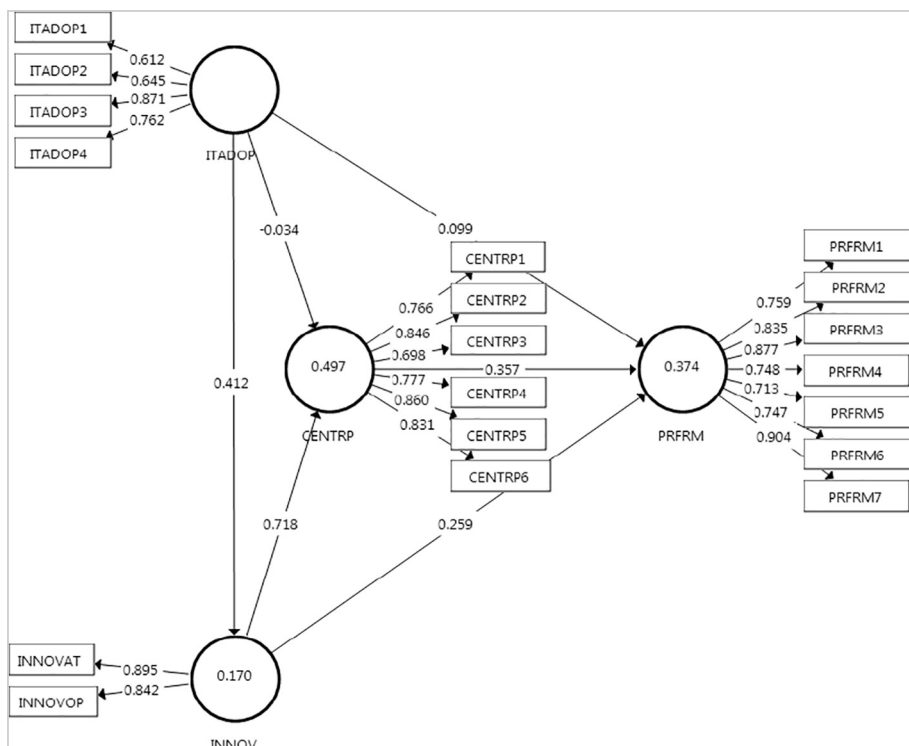


Fig. 5. Structural model – path coefficients for the ICT adoption.

Table 5  
Path coefficients and indirect effects for the ICT adoption model.

	Original sample	Sample mean	Standard deviation	t-Values	p-Values
<i>Direct effects</i>					
CENTRP → PRFRM	0.357	0.359	0.057	6.297	0.000
INNOV → CENTRP	0.718	0.717	0.033	22.022	0.000
ITADOP → CENTRP	-0.034	-0.028	0.053	0.635	0.525
ITADOP → INNOV	0.412	0.420	0.042	9.913	0.000
ITADOP → PRFRM	0.099	0.102	0.046	2.139	0.032
<i>Indirect effects</i>					
INNOV → PRFRM	0.256	0.258	0.043	5.897	0.000
ITADOP → CENTRP	0.296	0.301	0.035	8.448	0.000
ITADOP → PRFRM	0.200	0.205	0.033	6.076	0.000

support the moderation effect of ICT use on the relationships between ICT adoption and performance, thus supporting hypothesis H4.

### 6. Conclusion and discussion

When entrepreneurship is seen as the engine of growth, the

emphasis shifts towards the environment that provides the resources needed to create opportunities and the outcome that will reward successful entrepreneurship. ICT and innovation can be the main drivers of corporate entrepreneurship. However, considering the increasing amounts of ICT investments and the huge failure rates reported by ICT investment and ICT adoption surveys, it is prudent for organizations' executives, and decision makers to better understand how the ICT adopted by the company can be better used and integrated into the various processes and applications in the company. It is also pivotal to adopt appropriate strategies to explore and exploit the opportunities created by these investments. This paper contends that (1) the innovative use of ICT resources can generate better organizational performance; (2) ICT adoption enhances performance, but it is the proper usage of ICT and diffusion of innovation that lead to higher levels of growth and sustained competitive advantage; and (3) the opportunities resulting from ICT resources and innovation may have a profound impact on organizational performance if they are seized and managed within an environment characterized by entrepreneurial orientation. This phenomenon manifests itself in an atmosphere that encourages and applies proactiveness, innovativeness, and risk taking, and it is particularly important in the Lebanese market - an unstable market that

Table 6  
Multi-group analysis for the ICT adoption model.

Multi-group analysis	Path coefficients original		Path coefficients mean		STDEV		t-Values		p-Values	
	High ICT use	Low ICT use	High ICT use	Low ICT use	High ICT use	Low ICT use	High ICT use	Low ICT use	High ICT use	Low ICT use
<i>Direct effects</i>										
ENTREP → PERFORM	0.377	0.456	0.383	0.460	0.090	0.083	4.172	5.493	0.000	0.000
INNOV → CENTRP	0.638	0.744	0.626	0.743	0.077	0.053	8.284	14.011	0.000	0.000
ITADOP → CENTRP	-0.144	0.008	-0.120	0.015	0.112	0.099	1.287	0.084	0.198	0.933
ITADOP → INNOV	0.430	0.389	0.444	0.395	0.105	0.089	4.079	4.359	0.000	0.000
ITADOP → PERFORM	0.040	0.206	0.043	0.207	0.086	0.090	0.468	2.290	<b>0.640</b>	<b>0.022</b>
<i>Indirect effects</i>										
INNOV → PERFORM	0.240	0.339	0.241	0.343	0.068	0.071	3.549	4.771	0.000	0.000
ITADOP → CENTRP	0.274	0.289	0.282	0.293	0.080	0.068	3.409	4.275	0.001	0.000
ITADOP → PERFORM	0.161	0.214	0.176	0.218	0.083	0.073	1.932	2.942	<b>0.053</b>	<b>0.003</b>

is characterized by established SMEs and family businesses.

We proposed and tested ten hypotheses based on the body of literature related to the contribution of ICT adoption and/or use, innovation, and corporate entrepreneurship to the organization's overall performance and its stakeholder satisfaction. Our main objective was to contribute (1) to the literature by determining the factors that organizations should consider to make the best out of ICT resources and to better seize the opportunities made available by ICT and innovation diffusion levels in the organization; (2) to academia by integrating the dynamic capabilities view (Teecce et al., 1997) with the theory of innovation translation, derived from Actor Network Theory (Latour, 1996), thus assessing the contribution of ICT to organizational performance through a double-lens perspective; and (3) to practitioners by making clear the importance of ensuring a fertile environment for entrepreneurial orientation through a culture that encourages innovative uses of ICT. The ten hypotheses were tested using PLS to examine the relationships among ICT adoption and/or use, innovation, corporate entrepreneurship, and organizational performance. Further, the mediation effects of innovation and corporate entrepreneurship in the relationship between ICT use and organizational performance were also assessed. Finally, the moderation effect of ICT use on the relationships tested in the IT adoption model was addressed using multi-group analysis. Eight out of ten hypotheses were supported (Table 7), drawing attention to the importance of ICT use in driving an organization's performance but emphasizing that this contribution is strongly elevated by ensuring that ICT is used innovatively in the organization and that the opportunities offered by ICT and innovations are identified and seized promptly and effectively. In other words, (1) innovation and corporate entrepreneurship are essential catalysts in the ICT–performance relationship and (2) ICT use moderates the relationships in the ICT adoption model.

The findings generated by this study provide interesting and important insights regarding the role played by ICT adoption use, the innovation orientation and level of an organization, and corporate entrepreneurship in the determination of firm performance. To begin, the information technology paradox explained by the previous research (e.g., Brynjolfsson & Saunders, 2010) was addressed in this study. In

conformity with what has been found by the previous research, this study concludes that the technology paradox can be resolved by the understanding that, in a business environment, ICT cannot be directly and solely productive (Melville et al., 2004). Rather, it is the strategic use of ICT that contributes to the value of the organization. This explains the moderation effect of ICT use on the relationships tested in the ICT Adoption model.

Investments in ICT cannot be made in isolation from an organization's strategies, direction, mission, and goals. ICT must be in alignment with the company's objectives and should be adopted after the users' requirements and job needs for the ICT have been well determined (Pagano & Brugge, 2013). Orchestrating the ICT resources towards enhancing organizational performance and achieving competitive advantage requires an organizational culture that can help in identifying, assessing, and making use of these opportunities. On one hand, the innovative use of ICT resources can make available new venues for the initiation or development of new products, services, and business models. On the other, the ICT resources and innovations should be well examined for present and future opportunities to obtain higher competitiveness levels. In other words, innovation is the catalyst that will transform ICT resources, organizational processes, and tacit and explicit knowledge into new and improved resources, capabilities, and initiatives (e.g., Agarwal & Brem, 2015). This is in conformity with the dynamic capabilities view of the firm (Teecce et al., 1997).

The full-mediation effect of innovation in the ICT–performance relationship warrants a strategic move by organizations to emphasize blending ICT with efforts aiming at the realization of the strategic objectives of the firm. This is in conformity with the previous research (Lundvall & Nielsen, 2007). The large role played by innovation in allowing an organization to reap the benefits of ICT stems from the fact that it is the innovative use of ICT that differentiates competitive from noncompetitive organizations. This has been evident in the myriad of innovation potentials that have been made possible by ICT. Business process re-engineering, new business models, just-in-time and stockless inventory supply chain, and new services, such as e-banking and e-health are a few of many examples of innovations that have been made possible by ICT adoption and use. Early adopters of such ICTs can realize huge benefits in comparison to laggards and non-adopters. The main result is that the contribution of ICT is enhanced when ICT use and technological innovations are combined (Hempell, Leeuwen, & Wiel, 2004). Corporate entrepreneurship has been found to partially mediate the ICT and Innovation relationship with organizational performance. Investing in ICT-based innovations and making use of them to introduce new products, services, and business models requires a business culture that promotes transformational leadership, proactiveness, innovativeness, and risk taking (Todd & Javalgi, 2007), i.e., a corporate entrepreneurial spirit.

## 7. Research implications, limitations, and recommendations

ICT use is a pivotal topic that needs to be examined. After all, an adopted ICT can affect an organization or an industry only if it is used innovatively. Companies with the highest levels of returns to their ICT investments go far beyond buying ICT resources and tools. As stated by Brynjolfsson and Saunders (2010), such firms innovatively use their ICT resources by introducing organizational and business process changes. This study suggests that these benefits can potentially be realized in an environment fostered by entrepreneurial spirit. Accordingly, this paper extends the existing literature on ICT diffusion by proposing that ICT use has a potential positive impact on a firm's competitiveness and performance if the opportunities derived from its innovation use are seized and managed within an organization culture marked by corporate entrepreneurship. This corporate entrepreneurship, we suggest, can affect the needed changes at the organization and process levels to better seize and reap the benefits of these opportunities. This conforms to the recommendations to jointly consider technology adoption and

**Table 7**  
Hypothesis testing results summary.

Hypothesis	Supported (Y/N)
H1a: ICT use is positively related to organizational performance.	Yes
H1b: ICT use is positively related to innovation	Yes
H2a: ICT adoption is positively related to organizational performance.	Yes
H2b: ICT adoption is positively related to innovation.	Yes
H3a: Innovation mediates the relationship between ICT use and performance.	Yes
H3b: Innovation mediates the relationship between ICT adoption and performance.	Yes
H4: ICT use moderates the above relationships	Yes
H5a: ICT adoption is positively related to entrepreneurship.	No
H5b: ICT use is positively related to entrepreneurship.	No
H6a: Innovation is positively related to entrepreneurship.	Yes
H6b: Innovation mediates the relationship between ICT use and entrepreneurship.	Yes
H6c: Innovation mediates the relationship between ICT adoption and entrepreneurship	Yes
H7: Corporate entrepreneurship is positively related to organizational performance.	Yes
H8: Corporate entrepreneurship mediates the relationship between ICT and performance.	Yes
H9: Corporate entrepreneurship mediates the relationship between innovation and performance.	Yes
H10: Corporate entrepreneurship and innovation have a double mediation effect on the relationship between ICT use and performance.	Yes

use to better comprehend their long-term diffusion patterns (Lanzolla & Suarez, 2012).

The above-presented empirical results provide good support for the hypotheses that innovation and corporate entrepreneurship are - each and both - significant mediators in the ICT-Performance relationship. Of particular interest are our results in the ICT adoption model, in which ICT use level has a significant moderating effect on adoption-performance and adoption-CE relationships.

Our study has both theoretical and practical implications. At the theoretical level, the theory of innovation translation and the dynamics capabilities view were integrated to emphasize the pivotal role played by corporate entrepreneurship in establishing a network of actors (both technological and non-technological) (Latour, 1996) to better seize the opportunities made possible by two strategic resources, specifically, ICT and innovation, and use them to enhance firm competitiveness. With this theoretical integration, this research can examine the impact of innovation and corporate entrepreneurship on the ICT-performance relationship. Both ICT adoption and use were considered to highlight the important requirement that ICT resources should be innovatively used, and the opportunities they offer should be seized and fostered in an environment characterized by entrepreneurial spirit for a firm to achieve high levels of performance and competitiveness.

The analysis also showed significant results that supported 8 out of the 10 study hypotheses. This is important for academics in the entrepreneurship, technological entrepreneurship, innovation, and information systems disciplines. At the practical level, the study results have repercussions for managers, technology suppliers, and innovation adopters and managers, as this may contribute to a better understanding of the factors that could influence the adoption, management, and use of ICT resources to enhance levels of firm competitiveness. Our results also have implications for policy makers. When investments are made in ICT resources and tools, policy makers and technology adopters often attempt to find ways to speed up the diffusion process. However, ICT diffusion is successful only if ICT is appropriately and innovatively used, with its potential opportunities well managed and exploited within a corporate culture that nurtures corporate entrepreneurship. Policy makers are therefore recommended to increase their awareness of the differences between the adoption and actual usage of ICT, and thus set policies that support and promote effective ICT and innovation diffusion and not merely adoption. In addition, policies that foster a culture of corporate entrepreneurship and provide facilitating conditions such as entrepreneurship education and training (Bae et al., 2014) enable a better exploitation of the opportunities offered by ICT and innovation.

Despite the contribution and the significance of this study, there are some limitations that open interesting avenues for future research. To begin, the respondents were selected using the convenience sampling technique. This has its drawbacks with regard to the generalizability of the results, although this was deemed necessary due to the nature of the data collected from the Lebanese market. In addition, the data were collected through self-reported questionnaires, which constitute a major limitation to construct validity (Avolio, Yammarino, & Bass, 1991). The questionnaires ask for information about the companies to be reported by the executives and employees who work there. Moreover, the relationship between ICT, innovation, corporate entrepreneurship and performance can change and evolve over time, especially given that entrepreneurship is all about change, and ICT and innovation are considered to be catalysts of change (Van Winden, Van Der Meer, & Van Den Berg, 2004). Moreover, the study did not account for certain behavioural factors - with regard to employees' and managers' characteristics, attitudes, and entrepreneurial spirit. Finally, the use of perceptual data related to performance may have a bias effect on the study results. Nevertheless, Choi and Eboch (1998) argue that the use of perceptual performance measures, such as employee satisfaction, customer satisfaction, and overall performance may also be useful.

In light of these limitations, for future research, a longitudinal study

is recommended to obtain the relationship between ICT, innovation, corporate entrepreneurship and performance. Moreover, it is recommended that a replication study be conducted with random sample selection, which may improve the methodological rigor of the study. Further, we recommend the conducting of a regional comparative study in companies operating in environments similar to the Lebanese business environment; this will help to facilitate a better understanding of the ICT-innovation corporate entrepreneurship-performance relationship. Moreover, a combination of indicators related to organizational performance (Rahman & Bullock, 2005) can take into account the multidimensionality of the performance measure.

In conclusion, today's information age and globalized environments reveal contemporary challenges that cannot be underestimated. However, in addition to these challenges there exist many opportunities that will be achieved through ICT and innovation adoption and diffusion. Organizations can avoid these challenges and maintain a sustainable competitive advantage by using these resources and dynamic capabilities. In fact, ICT and innovation are strategic resources. However, their contribution to sustainable competitive advantage vitally depends on the entrepreneurial behaviours of those involved.

## References

- Agarwal, N., & Brem, A. (2015). Strategic business transformation through technology convergence: Implications from General Electric's industrial internet initiative. *International Journal of Technology Management*, 67(2–4), 196–214.
- Agarwal, R., & Prasad, J. (1998). The antecedents and consequences of user perceptions in information technology adoption. *Decision Support Systems*, 22(1), 15–29.
- Aleke, B., Ojiako, U., & Wainwright, D. W. (2011). ICT adoption in developing countries: Perspectives from small-scale agribusinesses. *Journal of Enterprise Information Management*, 24(1), 68–84.
- Amankwah-Amoah, J. (2016). An integrative process model of organisational failure. *Journal of Business Research*, 72(1), 1–10.
- Amit, R., Glosten, L., & Muller, E. (1993). Challenges to theory development in entrepreneurship research. *Journal of Management Studies*, 30(5), 815–834.
- Anaya, L., Dulaimi, M., & Abdallah, S. (2015). An investigation into the role of enterprise information systems in enabling business innovation. *Business Process Management Journal*, 21(4), 771–790.
- Avolio, B. J., Yammarino, F. J., & Bass, B. M. (1991). Identifying common methods variance with data collected from a single source: An unresolved sticky issue. *Journal of Management*, 17(3), 571–587.
- Bae, T. J., Qian, S., Miao, C., & Fiet, J. O. (2014). The relationship between entrepreneurship education and entrepreneurial intentions: A meta-analytic review. *Entrepreneurship Theory and Practice*, 38, 217–254.
- Bagozzi, R. P., & Edwards, J. R. (1998). A general approach for representing constructs in organizational research. *Organizational Research Methods*, 1(1), 45–87.
- Baumol, W. J., & Strom, R. J. (2007). Entrepreneurship and economic growth. *Strategic Entrepreneurship Journal*, 1(3/4), 233–237.
- Bayo-Moriones, A., & Lera-López, F. (2007). A firm-level analysis of determinants of ICT adoption in Spain. *Technovation*, 27(6), 352–366.
- Berghman, L., Matthyssens, P., Streukens, S., & Vandenbempt, K. (2013). Deliberate learning mechanisms for stimulating strategic innovation capacity. *Long Range Planning*, 46(1), 39–71.
- Blurton, C. *New directions of ICT-use in education*. (2002). Retrieved from <http://www.unesco.org/education/educprog/lwfw/dl/edict.pdf> accessed 11.20.2016.
- Braganza, A., Brooks, L., Nepelski, D., Ali, M., & Moro, R. (2017). Resource management in big data initiatives: Processes and dynamic capabilities. *Journal of Business Research*, 70(1), 328–337.
- Brockhaus, R. H. (1980). Risk taking propensity of entrepreneurs. *Academy of Management Journal*, 23(3), 509–520.
- Brynjolfsson, E. (1993). The productivity paradox of information technology. *Communications of the ACM*, 36(12), 66–77.
- Brynjolfsson, E., & Saunders, A. (2010). *Wired for innovation: How information technology is reshaping the economy*. MIT Press.
- Burgelman, R. A., & Doz, Y. L. (2013). The power of strategic integration. *Sloan Management Review*, 42(3), 28–38.
- Burnham, J. B. (2006). *Telecommunications policy in Turkey: Restructuring for economic growth*. European Union Center of Excellence, European Studies Center, University of Pittsburgh.
- Buyya, R., Ranjan, R., & Calheiros, R. N. (2009, June). Modeling and simulation of scalable Cloud computing environments and the CloudSim toolkit: Challenges and opportunities. *International Conference on High Performance Computing and Simulation HPCS'09* (pp. 1–11). IEEE.
- Callon, M., & Latour, B. (1981). Unscrewing the Big Leviathan: how actors macro-structure reality and how sociologists help them to do so. *Advances in social theory and methodology. Toward an integration of micro and macro-sociologies* (pp. 277–303). London: Routledge and Kegan Paul.
- Cardona, M., Kretschmer, T., & Strobel, T. (2013). ICT and productivity: Conclusions from the empirical literature. *Information Economics and Policy*, 25(3), 109–125.

- Cassia, L., Minola, T., & Paleari, S. (2011). Entrepreneurship, technology, and change: A review and proposal for an interpretative framework. In L. Cassia, T. Minola, & S. Pateari (Eds.), *Entrepreneurship and technological change* (pp. 3–14). MA: Edward Elgar Publishing, Inc.
- Cepeda, G., & Vera, D. (2007). Dynamic capabilities and operational capabilities: A knowledge management perspective. *Journal of Business Research*, 60(5), 426–437.
- Chen, Y., Wang, Y., Nevo, S., Benitez-Amado, J., & Kou, G. (2015). IT capabilities and product innovation performance: The roles of corporate entrepreneurship and competitive intensity. *Information Management*, 52(6), 643–657.
- Chin, W. (1998). Issues and opinion on structural equation modeling. *MIS Quarterly*, 22(1), 7–16.
- Choi, T. Y., & Eboch, K. (1998). The TQM paradox: Relations among TQM practices, plant performance, and customer satisfaction. *Journal of Operations Management*, 17(1), 59–75.
- Coffman, D. L., & MacCallum, R. C. (2005). Using parcels to convert path analysis models into latent variable models. *Multivariate Behavioral Research*, 40(1), 235–259.
- Cofriyanti, E., & Hidayanto, A. N. (2013). The relationship among organisations' factors, information technology, innovation and performance: An Indonesian SMEs study. *International Journal of Innovation and Learning*, 14(3–4), 422–443.
- Coltman, T. R., Tallon, P. P., Sharma, R., & Queiroz, M. (2015). Strategic IT alignment: Twenty-five years on. *Journal of Information Technology*, 28(2), 143–157.
- Consoli, D. (2005). The dynamics of technological change in UK retail banking services: An evolutionary perspective. *Research Policy*, 34(4), 461–480.
- Covin, J., & Miles, M. (1999). Corporate entrepreneurship and the pursuit of competitive advantage. *Entrepreneurship: Theory and Practice*, 23(3), 47–63.
- Covin, J. G., & Slevin, D. P. (1991). A conceptual model of entrepreneurship as firm behavior. *Entrepreneurship: Critical perspectives on business and management* (pp. 7–25). Baylor University.
- Daniel, E. M., & Wilson, H. N. (2003). The role of dynamic capabilities in e-business transformation. *European Journal of Information Systems*, 12(4), 282–296.
- Davcik, N., & Sharma, P. (2016). Marketing resources, performance, and competitive advantage: A review and future research directions. *Journal of Business Research*. <http://dx.doi.org/10.1016/j.jbusres.2016.04.169> (in press).
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982–1003.
- Davison, A. C., & Hinkley, D. V. (1997). *Bootstrap methods and their application*. Cambridge: Cambridge University Press.
- Desoto, H. (1989). *The other path: The invisible revolution in the third world*. New York: Harper.
- DiStefano, C., Zhu, M., & Mindrila, D. (2009). Understanding and using factor scores: Considerations for the applied researcher. *Practical Assessment, Research and Evaluation*, 14(20), 1–11.
- Dosi, G. (1982). Technological paradigms and technological trajectories: A suggested interpretation of the determinants and directions of technical change. *Research Policy*, 11(3), 147–162.
- Echols, A. E., & Neck, C. P. (1998). The impact of behaviors and structure on corporate entrepreneurial success. *Journal of Managerial Psychology*, 13(1/2), 38–46.
- Edmunds, R., Thorpe, M., & Conole, G. (2012). Student attitudes towards and use of ICT in course study, work and social activity: A technology acceptance model approach. *British Journal of Educational Technology*, 43(1), 71–84.
- Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: What are they? *Strategic Management Journal*, 21(10/11), 1105–1121.
- Erel, B. (2014). A lot of IT projects fail, but why? Retrieved from <http://saasaddict.walkme.com/lot-project-fails/>.
- Ferreira, J., Fernandes, C., Alves, H., & Raposo, H. (2015). Drivers of innovation strategies: Testing the Tidd and Bessant (2009) model. *Journal of Business Research*. <http://dx.doi.org/10.1016/j.jbusres.2015.01.021>.
- Fornell, C., & Larcker, D. G. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39–50.
- Gatignon, H., Tushman, M. L., Smith, W., & Anderson, P. (2002). A structural approach to assessing innovation: Construct development of innovation locus, type, and characteristics. *Management Science*, 48(9), 1103–1122.
- Gomez, P., Céspedes-Lorente, J., & Valle-Cabrera, R. (2005). Organizational learning capability: A proposal of measurement. *Journal of Business Research*, 58(6), 715–725.
- González, M. F., Husted, B. W., & Aigner, D. J. (2017). Opportunity discovery and creation in social entrepreneurship: An exploratory study in Mexico. *Journal of Business Research*, 81(1), 212–220.
- Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate data analysis*. Vol. 6. Upper Saddle River, NJ: Pearson Prentice Hall.
- Hall, B. H., Lotti, F., & Mairesse, J. (2013). Evidence on the impact of R&D and ICT investments on innovation and productivity in Italian firms. *Economics of Innovation and New Technology*, 22(3), 300–328.
- Hempell, T., Leeuwen, G. V., & Wiel, H. V. D. (2004). ICT, innovation and business performance in services: Evidence for Germany and The Netherlands. *ZEW-Centre for European Economic Research discussion paper* (04-006).
- Holcombe, R. G. (1998). Entrepreneurship and economic growth. *Quarterly Journal of Austrian Economics*, 1(2), 45–62.
- Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research: a review of four recent studies. *Strategic Management Journal*, 20(2), 195–204.
- Igun, S. E. (2014). Strategic impact of ICT on modern day banking in Nigeria. *International Journal of Strategic Information Technology and Applications (IJSITA)*, 5(4), 78–93.
- Ismail, T. M. (2012). The development of entrepreneurial social competence and business network to improve competitive advantage and business performance of Small Medium Sized Enterprises: Case study of Batik Industry in Indonesia. *Procedia - Social and Behavioral Sciences*, 65, 46–51.
- Jacobs, A. J. (2012). *Information system implementations: Using a leadership quality matrix for quality*. Bloomington, IN: Authorhouse.
- Kindstrom, D., Kowalkowski, C., & Sandberg, E. (2013). Enabling service innovation: A dynamic capabilities approach. *Journal of Business Research*, 66(8), 1063–1073.
- Kirchhoff, B. A. (1977). Organization effectiveness measurement and policy research. *Academy of Management Review*, 2(3), 347–355.
- Knight, G. A. (1997). Cross-cultural reliability and validity of a scale to measure firm entrepreneurial orientation. *Journal of Business Venturing*, 12(3), 213–225.
- Koellinger, P. (2008). The relationship between technology, innovation, and firm performance - empirical evidence from e-business in Europe. *Research Policy*, 37(8), 1317–1328.
- Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, 3(3), 383–397.
- Kuratko, D. F., & Audretsch, D. B. (2013). Clarifying the domains of corporate entrepreneurship. *International Entrepreneurship and Management Journal*, 9(3), 323–335.
- Kuratko, D. F., Covin, J. G., & Garrett, R. P. (2009). Corporate venturing: Insights from actual performance. *Business Horizons*, 52(5), 459–467.
- Kuratko, D. F., & Menter, M. (2017). The role of public policy in fostering technology-based nascent entrepreneurship. *Technology-based nascent entrepreneurship* (pp. 19–52). New York: Palgrave Macmillan.
- Kusumaningtyasa, N., & Suwardat, D. (2015). ICT adoption, skill and use differences among small and medium enterprises managers based on demographic factors. *Procedia - Social and Behavioral Sciences*, 169(1), 296–302.
- Landis, R. S., Beal, D. J., & Tesluk, P. E. (2000). A comparison of approaches to forming composite measures in structural equations modeling. *Organisational Research Methods*, 3(2), 186–207.
- Lanzolla, G., & Suarez, F. (2012). Closing the technology adoption-use divide: The role of contiguous user bandwagon. *Journal of Management*, 38(3), 836–859.
- Latour, B. (1992). Where are the missing masses? The sociology of a few mundane artifacts. In W. Bijker, & J. Law (Eds.), *Shaping technology/building society* (pp. 225–258). London: MIT Press.
- Latour, B. (1996). *Aramis or the love of technology*. Cambridge, MA: Harvard University Press.
- Law, J. (1987). Technology and Heterogeneous Engineering: The Case of Portuguese Expansion. In W. E. Bijker, T. P. Hughes, & T. Pinch (Eds.), *The Social Construction of Technological Systems* Cambridge, MA: MIT Press.
- Law, J. (1992). Notes on the theory of the actor-network: Ordering, strategy, and heterogeneity. *Systems Practice*, 5(4), 379–393.
- Liao, W. C., Tseng, C. C., & Ho, M. H. C. (2015). The effects of integrating innovative resources on organisational performance: The moderating role of innovation life cycle. *International Journal of Technology Management*, 67(2/4), 215–244.
- Lumpkin, G. T., & Dess, G. G. (1996). Clarifying the entrepreneurial orientation construct and linking it to performance. *Academy of Management Review*, 21(1), 135–172.
- Lundvall, B. A., & Nielsen, P. (2007). Knowledge management and innovation performance. *International Journal of Manpower*, 28(3/4), 07–223.
- Manochehri, N. N., Al-Esmail, R., & Ashrafi, R. (2012). Examining the impact of information and communication technologies (ICT) on enterprise practices: A preliminary perspective from Qatar. *The Electronic Journal on Information Systems in Developing Countries (EJISDC)*, 51(3), 1–16.
- Markus, M. L., & Robey, D. (1988). Information technology and organizational change: Causal structure in theory and research. *Management Science*, 34(5), 583–598.
- McDougall, P. P., Covin, J. G., Robinson, R. B., & Herron, L. (1994). The effects of industry growth and strategic breadth on new venture performance and strategy content. *Strategic Management Journal*, 15(7), 537–554.
- McFadzean, E., O'loughlin, A., & Shaw, E. (2005). Corporate entrepreneurship and innovation part 1: The missing link. *European Journal of Innovation Management*, 8(3), 350–372.
- Mcgrath, R. G., Venkataraman, S., & MacMillan, I. C. (1994). The advantage chain: Antecedents to rents from internal corporate ventures. *Journal of Business Venturing*, 9(5), 351–369.
- Melville, N., Kraemer, K., & Gurbaxani, V. (2004). Review: Information technology and organizational performance: An integrative model of IT business value. *MIS Quarterly*, 28(2), 283–322.
- Miller, D. (1983). The correlates of entrepreneurship in three types of firms. *Management Science*, 29(7), 770–791.
- Morris, M., Kuratko, D., & Covin, J. (2011). *Corporate entrepreneurship and innovation*. Cengage Learning.
- Mortara, L., Napp, J., Ford, S., & Minshall, T. (2011). Open innovation activities to foster corporate entrepreneurship. In L. Cassia, T. Minola, & S. Pateari (Eds.), *Entrepreneurship and technological change* (pp. 287–311). MA: Edward Elgar Publishing, Inc.
- Muchoki, E. (2013). *The effect of product innovation on the financial performance of mobile telephony firms in Kenya*. University of Nairobi (Doctoral dissertation).
- Naudé, W., & Szirmai, A. (2013). *Technological innovation, entrepreneurship, and development* (no. 2013/17).
- Norton, W. I., & Moore, W. T. (2006). The influence of entrepreneurial risk assessment on venture launch or growth decisions. *Small Business Economics*, 26(3), 215–226.
- OECD (2003). Seizing the benefits of ICT in a digital economy. *Meeting of the OECD Council at Ministerial Level, Organization for Economic Cooperation and Development, Paris*.
- Pagano, D., & Brugge, B. (2013, May). User involvement in software evolution practice: A case study. *Proceedings of the 2013 International Conference on Software Engineering* (pp. 953–962). IEEE Press.
- Parente, S. L., & Prescott, E. C. (1999). Monopoly rights: A barrier to riches. *American*

- Economic Review*, 1216–1233.
- Prahalad, C. K., & Hamel, G. (1990). The core competence of the corporation. *Harvard Business Review*, 68(3), 79–91.
- Rahman, S. U., & Bullock, P. (2005). Soft TQM, hard TQM, and organisational performance relationships: An empirical investigation. *Omega*, 33(1), 73–83.
- Rattner, J. (2014). Five ways social entrepreneurs use technology to increase their impact. *Forbes*, December 10, 2014. Retrieved from <https://www.forbes.com/sites/ashoka/2014/12/10/five-ways-social-entrepreneurs-use-technology-to-increase-their-impact/#7d0a537214cc>.
- Roaldsen, I., & Borch, O. J. (2011). Entrepreneurial strategies of SMEs in mature industries: The role of R&D alliances and value chain configuration. In L. Cassia, T. Minola, & S. Pateari (Eds.). *Entrepreneurship and technological change* (pp. 51–67). MA: Edward Elgar Publishing, Inc.
- Rogers, C. (1995). *A way of being*. Houghton Mifflin: Harcourt.
- Rohrbeck, R. (2010). Harnessing a network of experts for competitive advantage: Technology scouting in the ICT industry. *R&D Management*, 40(2), 169–180.
- Rosenbusch, N., Brinckmann, J., & Bausch, A. (2011). Is innovation always beneficial? A meta-analysis of the relationship between innovation and performance in SMEs. *Journal of Business Venturing*, 26(4), 441–457.
- Sangrà, A., & González-Sanmamed, M. (2010). The role of information and communication technologies in improving teaching and learning processes in primary and secondary schools. *ALT-J: Research in Learning Technology*, 18(3), 207–220. <http://dx.doi.org/10.1080/09687769.2010.529108>.
- Saran, C. (2012). Almost a third of BI projects fail to deliver on business objectives. *Computer Weekly*, January 10. Retrieved from <http://www.computerweekly.com/news/2240113585/Almost-a-third-of-BI-projects-fail-to-deliver-on-business-objectives>.
- Schumpeter, J. A. (1934). *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle*. Vol. 55. Transaction Publishers.
- Shamsuzzoha, A., Ferreira, F., Faria, J., Azevedo, A., Hao, Y., & Helo, P. (2012, December). Virtual enterprise management: Perspective of process-based business collaboration. *Industrial Engineering and Engineering Management (IEEM), 2012 IEEE International Conference* (pp. 2028–2032). IEEE.
- Sharma, P., & Chrisman, S. J. J. (2007). Toward a reconciliation of the definitional issues in the field of corporate entrepreneurship. *Entrepreneurship* (pp. 83–103). Berlin Heidelberg: Springer.
- Siegel, D. (2011). Preface. In L. Cassia, T. Minola, & S. Pateari (Eds.). *Entrepreneurship and technological change* (pp. xiii–xv). MA: Edward Elgar Publishing, Inc.
- Singleton, V., & Michael, M. (1993). Actor-networks and ambivalence: General practitioners in the UK cervical screening programme. *Social Studies of Science*, 23(2), 227–264.
- Soriano, D. R., & Huarnig, K. H. (2013). Innovation and entrepreneurship in knowledge industries. *Journal of Business Research*, 66(10), 1964–1969.
- Stam, E., & Garnsey, E. W. (2007). Entrepreneurship in the knowledge economy. *Centre for Technology Management (CTM) working paper* (2007/04).
- Stanimirovic, D. (2015). A framework for information and communication technology induced transformation of the healthcare business model in Slovenia. *Journal of Global Information Technology Management*, 18(1), 29–47.
- Tatnall, A. (2009). Innovation translation as a research approach to theorising information systems implementation. *International Journal of Networking and Virtual Organisations Archive*, 6(1), 64–76.
- Tatnall, A. (2011). *Actor-network theory and technology innovation: Advancements and new concepts*. Hershey, PA: IGI Global.
- Tatnall, A., & Davey, B. (2001). *How Visual Basic Entered the Curriculum at an Australian University: An Account Informed by Innovation Translation*. 510–517. <http://dx.doi.org/10.28945/2374>.
- Tatnall, A., & Davey, W. (2007). Researching the portal. *IRMA: Managing worldwide operations and communications with information technology*. Vancouver, BC, Canada: Information Management Resource Association.
- Teece, D., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509–533.
- Thornberry, N. (2001). Corporate entrepreneurship: Antidote or oxymoron? *European Management Journal*, 19(5), 526–533.
- Tian, J., Wang, K., Chen, Y., & Johansson, B. (2010). From IT deployment capabilities to competitive advantage: An exploratory study in China. *Information Systems Frontiers*, 12(3), 239–255.
- Todd, P. R., & Javalgi, R. R. G. (2007). Internationalization of SMEs in India: Fostering entrepreneurship by leveraging information technology. *International Journal of Emerging Markets*, 2(2), 166–180.
- Tran, Q., Zhang, C., Sun, H., & Huang, D. (2014). Initial adoption versus institutionalization of e-procurement in construction firms: An empirical investigation in Vietnam. *Journal of Global Information Technology Management*, 17(2), 91–116.
- Treacy, M., & Wiersema, F. (1993). Customer intimacy and other value disciplines. *Harvard Business Review*, 71(1), 84–93.
- Tusiime, E., & Byrne, E. (2011). Information systems innovation in the humanitarian sector. *Information Technologies and International Development*, 7(4), 35.
- Underwood, J., & McCabe, B. (2012). Using actor-network theory to research the adoption of inter-organizational information systems. *Inter-organizational information systems and business management: Theories for researchers* (pp. 83–98). Hershey: IGI Global.
- Van Ark, B., & Piatkowski, M. (2004). Productivity, innovation and ICT in Old and New Europe. *International Economics and Economic Policy*, 1(2/3), 215–246.
- Van Winden, W., Van Der Meer, A., & Van Den Berg, L. (2004). The development of ICT clusters in European cities: Towards a typology. *International Journal of Technology Management*, 28(3/6), 356–387.
- Wade, M., & Hulland, J. (2004). Review: The resource-based view and information systems research: Review, extension, and suggestions for future research. *MIS Quarterly*, 28(1), 107–142.
- Wennekers, S., & Thurik, R. (1999). Linking entrepreneurship and economic growth. *Small Business Economics*, 13(1), 27–56.
- Yu, Y., Dong, X.-Y., Shen, K. N., Khalifa, M., & Hao, J.-X. (2013). Strategies, technologies, and organizational learning for developing organizational innovativeness in emerging economies. *Journal of Business Research*, 66(12), 2507–2514.
- Zahra, S. A. (1991). Predictors and financial outcomes of corporate entrepreneurship: An exploratory study. *Journal of Business Venturing*, 6(4), 259–285.
- Zahra, S. A. (1993). Environment, corporate entrepreneurship, and financial performance: A taxonomic approach. *Journal of Business Venturing*, 8(4), 319–340.
- Zahra, S. A. (1995). Corporate entrepreneurship and financial performance: The case of management leveraged buyouts. *Journal of Business Venturing*, 10(3), 225–247.
- Zahra, S. A. (1996). Governance, ownership, and corporate entrepreneurship: The moderating impact of industry technological opportunities. *Academy of Management Journal*, 39(6), 1713–1735.
- Zahra, S. A., Jennings, D. F., & Kuratko, D. F. (1999). The antecedents and consequences of firm-level entrepreneurship: The state of the field. *Entrepreneurship Theory and Practice*, 24(2), 45–66.
- Zhao, F. (2005). Exploring the synergy between entrepreneurship and innovation. *International Journal of Entrepreneurial Behaviour & Research*, 11(1), 25,41.