



Lebanese American University Repository (LAUR)

Post-print version/Author Accepted Manuscript

Publication metadata

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

Author(s): Manal Yunis, Abbas Tarhini, Abdalnasser Kassar

Journal: Journal of Business Research

DOI/Link: <https://doi.org/10.1016/j.jbusres.2017.12.030>

How to cite this post-print from LAUR:

Yunis, M., Tarhini, A., & Kassar, A. (2018). The role of ICT and innovation in enhancing organizational performance: The catalysing effect of corporate entrepreneurship. *Journal of Business Research*, DOI, 10.1016/j.jbusres.2017.12.030, <http://hdl.handle.net/10725/11190>

© Year 2018

This Open Access post-print is licensed under a Creative Commons Attribution-Non Commercial-No Derivatives (CC-BY-NC-ND 4.0)



This paper is posted at LAU Repository

For more information, please contact: archives@lau.edu.lb

Paper Title: The Role of ICT and Innovation in Enhancing Organizational Performance: The Catalyzing effect of Corporate Entrepreneurship

Journal: Journal of Business Research. H Index 158, Rank: Q1

Citation: Yunis, M., Tarhini, A., El Kassar, A. (2018). The Role of ICT and Innovation in Enhancing Organizational Performance: The Catalyzing effect of Corporate Entrepreneurship. Journal of Business Research, 88(1),pp. 344–356.

Link: <https://www.sciencedirect.com/science/article/pii/S0148296317305246>

The Role of ICT and Innovation in Enhancing Organizational Performance: The Catalyzing effect of Corporate Entrepreneurship

Manal Yunis, Lebanese American University, Lebanon

myunis@lau.edu.lb

Abbas Tarhini, Lebanese American University, Lebanon

abbas.tarhini@lau.edu.lb

Abdulnasser Kassar, Lebanese American University, Lebanon

abdulnasser.kassar@gmail.com

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 research body pertinent to this area has substantially grown, research on 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 would depict and examine 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 proved to be fit, hypotheses are supported, and implications are discussed.

Keywords: *Information and Communication Technologies (ICT); Innovation; Corporate Entrepreneurship (CE); Performance; Dynamic Capabilities View; Innovation Translation Theory; PLS*

1 Introduction

Over the past three decades, research has shown that organizations initiate corporate entrepreneurship to add to their body of knowledge for increased revenues (McGrath et al, 1994), improved profitability (Zahra, 1993), for enhanced competitiveness (Kuratko et al, 2009), and for supporting innovativeness (Ferreira,J.J.M.,et al, 2015) as an important potential growth driver (Morris et al, 2011; Burgelman & Doz, 2013; 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 the 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 in order 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 to innovation-related activities, which all tend to be technology-based (Siegel, 2011), for better efficiency and higher performance (Ferreira,J.J.M.,et al, 2015; Igun, 2014; Consoli, 2005). However, despite wide adoption of ICT by organizations in various sectors, it is reported by various survey reports that several projects fail. In 2012, Gartner reported that fewer than 30% of information systems projects like Business Intelligence meet the business objectives (Saran, 2012) and that 55 to 75% of enterprise resource planning (ERP) projects encounter failure to meet the objectives that they have been intended to achieve, 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 have suffered project failures during the year 2014 and 50% failed to achieve their intended goals (Erel, 2014; Amankwah-Amoah J., 2016).

The above outcomes drive us to question the proper use of the adopted ICT in organizations. According to Kusumaningtyasa & 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, et al. (2012) states that in order to benefit from ICT adoption, organizations should provide needed infrastructure, and hire the skilled ICT personnel. In other words, there should be the means necessary to make effective use of the adopted ICT for it to contribute positively to organizational performance.

The above suggestions draw attention to the importance of having certain complimentary factors in the organization that would enable making 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 those business opportunities made possible by ICT and innovations; thus, entrepreneurs need to be proficient in speaking the language of technology; i.e., in matching technology potential with market changes, new customer needs, emerging problems, and possible opportunities.

This sheds the light on the importance of examining the extent to which innovation and entrepreneurship can enhance the role that ICT plays in galvanizing organizational performance. Previous studies examined the relationship between ICT adoption and use and innovation. Previous research also studied the role that corporate entrepreneurship plays in enhancing the organizational performance. While the importance and value of entrepreneurial strategies and actions have been highlighted (Mortara et al, 2011; Covin & Miles, 1999), understanding how corporate entrepreneurship interacts with organizational resources, such as ICT and innovation, yet need to be addressed. This could be attributed to the fact that corporate entrepreneurship has the necessary elements that organizations need for achieving higher performance and productivity in the rapidly changing global economy (Kuratko & Audretsch, 2013). Previous studies also examined the relationship between innovation and entrepreneurship (Rosenbusch et al, 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's a lack of

studies integrating in a holistic framework the impact of ICT and ICT-based innovations on organizational performance, taking into consideration the role that corporate entrepreneurship plays 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/use and organizational innovation levels on one hand and organizational performance on the other. This is important due to the fact that different companies have different ICT investments strategies, ICT resources, diffusion levels, and innovation capacities (Coltman et al, 2015; Anaya et al, 2015). The second purpose is to examine the role that corporate entrepreneurship may have in the above relationship. This is crucial as it will allow the identification of means so as to eliminate or mitigate the impact of pitfalls that may hinder the efforts to capitalize on the opportunities made possible by ICT capabilities and innovations. Incorporating corporate entrepreneurship into the model is based on a synthesis that will draw upon a review of both theoretical and empirical research pertinent to ICT, innovation, and corporate entrepreneurship. The third purpose is to assess the impact that ICT use has 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 to technology use (Lanzolla & Suarez, 2012). Rattner (2014) contends that adopting technology for the mere sake of adopting it would be a waste of resources. The author reported case examples about social entrepreneurs successfully using information and communication technologies, which helped them create social impact.

Emphasizing a holistic and dynamic framework linking ICT adoption/use, innovation and corporate entrepreneurship to a firm's competitiveness level make this study useful for academicians, government analysts, ICT developers and strategists, as well as information and innovation specialists. To start with, academicians can use the framework as a foundation for assessing the contribution of each of each of the four factors in enhancing the organization's performance. Moreover, the flexibility of the model allows it to be used as one integrated tool, or can be deployed to examine certain selected relationships. In addition, the study can help in better understanding how different companies have different performance and competitiveness levels. ICT managers and decision makers will be able to consider the various challenges and opportunities posed by the new computing models, including wireless and mobile computing, cloud computing, and social media (Buyya et al, 2009). Finally, ICT designers and developers can find the study useful in supporting the firm strategy-technology fit as it allows examining the impact of every innovation/ICT strategy or tool on the company's competitiveness objectives. With the aforementioned purpose in mind, the study addresses the following questions:

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

The remainder of the paper is organized as follows: Previous studies examining ICT adoption/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 data analysis results. This is followed by a presentation of results discussion. Finally, study conclusion, limitations, and implications/recommendations for future research and practice are presented.

2 Theoretical Framework

Two theoretical frameworks underpin this research: (1) the dynamic capabilities view (DCV) (Teece et al. 1997), and (2) the theory of Innovation Translation. The dynamic capabilities view endeavors to find sources of value creation and realization – i.e. capabilities – in rapidly changing environments, thus driving the company to better allocate resources and achieve sustainable competitive advantage (Eisenhardt and 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 could 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 the firm’s competitive advantage, which otherwise might be quickly eroded.

The applicability of this view to the information systems research stream has been demonstrated by several researchers (Braganza et al., 2017; Wade & Hulland, 2004; Daniel & Wilson, 2003). Wade & Hulland (2004) considered information systems (IS) as resources with many features 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 the value of the firm (e.g. Kindstrom et al, 2013; Rohrbeck, 2010; Tian et al, 2010; Cepeda & Vera, 2007). 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 few 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 managing their resources innovatively (Davicik, N. & Sharma, 2016). This could be accompanied with a steady learning process (Gomez et al., 2005) seizing new opportunities (Kogut and Zander, 1992), acquiring knowledge from all reachable resources (Prahalad and Hamel, 1990), and thus making appropriate decisions.

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

Informed by the Actor Network Theory (Callon and Latour 1981; Latour, 1992), the theory of Innovation Translation (Law, 1992) emphasizes the core, 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 has both human and non-human entities as the main actors (Law, 1987). Being 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 this 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 and 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 the detail of how individuals and specific organizations adopt technological innovations. Previous IS research examined the process of innovation in various contexts. Examples include the process of information systems curriculum innovation (Tatnall and 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 has in the humanitarian sector (Tusiime and Byrne, 2011), and the human and social issues involved in organizational decision-making that offers a suitable approach to modelling innovation in organizations (Underwood and McCabe, 2012).

The theory fits well with the study 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 these opportunities (Gonzalez et al, 2017; Mortara et al, 2011) to enhance their organization's value and competitiveness level. Based on above discussion, the conceptual model of the study could be depicted as follows (Figure 1).

[Insert Figure 1 about here]

Figure 1 ICT –Innovation-Entrepreneurship (IIE) Model

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

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

[Insert Figure 2 about here]

As shown in the figure, economic growth and competitiveness are associated to 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/use, innovation, and firm performance.

3 Literature Review and Hypotheses

Firm-level studies provide evidence of the benefits of ICT use (Brynjolfsson and Saunders, 2010). ICT helps firms gain market share and raise overall productivity (Bayo-Moriones and Lera-Lopez, 2007; Cardona et al, 2013; Tran et al, 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 (Koellinger, 2008; Van Ark and Piatkowski, 2004; Hall et al, 2013; Tran et al, 2014). In addition, the use of ICT may contribute to efficiency in operations and inventory management as well as to integration of activities, and thus productivity improvement (Liao et al, 2015; Igun, 2014).

Moreover, studies at the firm level reveal an important explanation to 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 if an ICT investment has been successful rest not simply in determining whether or not an organization adopts technology, but whether or not 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 so as to enable ICT to promote the organizational performance (Brynjolfsson and Saunders, 2010; Koellinger, 2008). So, 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; Yu, et al., 2013, Melville et al, 2004). 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.

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

H4: ICT use moderates the above relationships

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 and Robey, 1988), and as such, IT - a general purpose technology – creates opportunities that organizations with corporate entrepreneurship can seize and benefit from (Cassia et al, 2011). This applies to organizations in both technology-adopting or technology- producing businesses.

Over the past two decades, several changes and developments were generated by technological advancements and scientific inventions and discoveries. Accordingly, technology is considered one of the main factors fostering entrepreneurship (Dosi, 1982). This is due to the fact that ICT provides organizations with a vast array of opportunities for entrepreneurial organizations to take and develop (OECD, 2003, Stam and Garnsey, 2007). Examples 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 testing different situation and decision making scenarios, learning, setting 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 the organizations' strategies and creating

the right corporate culture for ICT adoption, use, and innovation diffusion. With this in mind, the following hypotheses could be posited:

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

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

Regarding innovation and corporate entrepreneurship, the two could be related. Innovation can be defined as a process that enhances an organization's value chain and value web through development of new products, services, work procedures, solutions, and methods of commercialization (Covin and Slevin, 1991; McFadzean et al., 2005). If well managed and supported, technological innovation can contribute to higher levels of economic output and help in creating and developing new goods and services. Research in the area of innovation at the firm level reported the importance of corporate entrepreneurship in exploiting innovation opportunities (Mortara et al, 2011; Covin and Miles, 1999) and promoting growth and development (Naude' and Szirmai, 2013). Without corporate entrepreneurship efforts, an organization's innovation capacity will not be 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 et al (1993) states that innovation and corporate entrepreneurship must be linked to each other since in a business environment, the innovation process concerned with resource deployment for wealth production is pivotal to apprehend entrepreneurship within an organization. As a matter of fact, corporate entrepreneurship is needed to foster innovation and enhance its contribution to the competitive advantage of the firm. Using Miller's (1983) entrepreneurial dimensions, the relationship between innovation and corporate entrepreneurship can be better understood and conceptualized. The main dimensions are: innovativeness, risk taking, changes in technology, and proactiveness.

To start with, innovativeness is a very crucial dimension of corporate entrepreneurship (Miller, 1983). In fact, both indicate innovation in products, services, markets, business processes, and business models (Mortara et al, 2011). These present new opportunities that should be taken by the organization's entrepreneurs to benefit from. Another dimension is the 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 still motivated by achieving high profits and growth. Accordingly, risk assessment and management are thus needed (Norton and Moore, 2006) to better use innovations and reap their benefits. A third dimension is the 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 level of risk (Mortara et al, 2011), which require corporate entrepreneurship to manage for better performance levels. Finally, there is the proactiveness dimension described by Miller (1983) as opportunity seeking through responding to the market ahead of 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 market competition. Based on this, a strong relationship between innovation and entrepreneurship could 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 literature pertinent to entrepreneurship implies a positive relationship between entrepreneurship and economic growth (Holcombe, 1998; Baumol and Strom, 2007). This is expected as we are living in a digital age and a global economy, where competition among organizations and economies has become knowledge-based (Naude' and Szirmai, 2013). The connection between economic growth and entrepreneurship stems from the fact that organizations with corporate entrepreneurship, supported by ICT, innovation atmosphere, and innovation opportunities, can see that ideas developed earlier could be the base for a new process, good, or service. According to Holcombe (1998), entrepreneurship is a main driver to economic growth, as entrepreneurial insights act as a base 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 possible only when enabled by supportive institutional policies and laws, as regulatory hurdles may make it extremely difficult to launch a new business or a new idea. This could be the answer for the big divide between developed and developing countries regarding the use of existing knowledge and available technologies more efficiently (Parente and Prescott, 1999), that is, to the question of why asymmetry is observed in innovation absorptive capacity, and hence economic growth and competitiveness across countries. At the firm level, studies reported a direct relationship between entrepreneurship and performance (Chen et al, 2015; Zahra et al, 1999 and Knight, 1997). 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 and 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 means to promote entrepreneurial spirit and behavior within an organization. Other researchers (e.g. Berghman et al, 2013) consider it responsible to stimulate the innovation capacity within an organization. This is realized by examining potential opportunities, proper acquisition and management of resources, and introducing new products and services. Entrepreneurial strategies could be a panacea for organizations aiming at achieving high performance levels and sustained competitive advantage (Roaldsen and Borch, 2011, Ismail, 2012).

H7: Corporate entrepreneurship is positively related to organizational performance.

Entrepreneurial strategies incorporate processes and actions that examine and exploit opportunities making innovative use of resources so as to achieve enhanced performance (Roaldsen and Borch, 2011). Examples of such strategies may include new business process redesign, new relations to various stakeholders, and renewal of business platforms. Kuratko et al. (2009) described it as “a vision-directed, organization-wide reliance on entrepreneurial behavior 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 and Borch, 2011). Accordingly, we can assume that ICT adoption/use and innovations contribute positively to organizational performance if the opportunities made possible by them get appropriately exploited through entrepreneurial strategies, actions, and behaviors; 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 could be depicted as follows:

[Insert Figure 3 about here]

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

[Insert Table 1 about here]

4 Methodology

4.1 Survey and data collection

This study employs correlational design to examine the relationships between IT adoption/ 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 respondents' attitudes and opinions about the ICT adoption/ use, Innovation level, Corporate Entrepreneurship, and Performance in their organizations. All items measuring these attitudinal variables used five-point Likert scales response formats (1 for Strongly Disagree, 5 for Strongly Agree).

Organizational performance measures could use both financial and nonfinancial measures , including profitability, market share, sales growth, overall performance, and stakeholder satisfaction (Lumpkin and Dess, 1996). Another useful performance measure is the “overall performance”, incorporating elements such as the organization's goals, objectives, and stakeholder satisfaction (Kirchhoff, 1978). 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 et al, 1994). The ICT adoption and use scale was used and validated in many research works like Davis et al. (1989), Rogers (1995), and Agarwal and Prasad (1998). More recently, Edmunds et al. (2012), Sangrà and González-Sanmamed (2010), and Aleke et al. (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 et al. (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 et al., 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 behaviors. A convenience sampling procedure was followed. Potential respondents were contacted by telephone or email and asked to participate. 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 usable, yielding a response rate of 44.0 percent.

Non-response bias was checked by contacting 18 non-respondents and asked about the reasons for not participating in the study. The busy schedule was identified as the main reason. In addition, the demographics values were used to conduct a Chi-Square (χ^2) test that allows 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 non-response bias.

[Insert Table 2 about here]

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 average number of years spent in company was 7.6 years. Further, the majority of the respondents (40.4%) worked in organizations belonging to the financial services industry followed by technology (16%), accounting (7.8%), commerce (6.1%), and hospitality (5.9%). Such cross-industry sample fits the study purpose as companies in various sectors are 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 more than 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 are considered to be under innovation atmosphere (INVATM) and the others under 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, the parceling scheme was followed (Bagozzi & Edwards, 1998; Coffman & MacCallum, 2005). The weighted sum composite scores for parceling 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 Figure 3 was examined through PLS-SEM using SMART-PLS software. 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, the centroid scheme was also indicated for estimating inner weights.

5.2 Outer model analysis

The measurement model was analyzed first 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 (Figure 4), the convergent validity of all five constructs was supported. As such, more than 50% of the variance in the observed variable could be explained by the underlying construct (Hulland, 1999). Furthermore, the 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 more than 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) exceed the shared variance with other constructs (values below or to the left), see (Fornell & Larcker, 1981).

[Insert Table 3 about here]

5.3 Inner model analysis and path estimates.

The second step of the analysis considered the inner model. In particular, the R^2 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 ($R^2 = 0.497$ and 0.378 for CENTRP and PRFRM constructs, respectively). These results agree with the proposed threshold of Chin (1998) so that the homological validity of the model is satisfactory.

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). Figure 4 depicts the results of both the inner model and the bootstrapping results given in Table 4.

[Insert Table 4 about here]

The path coefficients (Figure 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 the 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. As for innovation, it was found to have 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 impacts 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.

[Insert Figure 4 about here]

5.4 The ICT Adoption Model

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

The inner model analysis revealed an acceptable part of the variance of the performance constructs can be explained by the model ($R^2 = 0.497, 0.374$ and 0.170 for CENTRP, PRFRM and INNOV constructs, respectively). These results agree with the proposed threshold of Chin (1998) so that the nomological validity of the model is satisfactory.

Examining the structural model, the path coefficients among 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). Figure 5 depicts the results of both the inner model and the bootstrapping results are given in Table 5.

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

[Insert Table 5 about here]

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

[Insert Figure 5 about here]

5.5 IT Use Effects on the ICT Adoption Model: Multi-Group Analysis

To further examine the ICT adoption model depicted in Figure 5, multi-group analysis was employed to test for differences in the significance of path coefficients. Based on 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 via the standard score generated by factor analysis. Companies with a standardized score of less than 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 more than 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, change in the significance of both the direct and indirect effects of ITADOP on PRFRM were detected. IT adoption had significant direct positive effects on performance for the Low IT Use group but not the High IT Use Group ($\beta = 0.206$, $p\text{-value} = 0.022$ and $\beta = 0.040$, $p\text{-value} = 0.640$). Similarly, IT adoption had a significant indirect positive effects on performance for the Low IT Use group but not the High IT Use Group ($\beta = 0.214$, $p\text{-value} = 0.003$ and $\beta = 0.161$, $p\text{-value} = 0.053$). The results support the moderation effect that ICT use has on the relationships between ICT adoption and performance, thus supporting hypothesis H4.

[Insert Table 6 about here]

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 would reward successful entrepreneurship. ICT and innovation can be 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 in the company can be better used and integrated into the various processes and applications in the company. It is also pivotal to set 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 manifests itself in an atmosphere that encourages and applies proactiveness, innovativeness, and risk taking, and is particularly important in the Lebanese market - an unstable market characterized with established SMEs and family businesses.

We proposed and tested ten hypotheses based on a body of literature related to the contribution of ICT adoption/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 need to consider so as 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 (Teece et al, 1997) with the Theory of Innovation Translation, derived from the Actor Network Theory (Latour, 1996), thus assessing the contribution of ICT to organizational performance from 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 for examining the relationships between ICT adoption/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 done using multi-group analysis. Eight out of ten hypotheses were supported (Table 7), drawing attention to the importance of ICT use in driving forward the 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.

[Insert Table 7 about here]

The findings generated by this study provide interesting and important insights regarding the role that ICT adoption use, the innovation orientation and level of the organization, and corporate entrepreneurship play in the determination of the performance of the firm. To start with, the information technology paradox explained by previous researchers (e.g. Brynjolfsson and Saunders, 2010) was also addressed in this study. In conformity with what previous research found, this study concludes that the technology paradox could 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 that ICT use has on the relationships tested in the ICT Adoption model.

Investments in ICT cannot be done in isolation from the organization's strategies, direction, mission, and goals. ICT has to 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 and 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, 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 for 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 upgraded resources, capabilities, and initiatives (e.g. Agarwal and Brem, 2015). This goes in conformity with the Dynamic Capabilities view of the firm (Teece et al, 1997).

The full-mediation effect of innovation in the ICT-performance relationship warrants a strategic move in organizations to emphasize blending ICT with efforts aiming at the realization of the strategic objectives of the firm. This goes in conformity with previous research (Lundvall and Nielsen, 2007). The big role that innovation plays in allowing the organization 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 were made possible by ICT. Business process re-engineering, new business models, just-in-time and stockless inventory supply chain, and new services, like e-banking and e-health are few of many examples of innovations that were made possible by ICT adoption and use. Early adopters of these ICTs could 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 et al, 2004). Corporate entrepreneurship was found to partially mediate the ICT and Innovation relationships 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 and Javalgi, 2007), i.e. a corporate entrepreneurial spirit.

7 Research Implications, Limitations, and Recommendations

ICT use is a pivotal topic to be examined. After all, an adopted ICT can impact an organization or an industry only if it is used innovatively. Companies with the highest levels of returns to their ICT investments are going far beyond buying ICT resources and tools. As put by Brynjolfsson & Saunders (2010), these firms innovatively use their ICT resources by introducing organizational and business process changes. This study suggests that these could 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 imply, 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 urging recommendation to jointly consider technology adoption and use to better comprehend its long-term diffusion patterns (Lanzolla & Suarez, 2012).

The empirical results aforementioned provide good support for the hypotheses that innovation and corporate entrepreneurship are -each and both- significant mediators in the ICT-Performance relationship. Particularly interesting are our results in the ICT adoption model where 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 that corporate entrepreneurship plays in establishing a network of actors (both technological and non-technological) (Latour, 1996) to better seize the opportunities made possible by two strategic resources, namely ICT and innovation, and use them to enhance the competitiveness of the firm. With this theoretical integration, this research could 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 the 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 better understanding of the factors that could influence the adoption, management, and use of ICT resources for enhancing the competitiveness level of the firm. 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. Yet, ICT diffusion is successful only if ICT is appropriately and innovatively used, with its potential opportunities well managed and exploited within a corporate culture nurturing corporate entrepreneurship. Policy makers are therefore recommended to increase their awareness of the differences between adoption and actual usage of ICT, and thus set policies that support and promote effective ICT and innovation diffusion and not just adoption. In addition, policies fostering a culture of corporate entrepreneurship and providing it with facilitating conditions such as entrepreneurship education and training (Bae et al, 2014) enables better exploitation of 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 start with, the respondents were selected using the convenience sampling technique. This has its drawbacks regarding the generalizability of the results although this was deemed

necessary due to the nature of data collected from the Lebanese market. Also, the data were collected through self-report questionnaires, which constitute a major limitation to construct validity (Avolio et al., 1991). The questionnaires ask for information about the companies to be reported by executives and employees working there. Moreover, the relationship between ICT, innovation, corporate entrepreneurship and performance can change and evolve over time, especially that entrepreneurship is all about change, and that ICT and innovation are considered catalysts of change (Van Winden et al., 2004). Moreover, the study did not account for certain behavioral factors – related 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 measure, such as employee satisfaction, customer satisfaction, and overall performance could also be useful.

In light of these limitations, as a future work, a longitudinal study is recommended to seize the relationship between ICT, innovation, corporate entrepreneurship and performance. Moreover, it is recommended to run a replication study with random sample selection that may improve the methodological rigor of the study. Further, we recommend conducting a regional comparative study in companies operating in environments similar to the Lebanese business environment; this will give 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, beside these challenges there exist many opportunities that will be achieved with ICT and innovation adoption and diffusion. Organizations can avoid these challenges and maintain 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 behaviors 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 consequents 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.
- Bagozzi, R. P., & Edwards, J. R. (1998). A general approach for representing constructs in organizational research. *Organizational Research Methods*, 1(1), 45-87.
- Blurton, C. (2002). "New Directions of ICT-Use in Education". (Retrieved from <http://www.unesco.org/education/educprog/lwf/dl/edict.pdf> ; accessed 20 November 2016).
- 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.
- 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., & Saunders, A. (2010). *Wired for innovation: how information technology is reshaping the economy*. MIT Press.
- Brynjolfsson, E. (1993). The productivity paradox of information technology. *Communications of the ACM*, 36(12), 66-77.
- 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. *In International Conference on High Performance Computing and Simulation HPCS'09*. IEEE., 1-11.
- 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.*, K. Knorr-Cetina, A. V. Cicourel, R. Paul, and K. Paul, Eds., ed London, 277-303.
- 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. *Entrepreneurship and Technological Change* (ed. Cassia, L., Minola, T., and Pateari, S.), MA: Edward Elgar Publishing, Inc., 3-14.
- 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, AN. (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. G., & Slevin, D. P. (1991). A conceptual model of entrepreneurship as firm behavior. *Entrepreneurship: Critical perspectives on business and management*. Baylor University, 7-25
- Covin, J., & Miles, M. (1999). Corporate entrepreneurship and the pursuit of competitive advantage. *Entrepreneurship: Theory and Practice*, 23(3), 47-63.
- 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*, in press, <http://dx.doi.org/10.1016/j.jbusres.2016.04.169>
- 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. & D. V. Hinkley (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.
- 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.
- 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.
- Erel, B. (2014). A Lot of IT Projects Fail, But Why? (Retrieved from: <http://saasaddict.walkme.com/lot-project-fails/>)
- Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: what are they?.*Strategic management journal*, 21(10/11), 1105-1121.
- Ferreira,J.J.M.,et al. (2015), Drivers of innovation strategies: Testing the Tidd and Bessant (2009) model, *Journal of Business Research* , (Retrieved from: <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. ; Cespedes-Lorente, J. & Valle-Cabrera, R. (2005). Organizational learning capability: A proposal of measurement. *Journal of Business Research*, 58(6), 715-725.
- 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.
- 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.
- 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.
- 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, TM. (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.
- 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. And 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., And 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. In *Technology-Based Nascent Entrepreneurship* (pp. 19-52). Palgrave Macmillan, New York.
- Kusumaningtyasa, N., & Suwartob, 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
- 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. *Shaping technology/Building society*, (ed. Bijker, W. and Law, J.), London: MIT Press, 225-258.
- Latour, B. (1996). *Aramis or the Love of Technology*. Cambridge, MA: Harvard University 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 *Entrepreneurship and Technological Change* (ed. Cassia, L., Minola, T., and Pateari, S.), MA: Edward Elgar Publishing, Inc., 287-311.
- Muchoki, E. (2013). The effect of product innovation on the financial performance of mobile telephony firms in Kenya (Doctoral dissertation, University of Nairobi).
- 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. In Proceedings of the 2013 international conference on Software engineering (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. And Hamel, G., (1990). The core competence of the corporation. *Harvard business review*, 68(3), 79-91.
- Rahman, S. U., And 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 Entrepreneurship and Technological Change (ed. Cassia, L., Minola, T., and Pateari, S.), MA: Edward Elgar Publishing, Inc., 51-67.
- Rogers, C. (1995). A way of being. Harcourt: Houghton Mifflin.
- 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, DOI: 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. *In Industrial Engineering and Engineering Management (IEEM), 2012 IEEE International Conference (2028-2032)*. IEEE.
- Sharma, P., & Chrisman, S. J. J. (2007). Toward a reconciliation of the definitional issues in the field of corporate entrepreneurship. *In Entrepreneurship (83-103)*. Berlin Heidelberg: Springer.
- Siegel, D. (2011). Preface, in Entrepreneurship and Technological Change (ed. Cassia, L., Minola, T., and Pateari, S.), MA: Edward Elgar Publishing, Inc., xiii-xv.
- 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., & Huarng, K. H. (2013). Innovation and entrepreneurship in knowledge industries. *Journal of Business Research*, 66(10), 1964-1969.
- 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.
- Stam, E., & Garnsey, E. W. (2007). Entrepreneurship in the knowledge economy. *Centre for Technology Management (CTM)*. Working Paper, (2007/04).
- 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, W. (2001). How Visual Basic entered the curriculum at an Australian University: An account informed by innovation translation. Challenges to Informing Clients: A Transdisciplinary Approach (Informing Science, June 2001).
- 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. and 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*, ed Hershey: IGI Global, 83-98.
- 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. (1996). Governance, ownership, and corporate entrepreneurship: The moderating impact of industry technological opportunities. *Academy of management journal*, 39(6), 1713-1735.
- 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., Jennings, D. F., And 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.

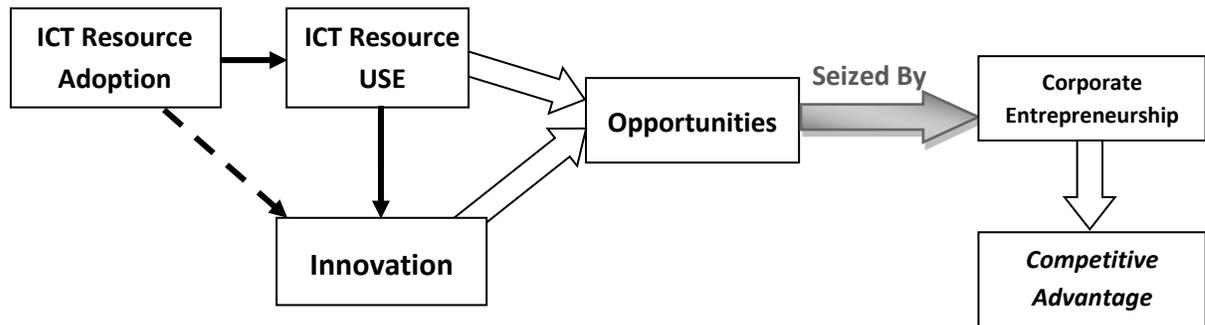


Figure 1 ICT –Innovation-Entrepreneurship (IIE) Model

Level of Analysis	Crucial Elements of Entrepreneurship	Impact of Entrepreneurship.
<i>Individual Level</i>	Opportunity recognition, opportunity creation, decision making process	Self-realization and personal wealth.
Firm Level	New venture creation, <i>ICT adoption/use</i> , R&D activities, entry in new markets, <i>innovation</i>	→ <i>Firm Performance</i> , corporate change.
<i>Marco Level</i>	Variety, Competition, selection, emulation	Competitiveness, economic growth, industrial change, job places and social responsibility

Figure 2 Entrepreneurship- Individual, Firm, and Macro Level. Source: Adapted from Wennekers and Thurik (1999)

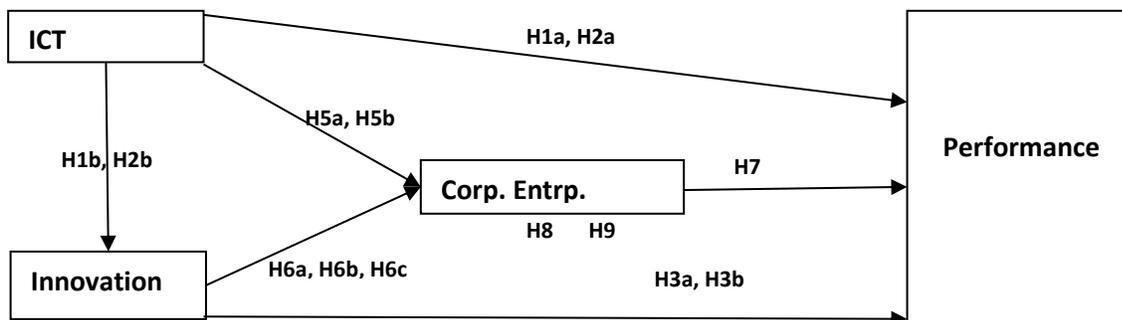


Figure 3 Research Model

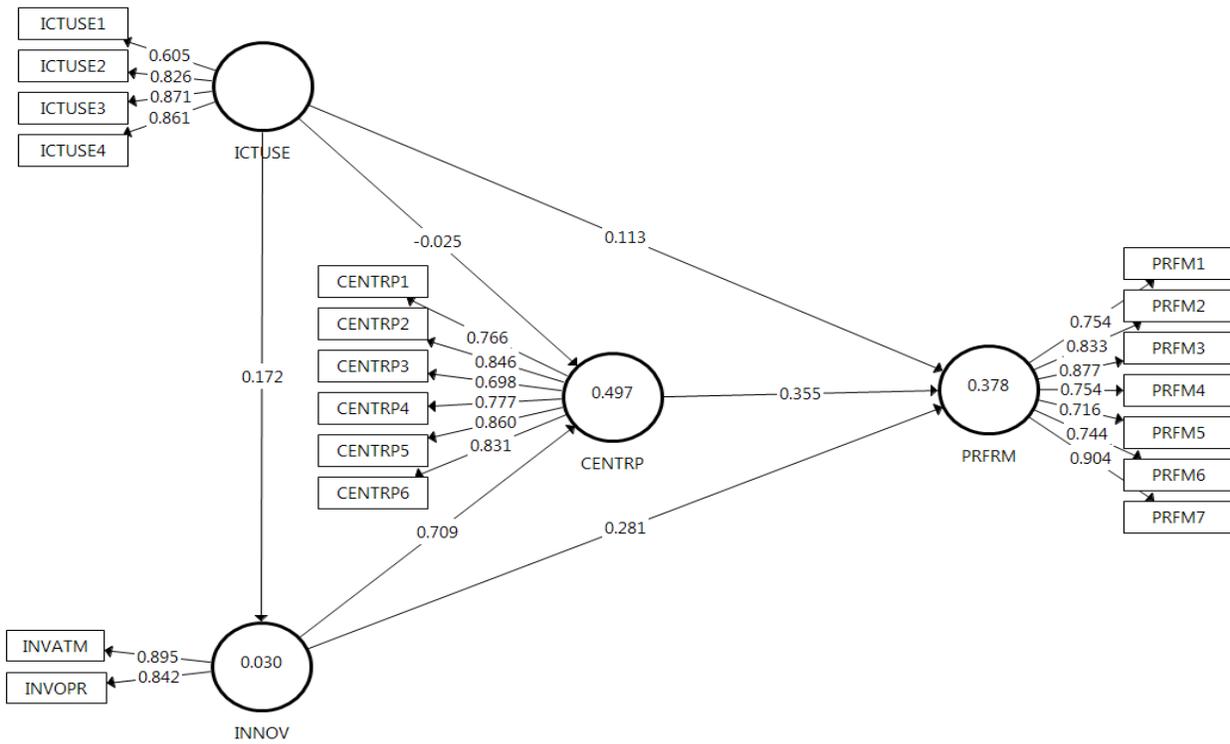


Figure 4 Structural model – path coefficients

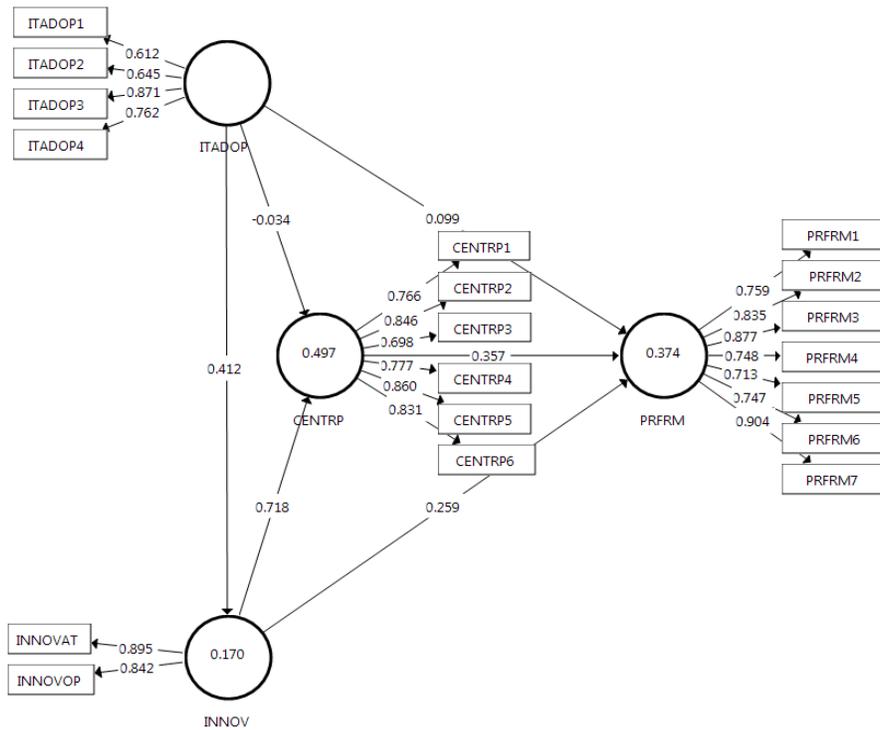


Figure 5 Structural model – path coefficients for the ICT Adoption

Table 1 Relationships and Supporting Theories

Relationships	Supporting Theory	Hypothesis Derived
ICT → Performance	Dynamic Capabilities	<i>H1a: ICT use is positively related to Organizational performance.</i> <i>H2a: ICT adoption is positively related to Organizational performance.</i>
Entrepreneurship → Performance	Dynamic Capabilities	<i>H7: Corporate entrepreneurship is positively related to organizational performance.</i>
ICT → Innovation → Performance	Dynamic Capabilities	<i>H3a: Innovation mediates the relationship between ICT use and Performance.</i> <i>H3b: Innovation mediates the relationship between ICT adoption and Performance.</i>
ICT → Entrepreneurship → Perf.	Dynamic Capabilities	<i>H8: Corporate Entrepreneurship mediates the relationship between ICT and performance.</i>
Innovation → Entrepr. → Perf.	Dynamic Capabilities	<i>H9: Corporate Entrepreneurship mediates the relationship between Innovation and performance.</i>
ICT use as moderator for all relationships in IT adoption model	Dynamic Capabilities	<i>H4: ICT use moderates the above relationships</i>
ICT → Corp. Entrepreneurship	Innovation Translation	<i>H5a: ICT adoption is positively related to entrepreneurship.</i> <i>H5b: ICT use is positively related to entrepreneurship.</i>
Innovation Entrepreneurship → Corp.	Innovation Translation	<i>H6a: Innovation is positively related to entrepreneurship.</i>
ICT → Innovation → Entrepreneurship	Innovation Translation	<i>H6b: Innovation mediates the relationship between ICT use and entrepreneurship.</i> <i>H6c: Innovation mediates the relationship between ICT adoption and entrepreneurship</i>
ICT → Innovation	Innovation Translation	<i>H1b: ICT use is positively related to innovation</i> <i>H2b: ICT adoption is positively related to innovation.</i>

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	

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	0.730				
CENTRP	0.913	0.637	0.262	0.798			
ICTUSE	0.873	0.637	0.303	0.097	0.798		
INNOV	0.860	0.755	0.412	0.704	0.172	0.869	
PRFRM	0.925	0.641	0.299	0.564	0.196	0.551	0.800

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

Table 5 Path Coefficients and Indirect Effects for the ICT Adoption Model

Direct Effects	Original Sample	Sample Mean	Standard Deviation	t-Values	p-Values
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
Indirect Effects					
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

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
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	0.640	0.022
Indirect Effects										
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	0.053	0.003

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