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Impact of ICT-based Innovations on Organizational Performance: The Role of Corporate Entrepreneurship

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Abstract

Purpose –The purpose of this paper is to develop and test a framework that would depict and examine the nature of the relationship between ICT use and organizational performance in the Lebanese market, taking into consideration the impact that innovation and corporate entrepreneurship may have on this relationship.

Design/methodology/approach – In this study it is hypothesized that ICT and ICT-based innovations present huge opportunities for organizations of all kinds. Corporate entrepreneurship is thus needed to take these opportunities and make use of them to respond to environmental changes and realize sustainable competitive advantage. To investigate the proposed model a survey targeting employees, department heads, and managers who adopted ICT applications in SMEs located in Lebanon was conducted.

Findings – The results indicate that ICT and innovation are strategic resources. However, their contribution to sustainable competitive advantage vitally depends on the implicitness and entrepreneurial behaviors of those involved. It is through this capability that ICT and ICT based innovations could make a difference in organization's performance – both present and future.

Research limitations/implications – First, the respondents were selected using the convenience sampling technique. Second, the data were collected through self-report questionnaires. Third, 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.

Practical implications – 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.

Originality/value – The results of this study have implications for ICT adoption in Lebanese SMEs. More importantly, they suggest a framework which depicts the relationship between ICT and the organization's innovation level on one hand, and a company's performance on the other, taking entrepreneurship as a mediator in this relationship.

Keywords Information Technology (IT); Information and Communication Technologies (ICT); Innovation; Corporate Entrepreneurship (CE); Performance; Dynamic Capabilities View; Theory of Innovation Translation.

1 Introduction

The digital and information age and the knowledge-based global economy have led to the important realization that corporate entrepreneurship may be an effective means towards achieving high performance and competitiveness levels in an organization (Kuratko and Audretsch, 2013). Recent research has emphasized corporate entrepreneurship as an important potential growth driver (Morris et al, 2011; Burgelman and Doz, 2013). Concurrently, in the era of globalization and digitization, innovation proliferation at the organizational and national levels is undertaking new paths. As a result of globalization, organizations are setting strategies, establishing policies, and signing agreements aimed at enhancing innovation and achieving a competitive and sustainable performance. In other words, the emphasis is no more merely on inter-firm collaboration (Patrakosol and Olson, 2007; Malhotra et al., 2001) and collaboration among globally distributed teams (Kotlarsky and Oshri, 2005) as the means for enhancing innovation. Rather, international RandD agreements, intergovernmental collaborations, and positive externalities are also embraced as pivotal elements in supporting and improving domestic innovation efforts and policies (Fernandez-Ribas and Shapira, 2009). Moreover, in this era, where advancements in information and communication technologies (ICT) are taking place at a rapid pace, these advancements may have a crucial role in galvanizing ICT-based innovations (Pilat and Wolf, 2004).

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), enhanced competitiveness advantage (Kuratko et al, 2009), and supporting innovativeness (Baden-Fuller, 1995). 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 and implementation of 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 for better efficiency and higher performance (Igun, 2014; Consoli, 2005). However, despite wide adoption of ICT by organization in various sectors, it is reported by various survey reports that several IT 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).

Gartner Research analyzed the above findings, especially those applied to IT projects in government institutions. The research company reported that such failure rate could be attributed to lack of proper business process management, lack of IT-organizational strategy alignment, and lack of proper governance and risk management (Carlton, 2014). Such problems could be addressed, according to Deloitte, by top managers and decision makers ensuring the following: (Deloitte, 2015)

1. Understanding and articulating the need for change.
2. Providing adequate sponsorship and leadership.
3. Understanding the organizational culture and response to change and appreciating the importance of detailed change management and communication plan.
4. Setting clear roles and responsibilities and building accountability.
5. Developing and enforcing a clear risk assessment and management plan.

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 achieving competitive advantage. Experts in the field suggest that in an unstable economic scenario, innovation would be mission critical for companies aiming at creating and defending their competitiveness advantage as well as nurturing sustainable growth. With rapidly growing ICT advancements, innovation and the business opportunities it creates all tend to be technology-based (Siegel, 2011). To capture those opportunities made possible by ICT and ICT-based innovations, entrepreneurs' ideas and actions are needed. In this information age, 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 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 and 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 and Audretsch, 2013). Previous research examined the relationship between innovation and entrepreneurship (Rosenbusch et al, 2011). Previous research also reported the importance of entrepreneurial strategies in the achievement of competitive advantage (Roaldsen and 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.

The purpose of this research is threefold. Taking the Lebanese market into consideration, the first purpose is to present an integrated and comprehensive framework depicting the relationship between ICT and the organization's innovation level on one hand, and a company's performance on the other. This is important given the fact that different companies have different ICT resources (Coltman et al, 2015; Anaya et al, 2015), innovation capacities, and diffusion levels. The second is to examine the role that corporate entrepreneurship might play in this relationship. This will also spot the pitfalls that may hamper the efforts to capitalize on the opportunities made possible by ICT capabilities and innovations. The synthesis will draw upon a review of both theoretical and empirical research pertinent to the three concepts. Finally, the third is to provide an empirical test for the conceptual model proposed using firm-level data. This will help in establishing standards and policies that can govern ICT investments and their innovative use as well as potentially increasing their contribution to the organization's well-being. It will also be crucial for formulating entrepreneurial strategies with an eye on the company's ICT and innovation capabilities.

Emphasizing a holistic and dynamic framework linking ICT, innovation, and corporate entrepreneurship to a firm's competitiveness level will make this study useful for scholars, government analysts, information and innovation specialists, as well as ICT developers and strategists. To start with, scholars can use the framework as a foundation for assessing the contribution of each of each of the three factors to the organization's performance. Moreover, the model is flexible. For example, it can be used as one integrated tool, or can be deployed to examine relationships only as they relate to various selected elements. In addition to this, the study can help in 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, to support the firm strategy-technology fit, ICT designers and developers can find the study useful as it allows examining the impact of every innovation/ICT strategy or tool on the ICT performance and on the company's competitiveness objectives. Based on the aforementioned purpose, the study addresses the following questions:

- What is the relationship between ICT use and ICT-based innovation on one hand and a firm's performance on the other?
- What is the relationship between corporate entrepreneurship and a firm performance?
- What role does innovation play in the ICT – performance relationship?

- What role does corporate entrepreneurship play in the ICT-innovation relationship with organizational performance?

The remaining of this paper is organized as follows. The next section presents the theoretical framework that the study draws upon. This is followed by a literature review related to information and communication technologies, innovation, corporate entrepreneurship, and organizational performance in an attempt to probe important relationships and derive the study hypotheses. Based on the analysis of the literature and the hypotheses derived, a conceptual model will be proposed. After this, the study design and methodology, along with the variables examined, the data used, and the analysis performed to test the study hypotheses and the conceptual model will be presented and discussed. The results of the data analysis and the evaluation of the hypotheses in light of the findings will then be reported and interpreted. Finally, the study implications, along with the limitations and the recommendations for future research will be presented.

2 Theoretical Framework

The study draws on two main theoretical frameworks: (1) the dynamic capabilities view (Teece et al. 1997), emerging from the resource based view (Barney, 1991), and (2) the theory of innovation translation.

The dynamic capabilities applies to environments of rapid change and attempts to identify sources of value creation and value realization. More explicitly, it endeavors to locate capabilities that can drive the company to the achievement of sustainable competitive advantage, and to explain how these dynamic capabilities can help in better resource allocation in the firm (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’.

Considerations such as how resources are developed, how they are integrated within the firm and how they are released have been under-explored in the literature. Dynamic capabilities attempt to bridge these gaps by adopting a process approach: by acting as a buffer between firm resources and the changing business environment, dynamic resources help a firm adjust its resource mix and thereby maintain the sustainability of the firm’s competitive advantage, which otherwise might be quickly eroded. So, while the RBV emphasizes resource choice, or the selecting of appropriate resources, dynamic capabilities emphasize resource development and renewal.

According to Wade and Hulland (2004), IS resources may take on many of the attributes of dynamic capabilities, and thus may be particularly useful to firms operating in rapidly changing environments. Thus, even if IS resources do not directly lead the firm to a position of superior sustained competitive advantage, they may nonetheless be critical to the firm’s longer-term competitiveness in unstable environments if they help it to develop, add, integrate, and release other key resources over time.

The applicability of this view of the information systems research stream has been demonstrated by several researchers (Wade and Hulland, 2004; Daniel and Wilson, 2003; Jarvenpaa and Leidner, 1998). Wade and 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 IT/IS to the value of the firm (e.g. Kindstrom et al, 2013; Rohrbeck, 2010; Tian et al, 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 making are few of the many ways that ICT manifests its dynamic capabilities features. This conforms with the Schumpeterian view (1934) regarding the achievement of competitive advantage based on improving, shaping or enhancing existing resources and competencies via innovative ways and complex processes (Lawson and Samson, 2001). This involves knowledge integration from various sources (Prahalad and Hamel, 1990) continuous learning processes (Pisano, 1994), seizing new opportunities, and managing risk and uncertainty (Kogut and Zander, 1992).

The above discussion applies well to this study. ICT and ICT-based innovation pave the way for meeting the strategic objectives of the firm, including but not confined to, operational excellence, 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.

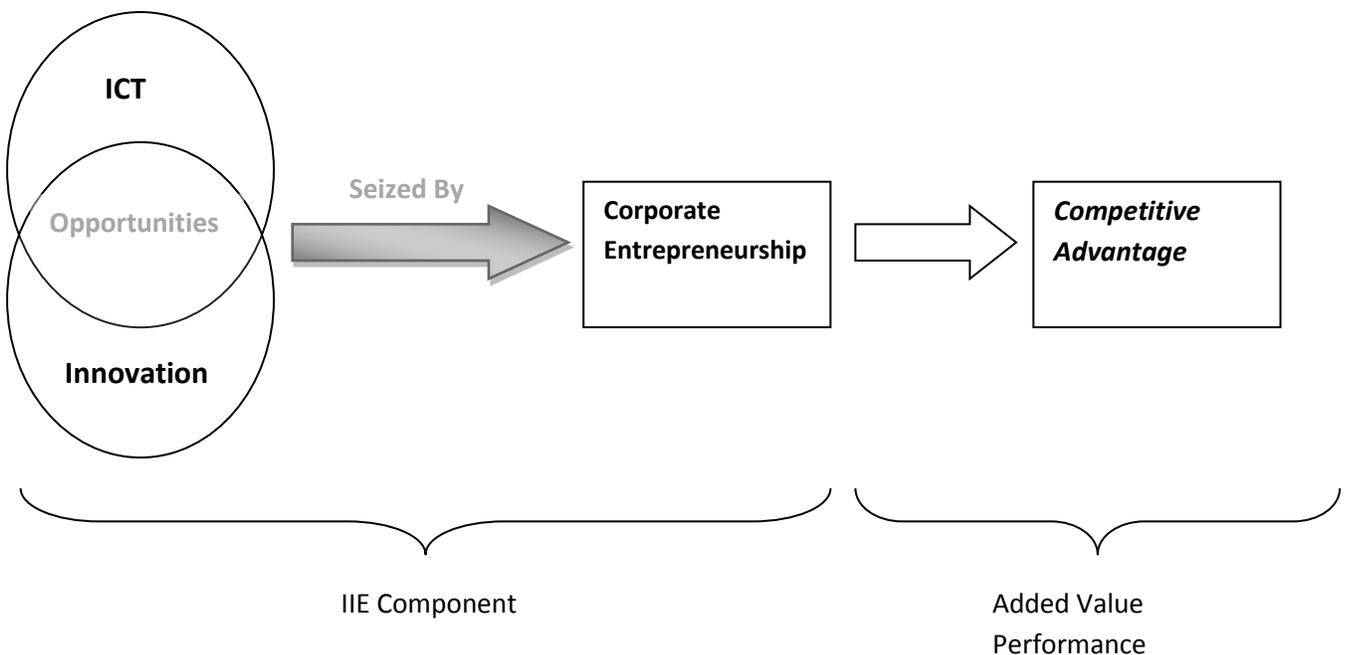
As for the theory of innovation translation, it is a view proposed in the Actor Network Theory, where the core is translation (Law, 1992). This can be defined as, "... the means by which one entity gives a role to other" (Singleton and Michael 1993:229). The theory of innovation translation is derived from the Actor Network Theory (Latour, 1992). The theory views technological changes as socio-technical projects, with the main actors being both human and non-human entities (Law, 1987). Latour (1996) describes the innovation translation as the movement of innovation across space and time in the hands of people who deal with it in different ways. Depending on people's reactions to it, the innovation may be accepted, modified, or dropped. Accordingly, the adoption of the innovation comes as a consequence of the actors' reactions to it and how they shape it. In other words, as stated by Latour (1996), innovation is a process characterized by continuous transformation.

Previous IS research deployed the theory of innovation translation to study 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), and the dynamics of the innovation process in the humanitarian sector (Tusiime and Byrne, 2011).

The theory applies well to this paper since ICT-based innovations continuously change, and are adopted by decision makers in the organization – those who can assess the opportunities made possible by those innovations. The decision makers, with their entrepreneurial spirit, will make use of these opportunities (Mortara et al, 2011) to enhance the value of their organization and drive it to high competitiveness levels. The above discussion makes possible the visualization of the conceptual model of the study. This is shown in figure 1.

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. These opportunities are seized by managers with entrepreneurial spirit who can take risk, manage resources, and properly use these innovations to foster the organization’s growth and competitive advantage.

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. 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 use, innovation, and firm performance.

Figure 2 Entrepreneurship- Individual, Firm, and Macro Level

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

Source: Wennekers and Thurik (1999)

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 enhance integration of activities, and thus improve productivity (Liao et al, 2015; Igun, 2014).

Moreover, studies at the firm level reveal an important explanation to the relationship between ICT use and 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 (Melville et al, 2004). Brynjolfsson (1993) found that ICT enhances performance through its innovative use and application. Hence, we posit the following hypotheses:

H1: ICT use is positively related to Organizational performance.

H2: ICT use is positively related to innovation.

H3: Innovation is positively related to organizational performance.

H4: Innovation mediates the relationship between ICT use and Performance.

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 technological innovations, such as social media, mobile commerce, cloud computing, and others, have presented a vast array of opportunities for entrepreneurial organizations to take and develop (Stam and Garnsey, 2007).

ICT provides organizations with a vast array of opportunities (OECD, 2003) including, but not restricted to, e-business, mass customization, effective customer relationship management, efficient supply chain management, continuous communication with internal and external stakeholders, and better access, management, and controlling of resources. Corporate entrepreneurship is thus needed to seize the benefits of ICT by integrating them into the organizations' strategies and help create the right environment for ICT use and innovation diffusion. With this in mind, the following hypotheses could be posited:

H5: ICT is positively related to entrepreneurship.

Regarding innovation and corporate entrepreneurship, the two could be related. The former presents opportunities and the latter presents a means to seize these opportunities. 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).

Research in the area of innovation at the firm level reported the importance of corporate entrepreneurship in exploiting the opportunities made possible by innovation (Mortara et al, 2011; Covin and Miles, 1999). Without corporate entrepreneurship efforts, the innovation capacity in an organization 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. Innovation implies change and change entails risk (Mortara et al, 2011). Risk assessment and management are thus needed to properly use innovations and reap their benefits. A third dimension is the technological changes. 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, we can assume a strong relationship between innovation and entrepreneurship.

H6: Innovation is positively related to entrepreneurship.

Finally, the body of literature pertinent to entrepreneurship has implied that there is a positive relationship between entrepreneurship and economic performance. For example, DeSoto (1989) highlighted the importance of entrepreneurship as a powerful means for transferring technology and new ideas into an economy, thus enhancing its competitiveness and growth (DeSoto 1989, as adapted from Burnham, 2006). Burnham (2006) contended that this is possible only when enabled by the prevailing institutions and laws, as regulatory hurdles may make it extremely

difficult to start a new business or implement a new idea. In fact, self-imposed constraints such as restricting freedom of experimentation, the adoption of new technologies, and the adoption and implementation of more efficient processes can all be answers to the question of why poor countries don't use the existing knowledge and available technologies more efficiently (Parente and Prescott, 1999), that is, to the question of why asymmetry is observed in technical change and hence economic growth and competitiveness across countries. At the firm level, studies reported a direct relationship between entrepreneurship and performance (Zahra et al, 1999 and Knight, 1997). Corporate entrepreneurship has been increasingly recognized by researchers in the field to be a strong enabler for the development of new businesses or the renewal of existing ones (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 consider it responsible to stimulate the innovation capacity within an organization by examining potential opportunities, acquisition and management of resources and commercialization of new products and services. Zahra (1995) defines corporate entrepreneurship as the attitudes and actions that empower a company to seize opportunities, take risks, and innovate. Entrepreneurial strategies could be a panacea for organizations aiming at achieving high performance levels and sustained competitive advantage (Roaldsen and Borch, 2011).

H7: Corporate entrepreneurship is positively related to organizational performance.

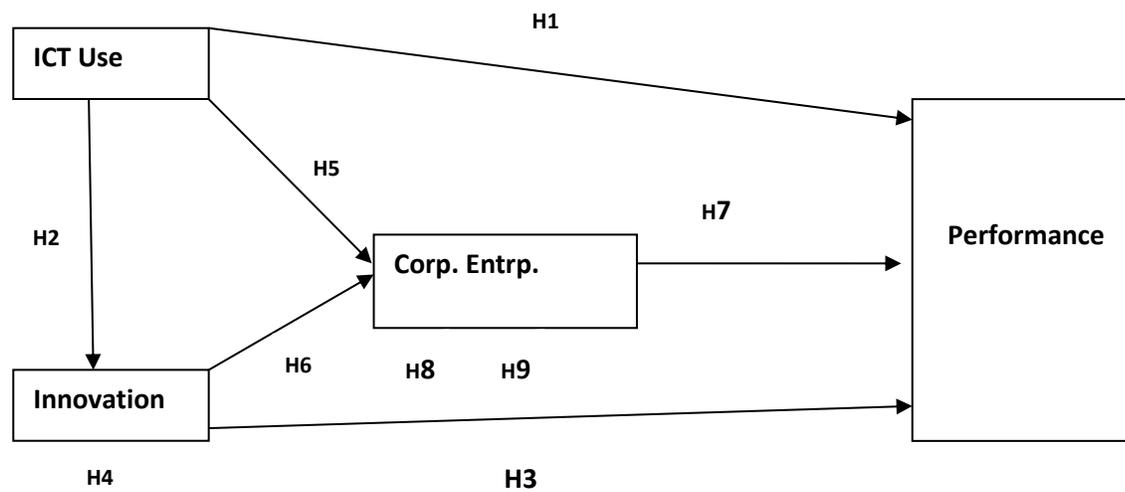
Entrepreneurial strategies represent processes and actions that explore and exploit opportunities making use of resources in an innovative way so as to achieve added value performance (Roaldsen and Borch, 2011). These strategies may involve new business process redesign, new relations to customers, suppliers, and industry partners, and renewal of business platforms. They also could be described 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” (Kuratko and Audretsch, 2009, P.5). These strategies make possible new ways to performance improvement and to sustained competitive advantage (Roaldsen and Borch, 2011). Based on this, we can assume that ICT use and ICT-based innovations contribute positively to organizational performance if the opportunities made possible by them get appropriately exploited through entrepreneurial strategies and behaviors.

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

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

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

Figure 3 Research Model



4 Methodology

4.1 Survey and data collection

This study is a correlational design study seeking to assess the relationship between ICT use, **Innovation**, and **Corporate Entrepreneurship** and to explore the potential causal impact of each of these factors on **organizational performance**. In order to do these assessments and test the above stated hypotheses, measurement scales were developed, tested, and used. The first step was a draft questionnaire that was constructed and pre-tested with five academics and two industry experts. Based on this, the content validity of the scale was checked and improved. The measurement scales in the used questionnaire consisted of items representing respondents' attitudes and opinions about the ICT use, Innovation, Corporate Entrepreneurship, and Performance in their organizations. The response formats used for all items representing these attitudinal variables were five-point Likert scales, ranging from (1) Strongly Agree to (5) Strongly Disagree.

In assessing organizational performance, while financial considerations are important, non-financial considerations may be important as well. In this regard, different studies adopted various performance measures, including sales growth, market share, profitability, overall performance, and stakeholder satisfaction (Lumpkin and Dess, 1996). In addition, researchers may adopt the "overall performance" measure, which could be useful since it incorporates the firm's goals, objectives, and other elements related to stakeholder satisfaction (Kirchhoff, 1978). Firm **performance** in this study was measured with **seven items** that asked respondents to evaluate their **organization's performance relative** to their competitors, stakeholders' satisfaction, and overall performance (McDougall et al, 1994). The information technology use scale included **6 items** related to the *frequency of use of ICT in the organization, its integration to the business and work processes, and the support it provides in managerial decision making and task completion*. The scale used was adopted from Davis et al (1989), Rogers (1995), and Agarwal and Prasad (1998). The firm's **innovation orientation** scale contained **8 items** measuring, for example, *the degree to which a company encourages pursuit of new knowledge,*

search for latest technologies, introducing breakthrough improvements, and is characterized by high RandD spending levels at the company and the industry levels. The innovation orientation scale items were based on Gatignon et al. (2002). Finally, the corporate entrepreneurship scale was based on Zahra (1996), and included items that had to do with innovativeness, risk taking, and proactiveness.

Also, the scale was tested for both construct loadings and reliability, and the scale and its subscale items proved to have high **loadings (>0.5)** and high **reliability (Cronbach's $\alpha > 0.7$)** (Hair et al., 2006). The **instrument constructs, corresponding items, their factor loadings, and construct reliability** are presented in **Table 1**. Cronbach's alpha coefficients for questionnaire-based variables ranged from 0.83 to 0.91, which exceeds the recommended minimum of 0.7 for combining the questions of each variable together on one scale (Nunnally, 1994, p. 245). The mean of the responses for the questionnaire items of each variable was used to operationalize this research variable.

4.2 Sample

Based on the nature of the study, the target population was employees, department heads, and managers with middle and senior level positions working in organizations that had adopted ICT applications. The respondents were expected to be familiar with the ICT adopted and used in the organization as well as the organization's innovation orientation and entrepreneurial behaviors. Using a convenience sampling procedure, managers and employees of organizations operating in various sectors (financial, commerce, technology, services, and others) were contacted by telephone or email to identify those who were willing to participate. **450 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 450 questionnaires, **150 were returned** yielding a response rate of **33.3 percent**.

To check for non-response bias, 18 non-respondents were contacted, who revealed the busy schedule as the major reason for not filling out the questionnaires. Using the demographics values of and running a Chi-Square (χ^2) test allowed for a comparison between initial respondents (those who responded within the first two weeks) and late respondents (those who were contacted several times and responded after 75 to 90 days). The lack of significant differences in the demographics indicated that late respondents (who most probably shared some characteristics with non-respondents) did not significantly differ from respondents (initial), implying that the study has no significant response-bias.

The sample was primarily male (64%) and relatively young (65.3% with age ranges of <25 or of 25-35). The sample consisted of 26% senior level managers and 27% middle managers or department heads. The average years of experience were 10.4 years and average number of years spent in company was 6.3 years. Further, the majority of the respondents (42%) worked in organizations belonging to the financial services industry, followed by Commerce (11.3%), technology (10%), and hospitality (7.3%). 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, 84% of the responding companies had more than 50 employees.

Table 1 Factor Loadings and Reliability Scores for ICT use, Innovation, Corporate Entrepreneurship, and Performance Items

Construct	Items	Factor Loadings	Cronbach
Information Technology Use	IT integration in work processes	0.854	0.867
	Use IT and IS capabilities	0.835	
	Frequent user of organization's IT and IS	0.816	
	Experiment with new IT	0.843	
	First to use new IT	0.832	
	Receptive to new IT	0.715	
Innovation	Pursuit of novel knowledge	0.693	0.837
	Search for latest technology	0.748	
	Investigation in various directions	0.743	
	Exploration of new areas	0.702	
	Discovery	0.747	
	Breakthrough improvements	0.69	
	High RandD spending in industry	0.656	
	High RandD spending in company	0.707	
Corporate Entrepreneurship	Introduced new products and services over the past three years	0.79	0.881
	Dramatic changes in products and service mix over the past three years	0.843	
	Emphasis on major innovations in products and services over the past three years	0.786	
	Tendency for high risk projects over the past three years	0.752	
Organizational Performance	High efficiency levels in operations	0.839	0.907
	Productivity is high	0.828	
	Performance better than rivals	0.652	
	Organization's market constantly growing	0.653	
	Customers are satisfied	0.777	
	Overall, Company performance is high and improving	0.798	

4.3 Data Analysis

Data analysis was performed using SPSS, Sobel test for mediation, and Preacher and Hayes' SPSS Macro for multiple mediation assessment. First, to check and establish the unidimensionality of factors, an exploratory factor analysis using principal component analysis was used. Further, the Varimax rotation was done to check the loadings of the various ICT use, innovation, corporate entrepreneurship, and performance items into their factors. Results, shown in Table I, demonstrate that the different items loaded highly into the different constructs and demonstrated high Cronbach alpha (α) scores, thus illustrating the convergent validity and the construct reliability of the scales used.

A multiple linear regression analysis was used since it was appropriate for an exploratory study designed to find out the nature of the relationship between ICT use, innovation, and corporate entrepreneurship. Further, to examine the potential causal impact of these variables on organizational performance, regression analysis with mediation testing was performed.

Several regression models were built to test the various hypotheses stated in the study. Following Baron and Kenny's (1986) steps, mediational models were estimated. The four steps in establishing mediation go as follows: (Baron and Kenny, 1986; James and Brett, 1984)

Step 1: Showing that predictor X is related to criterion Y; i.e. $X \xrightarrow{c} Y$

Step 2: Showing that the causal variable (predictor X) is correlated with the mediator; i.e., $X \xrightarrow{a} M$

Step 3: Showing that the mediator is correlated with (or affects) criterion Y (the outcome dependent variable); i.e., $M \xrightarrow{b} Y$.

Step 4: Assessing whether the assumed mediation is partial or complete (depending on whether the effect of X on Y controlling for M is zero or just reduced); i.e. $X \xrightarrow{c'} M \xrightarrow{b} Y$

When establishing mediational models, it is important to determine the amount of mediation, aka the indirect effect (ab), knowing that:

Total effect = direct effect + indirect effect; i.e.:

$$c = c' + ab$$

With the above understanding, several regression models were built and estimated to:

1. Assess the potential causal impact of ICT use, Innovation, and corporate entrepreneurship on organizational performance.
2. Assess the potential causal impact of ICT use and innovation on Corporate Entrepreneurship.

3. Assess the amount of the mediation (indirect effect) of Innovation in the ICT-Performance relationship.
4. Assess the amount of the mediation (indirect effect) of Corporate Entrepreneurship in the ICT-Performance and Innovation-Performance relationship.
5. Assess the amount of mediation of both Innovation and Corporate Entrepreneurship in the ICT-Performance relationship.

The above relationships and the tests used to assess them are shown in Table 2.

Table 2 Relationships and Tests Used

Relationship tested	Test Applied
ICT Use → Performance Innovation → Performance Corporate Entrepreneurship → Performance	Simple Linear Regression
ICT Use → Corporate Entrepreneurship Innovation → Corporate Entrepreneurship	Simple Linear Regression
ICT Use → Innovation → Performance ICT → Corporate Entrepreneurship → Performance Innovation → Corporate Entrepreneurship → Performance	Sobel Test for Simple Mediation
ICT Use → Innovation → Corporate Entrepreneurship → Performance	Double Mediation Test

4.4 Findings

A bivariate correlation analysis was done to check the strength and direction of the relationships amongst the various variables. The results are shown in Table 3. The table shows positive and significant correlations among ICT Use, Innovation, and Corporate Entrepreneurship, as well as positive and significant correlations between each of these variables and Performance. To check whether there is high collinearity among the predictors, the VIF (variance inflation factor) was computed. The results shown in Table 4 shows that all reported VIF values are less than the

acceptable threshold 10 (Hair et al, 2006), implying that there is no high correlation between the variables.

Table 3 Bivariate Correlations

	ICT Use	CE	Performance	Innovation
ICT Use	1	.276**	.407**	.445**
CE	.276**	1	.636**	.706**
Performance	.407**	.636**	1	.569**
innovation	.445**	.706**	.569**	1

**Correlation is significant at the 0.01 level (2-tailed)

The above table shows positive and significant correlations among ICT Use, Innovation, and Corporate Entrepreneurship, as well as positive and significant correlations between each of these variables and Performance. To check whether there is high collinearity among the predictors, the VIF (variance inflation factor) was computed. The results showed that all reported VIF values are less than the acceptable threshold 10 ($VIF_{ICTUse}=1.252$; $VIF_{CEntrep}=1.999$; and $VIF_{Innov}=2.304$) (Hair et al, 2006).

4.4.1 Simple Linear Regression

A simple linear regression analysis was conducted to test the impact of ICT Use on organizational performance. The ANOVA model was fit with $R^2 = 0.165$ and $F=29.341$ ($Sig=0.000$). The estimated Coefficient (B) for ICT Use was 0.548, with a t-statistic of 5.417 ($Sig= 0.000$). Similar analyses were done for Innovation and Corporate Entrepreneurship with performance; ICT Use and Innovation with Corporate Entrepreneurship; and ICT use with Innovation. The results of these analyses are listed in Table 4 below.

Table 4 Simple linear Regression Results

Criterion Variable	Predictor Variable	R ²	ANOVA F	Sig.	B Coeff.	t-statistic	Sig
Performance	ICT Use	0.165	29.341	0.000	0.548	5.417	0.000
	Innovation	0.393	70.700	0.000	0.775	8.408	0.000
	Corporate	0.405	100.6	0.000	0.579	10.03	0.000

	Entrepreneurship						
Corporate Entrepreneurship	ICT Use	0.076	12.169	0.001	0.408	3.488	0.001
	Innovation	0.498	146.7	0.000	1.057	12.112	0.000
Innovation	ICT Use	0.198	36.620	0.000	0.440	6.051	0.000

As could be clearly noticed, the results support hypotheses H1, H2, H3, H5, H6, and H7. The above results also represent the first step in testing mediation effects. In other words, they establish that zero-order relationships – needed to conclude that mediation effects are possible – exist among the variables (Mackinnon et al, 2007).

4.4.2 Simple Mediation Effect Test and Measurement

The second step in our analysis involved testing the possible mediation effect that Innovation may have in the ICT Use – Performance relationship, and the effect that Corporate Entrepreneurship may have in the ICT Use – Performance relationship and in the Innovation – performance relationship. These are all simple mediations, and could be measured for amount and significance using the Sobel test. The test was first introduced by Sobel (1982). It requires S_a , the standard error of a (the X Coefficient in the $X \rightarrow M$ simple regression model) and S_b , standard error of b (the M Coefficient in the $M \rightarrow Y$ simple regression model). The test generates an approximate test of the standard error of a b (the indirect effect in the $X \rightarrow Y$ relationship controlling for the mediator M). Preacher and Hayes (2004) consider the Sobel test the most commonly used estimate, and have generated a simple macro application for estimating the simple mediation amount and testing its significance.

Applying Preacher and Hares’ (2008) macro for mediation, the mediation effects of each of Innovation and Corporate Entrepreneurship was computed. After computing, the mediation effect, the Sobel test and the Normal Theory test (i.e., t-score) were applied to test the mediation (indirect) effect for significance.

4.4.2.1 Mediation Effect of Innovation in the ICT-Performance Relationship

The SPSS Macro for mediation effect computation was run to assess the type and magnitude of the potential mediating effect of innovation in the ICT-Performance relationship. The results came out as follows (figure 4).

As could be clearly seen in Figure 4, the four steps stated by Baron and Kenny (1986) were applied to test the possibility of a mediation effect. First, the relationship of ICT Use to the mediator (Innovation) was shown ($B=0.5879$, $P=0.000$; Innovation – performance). The impact of ICT Use on Performance regardless of the mediating effect is also computed ($B_{ICT\text{Use-performance}}$

B=0.5481 and P=0.000). Finally, the impact of ICT use on performance while controlling for innovation was also computed. Here, $B_{\text{ICTuse-performance}}$ dropped to 0.1654, and the t-test for the relationship turned to be insignificant (P=0.1003).

Figure 4 Mediation Effect of Innovation in ICT-Performance Relationship: SPSS Macro Output

Dependent, Independent, and Proposed Mediator Variables:						
DV =	Perf					
IV =	ITUse					
MEDS =	Innov					
IV to Mediators (a paths)						
	Coeff	se	t	p		
ITUse	.5879	.0821	7.1593	.0000		
Direct Effects of Mediators on DV (b paths)						
	Coeff	se	t	p		
Innov	.6510	.0863	7.5429	.0000		
Total Effect of IV on DV (c path)						
	Coeff	se	t	p		
ITUse	.5481	.1012	5.4168	.0000		
Direct Effect of IV on DV (c' path)						
	Coeff	se	t	p		
ITUse	.1654	.1000	1.6538	.1003		
Model Summary for DV Model						
	R-sq	Adj R-sq	F	df1	df2	p
	.3983	.3901	48.6589	2.0000	147.0000	.0000

This indicates that the null hypothesis that the indirect effect (ab) is zero cannot be rejected, implying a full mediation effect of Innovation in the ICT Use – Performance relationship. The R^2 of the model was =0.4, meaning that 40% of the variance in organizational performance could be attributed to ICT USE through innovation. The above results and analysis support hypothesis H4.

4.4.2.2 Simple Mediation Effect of Corporate Entrepreneurship in the ICT-Innovation Relationship with Performance

To assess the mediation impact of corporate entrepreneurship in the ICT Use – performance and the Innovation-Performance relationships, the same procedure was applied. The results derived from running the SPSS Macro for mediation resulted in the output shown in Figure 5 and Figure 6.

The main findings shown in figure 5 and 6 could be summarized as follows:

- a. The first three criteria of Baron and Kenny (1986) for the possibility that a mediation effect exists are met (the a , b , and c paths are significant).
- b. The direct impact of innovation on Corporate Entrepreneurship is higher than that of ICT Use ($B_{ICTUse-corporate\ entrepreneurship} = 0.4081, P = 0.0006$, compared to $B_{Innovation-corporate\ entrepreneurship} = 1.0572, P=0.000$).

Figure 5 Mediation Effect of Corporate Entrepreneurship in ICT-Performance Relationship: SPSS Macro Output

Dependent, Independent, and Proposed Mediator Variables:							
DV = Perf; IV = ITUse; MEDS = CEntrep							
IV to Mediators (a paths)							
	Coeff	se	t	p			
ITUse	.4081	.1170	3.4884	.0006			
Direct Effects of Mediators on DV (b paths)							
	Coeff	se	t	p			
CEntrep	.5161	.0572	9.0163	.0000			
Total Effect of IV on DV (c path)							
	Coeff	se	t	p			
ITUse	.5481	.1012	5.4168	.0000			
Direct Effect of IV on DV (c' path)							
	Coeff	se	t	p			
ITUse	.3375	.0848	3.9817	.0001			
Model Summary for DV Model							
	R-sq	Adj R-sq	F	df1	df2	p	
	.4626	.4553	63.2768	2.0000	147.0000	.0000	

Figure 6 Mediation Effect of Corporate Entrepreneurship in Innovation-Performance Relationship: SPSS Macro Output

Dependent, Independent, and Proposed Mediator Variables:							
DV = Perf; IV = Inov; MEDS = CEntrep							
IV to Mediators (a paths)							
	Coeff	se	t	p			
Inov	1.0572	.0873	12.1118	.0000			
Direct Effects of Mediators on DV (b paths)							
	Coeff	se	t	p			
CEntrep	.4259	.0797	5.3402	.0000			
Total Effect of IV on DV (c path)							
	Coeff	se	t	p			
Inov	.7754	.0922	8.4083	.0000			

Direct Effect of IV on DV (c' path)						
	Coeff	se	t	p		
Inov	.3252	.1195	2.7213	.0073		
Model Summary for DV Model						
	R-sq	Adj R-sq	F	df1	df2	p
	.4332	.4255	56.1815	2.0000	147.0000	.0000

- c. The impact of Corporate Entrepreneurship as a mediator in the Innovation-Performance relationship is stronger than that of its impact on the ICT Use – performance relationship ($B_{\text{Innovation-performance}} = 0.7754$ dropped to 0.3252 when the Innovation-performance relationship is investigated controlling for corporate Entrepreneurship. However, the $B_{\text{ICTuse-performance}}$ dropped from 0.5481 to 0.3375 when the ICT – performance relationship is examined while controlling for Corporate Entrepreneurship).
- d. While the impact magnitude in ICTuse – performance relationship is different from that in Innovation-Performance relationship, the mediation effect of Corporate Entrepreneurship in both relationships is proved to exist. The mediation impact in both relationships is partial (The null hypothesis that the ab coefficient is zero is rejected).

These findings support hypotheses H8 and H9.

4.4.3 Simple Mediation Significance Testing

Applying the Sobel test, which takes the requisite formulas and steps of Baron and Kenny (1986) into consideration, the mediation effects of Innovation and Corporate Entrepreneurship were tested for significance¹. The results are depicted in Table 7, which shows the output of the Sobel test as coded and developed by Preacher and Hayes, using the coefficient estimates and standard error (S_e) of estimates (as generated by the SPSS regression analysis).

In conformity with Baron and Kenny (1986) and Mackinnon et al (1995), the Sobel test is conducted by computing the critical ratio derived from a (the coefficient estimate of $X \rightarrow M$), S_a (Standard error of the a estimate), b (the coefficient estimate of $M \rightarrow Y$), and S_b (Standard error

¹ Testing the significance of the indirect effect is not a common practice among researchers despite its importance (Preacher and Hayes, 2004). According to the authors, there are two possible explanations for why researchers are reluctant to test it in practice: (a) the statistical significance of the indirect effect ab is not stated as a requisite of mediation by Baron and Kenny (1986), and (b) while the commonly used applications for regression analysis (such as SPSS) generates all the tests needed to compute the Sobel test manually, researchers may not feel obliged to put the effort since originally it was not required by Baron and Kenny

of the b estimate). Following is the output of the Sobel test as derived from using the application code developed by Preacher and Hayes (2004).

Figure 7 Results of Testing the Significance of the Simple Mediating Effects Using the Sobel Test

ITUse-Innovation-Performance				
Input:		Test statistic:	Std. Error:	p-value:
a	0.5879	Sobel test: 5.19345184	0.07369336	2.1e-7
b	0.6510	Aroian test: 5.16961333	0.07403318	2.3e-7
s _a	0.0821	Goodman test: 5.2176232	0.07335196	1.8e-7
s _b	0.0863			

ITUse-CE-Performance				
Input:		Test statistic:	Std. Error:	p-value:
a	0.4081	Sobel test: 3.25339165	0.06473872	0.00114036
b	0.5161	Aroian test: 3.23614606	0.06508372	0.00121155
s _a	0.1170	Goodman test: 3.27091592	0.06439188	0.001072
s _b	0.0572			

Innovation-CE-Performance				
Input:		Test statistic:	Std. Error:	p-value:
a	1.0572	Sobel test: 4.88895532	0.09209769	0.00000101
b	0.4259	Aroian test: 4.87506284	0.09236014	0.00000109
s _a	0.0873	Goodman test: 4.90296724	0.09183449	9.4e-7
s _b	0.0797			

The results show highly significant Sobel tests. This implies that the mediation (Indirect) effect of innovation in the ICT Use – performance – relation is significant. Given the previous finding that Innovation has a full mediation effect on the ICT Use – Performance relationship, the high significance level of the Sobel test shows that ICT Use impact on organizational performance takes place through innovation only. As for corporate entrepreneurship, it assumes a partial mediation effect in both ICT Use – Performance and the Innovation – Performance relationship

(as shown in figures 5 and 6). These partial mediation effects proved to be highly significant based on the Sobel test results in figure 7.

A summary of the mediation effects that innovation and corporate entrepreneurship have are summarized in Table 5.

Table 5 Summary of Mediation Effects

Relationship	Mediator	Mediation effect?	Full / partial
ICT USE – Innovation – Performance	Innovation	YES	Full
ICT Use-Corporate Entrepreneurship -Performance	Corporate Entrepreneurship	YES	Partial
Innovation – Corporate Entrepreneurship – Performance	Corporate Entrepreneurship	YES	Partial

4.4.4. Double Mediation Effect Test and Measurement

Following the simple mediation effect testing which involved a single mediator at a time, the mediation impact of both Innovation and Corporate Entrepreneurship was examined. This double mediation test was conducted using an SPSS application code written by Hayes (Preacher and Hayes, 2008). Running the code generated the following result, as shown in figure 8.

Examining the results shows that innovation and Corporate Entrepreneurship together have a strong mediation effect on the ICT Use – Performance relationship. The model explains 49.1% of the variance in organizational performance, with ICT Use, Innovation, and corporate Entrepreneurship being predictors, and innovation and corporate Entrepreneurship being the mediators in the ICT-performance relationship.

The estimated coefficient of the ICT-Performance relationship was 0.5481 with a significance of 0.0000. However, when the two variables were introduced to test their potential mediating effect, the estimated coefficient significantly dropped to 0.2174 with a significance level of 0.0206.

Figure 8 Double Mediation Effect of Innovation and Corporate Entrepreneurship in ICT-Performance Relationship: SPSS Macro Output

Dependent, Independent, and Proposed Mediator Variables: DV = Perf; IV = ITUse; MEDS = Innov, CEntrep						
IV to Mediators (a paths)						
	Coeff	se	t	p		
ITUse - Innov	.5879	.0821	7.1593	.0000		
ITUse - CEntrep	.4081	.1170	3.4884	.0006		
Direct Effects of Mediators on DV (b paths)						
	Coeff	se	t	p		
Innov	.2991	.1049	2.8509	.0050		
CEntrep	.3795	.0736	5.1547	.0000		
Total Effect of IV on DV (c path)						
	Coeff	se	t	p		
ITUse	.5481	.1012	5.4168	.0000		
Direct Effect of IV on DV (c' path)						
	Coeff	se	t	p		
ITUse	.2174	.0929	2.3410	.0206		
Model Summary for DV Model						
	R-sq	Adj R-sq	F	df1	df2	p
	.4910	.4805	46.9392	3.0000	146.0000	.0000

4.4.5 Double Mediation Significance Testing

To test the significance of the double mediation effect of Innovation and Corporate Entrepreneurship in the ICT use – performance relationship, the boots trapping method was used (Shrout and Bolger, 2002). Bootstrapping is a method that uses resampling with replacement repeated many times. The indirect effect from each of these samples is computed, and a sampling distribution is generated. The method will provide a confidence interval, which will be checked for a zero within the interval. The indirect effect is significant if zero is not in the interval. The result of the bootstrapping method is shown in figure 9. As could be noticed, the zero is not within the interval, thus proving the significance of the double mediator effect.

Figure 9 Double Mediation Effect Significance Testing – Bootstrapping Method

BOOTSTRAP RESULTS FOR INDIRECT EFFECTS				
Indirect Effects of IV on DV through Proposed Mediators (ab paths)				
	Data	Boot	Bias	SE
TOTAL	.3307	.3336	.0028	.0873
Innov	.1758	.1715	-.0044	.0634
CEntrep	.1549	.1621	.0072	.0626
Bias Corrected Confidence Intervals				
	Lower	Upper		
TOTAL	.1727	.5175		
Innov	.0593	.3164		
CEntrep	.0557	.2963		

4.5 Effect Size Assessment

The importance of effect size estimation has been highlighted by research experts in various fields of study (Coe, 2002; Cohen, 1990). This is because research is more about effect size than about p-values (Cohen, 1990). In this study, the effect size of the mediation test was computed using $\rho\rho$, the partial correlation coefficient product. Then, referring to Cohen's guidelines, the effect size magnitude will be determined. Given a sample size of 150, the power analysis will be done using power-determining software available online. Table 5 presents the effect size magnitude and the power of the mediation tests done in the study. The estimations were done at a significance level of 0.05.

Table 5 Effect Size, Magnitude, and Power Level at $\alpha = 0.05$

Mediation Test	Effect Size	Magnitude *	Power
Innovation in ICT Use – Performance	$\rho\rho = 0.1042$	Medium	0.92
Corporate Entrepreneurship in ICT Use – Performance	$\rho\rho = 0.068$	Small to Medium	0.89
Corporate Entrepreneurship in Innovation – Performance	$\rho\rho = 0.255$	Large	0.97

**Cohen's Criteria*: 0.01 small effect size; 0.09 medium; and 0.25 large.

The results reflect remarkable effect size's and power levels for the various mediation tests done in the study. This means the mediation effect of innovation and corporate entrepreneurship in the ICT Use – Performance relationship cannot be underestimated.

5 Conclusion and Discussion

Considering the magnitude 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. This paper contends that the innovative use of ICT resources and the availability of an entrepreneurial orientation that manifests itself in an atmosphere that encourages and applies proactiveness, innovativeness, and risk taking may have a profound impact on organizational performance. This is particularly important in the Lebanese market - an unstable market characterized with established SMEs and family businesses.

We proposed and tested nine hypotheses based on a body of literature related to the contribution of ICT adoption and use to the organization's overall performance and its stakeholder

satisfaction. Our main objective was to contribute to the literature by determining the factors that organizations need to consider so as to make the best out of ICT resources, and 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). The nine hypotheses were tested using regression analysis for testing the relationships between ICT, innovation, corporate entrepreneurship, and organizational performance. Further, the regression analysis was empowered with SPSS macros for identifying, measuring, and testing the significance of single and double mediation effects of innovation and corporate entrepreneurship in the relationship between ICT use and organizational performance. The nine hypotheses were supported (Table 6), 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 ICT-based innovations are quickly identified and seized. In other words, innovation and corporate entrepreneurship are essential catalysts in the ICT – performance relationship.

Table 6 Hypothesis Testing Results Summary

Hypothesis	Supported (Y/N)
H1: ICT use is positively related to Organizational performance.	YES
H2: ICT use is positively related to innovation.	YES
H3: Innovation is positively related to organizational performance.	YES
H4: Innovation mediates the relationship between ICT use and Performance.	YES
H5: ICT is positively related to entrepreneurship.	YES
H6: Innovation is positively related to 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

The findings generated by this study provide interesting and important insights regarding the role that ICT 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.

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 the ICT-based 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).

6 Research Implications, Limitations, and Recommendations

The main contribution of this study is the development of a model that explains through direct and mediating effects how ICT can enhance performance at the firm level. The integration of ICT, innovation, and corporate entrepreneurship in one model, and the examination of their impact on organizational performance are not sufficiently addressed in the literature. Further, the literature lacks an analysis of the single and multiple mediations of factors (such as innovation

and corporate entrepreneurship) deemed necessary in today's globalized and knowledge-based economies in the ICT-performance relationship.

Our study has both theoretical and practical implications. At the theoretical level, the dynamics capabilities view and the theory of innovation translation were used together (1) to show the new processes, renewal of resources, and enhancement of operations and methods of work made possible by ICT and ICT-based innovations adopted and used by organizations, and (2) 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 these strategic resources 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. The results showed not only high significance levels, but also moderate to high effect size magnitudes (Cohen, 1990). 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.

Despite the contribution and the significance of this study, it has several limitations. 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, future research is recommended to apply a longitudinal study to better capture the relationships between ICT, innovation, corporate entrepreneurship, and performance. Moreover, using mixed methods research would yield better validated results. Moreover, conducting a replication study with random sample selection can improve the methodological rigor of the study and support its external validity. Also, conducting a

comparative analysis with companies in the region can give a better insight of the ICT-innovation- corporate entrepreneurship- performance relationship in companies operating in environments that have some common characteristics with the Lebanese business environment. Furthermore, examining the impact of an integrated model using SEM can provide a holistic and comprehensive framework where all the relationships are studied simultaneously. Moreover, a combination of indicators related to organizational performance (Rahman and Bullock, 2005), can take into account the multidimensionality of the performance measure.

In conclusion, contemporary challenges emerging from today's information age and globalized environments cannot be underestimated. Alongside with these challenges lie many opportunities that ICT and innovation adoption and diffusion make possible. These resources and dynamic capabilities can help organizations circumvent these challenges and reach and maintain sustainable competitive advantage. It is through innovative use of ICT and an organizational culture that fosters proactiveness, innovativeness, and risk assessment and management that organizations can attain and maintain high performance levels. In fact, ICT and innovation are strategic resources. However, their contribution to sustainable competitive advantage vitally depends on the tacitness and entrepreneurial behaviors of those involved. It is through this capability that ICT and ICT based innovations could make a difference in organization's performance – both present and future.

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