

# **A Framework Proposal for Examining the Effect of ICT Adoption Level on Innovativeness in SMEs**

*Completed Research*

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## **Abstract**

SMEs which constitute a major part of companies all over the world, because of their unique characteristics such as limited knowledge, skills and resources may not be capable of getting full benefit from ICTs when compared to large companies. A significant amount of research examined inhibitor and impeller of ICT adoption in SMEs and diagnosed some organizational and individual characteristics affecting it. In general, ICT practices are considered a significant indicator of innovation and entrepreneurship. Embracement of ICT-based solutions and competitiveness with the aid of ICTs is crucial for entrepreneurship and innovation, especially in SMEs. Thus, assessing SMEs' way of ICT adoption and how it is correlated with its entrepreneurship and innovation levels helps in evaluating their business practices and entrepreneurial and innovativeness performances from a combined viewpoint. Thus, this research paper proposes a framework to assess the impeller factors of the ICT adoption, and measure the effect of entrepreneurship orientation and ICT adoption on the innovativeness level. This framework could be modified for large companies as well.

## **Keywords**

Information and communication technologies (ICT), entrepreneurship, SMEs

## **Introduction**

In the age of knowledge-based economy ICT ownership and its innovative utilization is a key for improving competitiveness by means of enhancing productivity and market share. The degree of ICT adoption has been the topic of numerous researches. Since SMEs have limited resources and relatively weak business processes compared to large scale companies, adoption of ICT varies in a wide range which results in more significant ICT impact. According to Bhagwat & Sharma (2007) limited resources in terms of financials, R&D, technical support, existence of personalized management, informal strategies, operating in bounded markets with a moderate number of customers, demonstrating flexibility and owing high potential of innovation are among important characteristics of SMEs. Among these factors limited resources, lack of proper guidance, skills, strategies and scant market conditions have great impact on the level of ICT utilization. To look at influences of ICT, ICT's utilization has impact on improving processes, knowledge creation and innovation. Entrepreneur SMEs usually have capabilities of taking the advantage of ICT utilization. This relationship is two-fold; Entrepreneurship and perceptions regarding the innovation may have impact on the investments for ICT and degree of implementation by fostering new products, processes and collaboration between partners, or ICT implementations may promote innovativeness by constituting a valuable mechanism for producing ICT-based solutions to organizational or environmental problems. Consequently, the aim of this study is to assess entrepreneurial orientation of SMEs via the innovativeness, pro-activeness, risk-taking, aggressive competitiveness and autonomy dimensions and assessing the

innovativeness through measuring the extent of innovations such as radical or incremental. Another goal, is to evaluate the ICT positioning and the level of ICT adoption in SMEs by means of a proposed framework which has been developed for questioning the owners/managers of SMEs so as to investigate the level of ICT implementation. This framework is special to SMEs and depends on the relevant literature which has research origins in SMEs. Thus, the framework is blended of researches about IT and ICT approaches and practices in SMEs. Moreover, investigating the determinants of the ICT utilization from a combined viewpoint of managerial, organizational and environmental characteristics in within the scope of the study.

## **Literature Review**

### ***SMEs and ICT Ownership and Utilization in the Developing Country Context***

SMEs adopting ICT get benefit of improving efficiency, effectiveness, their compatibility and performance in terms of financial, new product development, sales growth, quality, cost and innovation. Griffin and Ebbert (2009) argue that SMEs produce 13 times as many patents per employee as large patenting firms, despite of their sizes, limited resources and limited intellectual accumulation. However, in developing countries, SMEs have low diffusion of technology and seem not having full benefit from the ICT utilization. For instance, although SMEs in Turkey constitute 99.8% of the whole enterprises and keep 75% of the total workforce, they exhibit poor performance in ICT utilization. In terms of technology, 60% of SMEs having less than 20 employees exhibits poor technology adoption performance. It is important to emphasize that it is similar for SMEs in (20-50) and (50-250) size classes in terms of number of employees. Taking the whole picture into account, only 0.3% of all SMEs adopts high technology whereas almost 60% of them have low technology level (Turkish Statistical Institute, 2017). Moreover, in Turkey SMEs exhibit poor performance in terms of R&D expenditure as solely 18% of the total R&D expenditure comes from SMEs. 98% of SMEs having 50-250 employees have Internet access and 82% of them possess web site. The ratio is lower in SMEs employing less than 50 employees, as 71% of them have their own web site. In terms of e-business less than 13% of SMEs utilize Electronic Data Interchange (EDI) (Turkish Statistical Institute, 2017). Ownership of web site is not a good indicator at all as it is a legal obligation and daily functional utilization of web sites is lower than the possession rates. Despite the growing computer and Internet diffusion and web site ownership for the last decade, utilization of ICTs in SMEs is not rewarding. Wide literature shows that there could be governmental, cultural, financial, organizational and personal factors behind this matter. Thong and Yap (1995) mentioned about size, centralization, external integration, functional differentiation, competitiveness of the environment, and information intensity as organizational factors and called attention to the critical position of CEO (owners/managers) especially in the case of SMEs. Perceived impacts/barriers of ICT adoption, lack of top management support and guidance, resistance for change, and lack of knowledge/skills that monitor the adoption steps are also among determinants of ICT utilization (Thong, 2001; Bayo-Moriones and Lera-Lopez, 2007; Redoli et al., 2008). Findings of previous researches demonstrated a strong positive correlation between individual characteristics of CEOs (eg. innovativeness, positive attitudes for ICT adoption and knowledge) and the level of ICT adoption. Many previous research has drawn attention to owners/managers of SMEs and their entrepreneur characteristics as a vital factor for the success of the business. For most SMEs, CEO who is mostly the owner of the company significantly influences the ICT adoption as he/she is the major decision-maker (Thong and Yap, 1995). Thong and Yap (1995) investigated the effects of CEO innovativeness, attitudes towards IT implementation and IT knowledge. Lybaert (1998) considered personality, growth-oriented vision, education and economic history as individual characteristics. Kusumaningtyas and Suwanto (2015) found a significant relationship between age and education level of owners/managers and ICT utilization. In terms of organizational characteristics, Thong (1999) mentioned employees' IS knowledge and information intensity as indicators of IT adoption. In addition, ICT infrastructure, organizational competence and perceived usefulness were also mentioned on the relevant literature (Ahmad, Ibrahim and Ahmad, 2017). Consoli (2012) considered culture on IS and skills, human capital and in-house participation while Bruque and Moyano (2007) focused on growth, professionalization, technology strategy and implementation of quality management systems as determinants of ICT adoption. Ghobakhloe, Hong, Sabouri and Zulkifli (2012) categorized the influencers of the adoption that investigated by the previous literature as follows: Owners/Managers' characteristics, organizational characteristics, resources, IT products in the market and competition. Hollenstein (2004) also argued that industry type, as a component of environmental factors, may affect the ICT ownership because firms in different industries have to deal with different dynamics. Moreover, competitive pressure

was listed at the top of the environmental factors affecting ICT adoption (Gattignon and Robertson, 1989; Teo et al. 1997). It was claimed that intense rivalry in industry forces firms to watch their rivals' competitive moves closely, which results in relatively quick implementation of technological innovations (Gattignon and Robertson, 1989).

In this respect this survey aims to search individual, organizational and environmental factors influencing ICT adoption in a comprehensive manner. Age, gender, education level, ICT literacy and innovativeness of managers/owners will be examined as impacting individual factors, based on the upper echelon theory and previous studies indicating that managers' demographic characteristics and personality traits of openness and extraversion are the significant determinants of IT usage (Chuang et al., 2009). Moreover, environmental factors in terms of industry type and industry competitiveness, and the organizational factors encompassing organizational culture, organizational structure, organizational capability, organizational learning, ICT investment level and financial resources of the SMEs will be analyzed as impeller factors of ICT adoption in SMEs. Organizational capability, defined as ability and capacity of an organization stated in terms of its management, production, marketing and sales, information systems, logistic, learning and external relationship (Acar and Zehir, 2009), and organizational learning, consisting of knowledge acquisition, information distribution, information interpretation and organizational memory (Huber, 1991; Slater and Narver, 1995) have been mostly linked to new knowledge and technology acquisition and creation (Lopez-Nicolas and Soto-Acosta, 2010).

### ***ICT Utilization-Entrepreneurship Orientation and Innovativeness***

Innovation and entrepreneurship orientation in the context of smaller firms has attracted interests of both researchers and practitioners because of the importance of innovation, entrepreneurship and SMEs in the development of (the new economy) economy and technology (Acs and Audretsch, 1988). SMEs are considered as successful innovators, because entrepreneurial SMEs are more fast, flexible, proactive and risk taker rather than large scale (Ndubisi and Kahraman., 2005; Nooteboom, 1994; Vossen, 1998). Cumming (1998) describe innovation as the creation of new product or process. Similarly, Damanpour (1991) defines organizational innovation as the adoption of new idea or behavior, which includes organizational activities, such as a new product or service, a new production process technology, a new structure or administrative system and a new plan or program within the organization. Of the various definitions of innovation from different perspectives, four dimensions of innovation, namely product and process innovation besides radical and incremental innovation, have been emphasized as relevant to this survey. While radical and incremental innovation forms the nature of innovation; product and process innovations are the types of innovation (Baregheh, Rowly and Sambrook, 2009). Product/service innovation describes the introduction of new products or services, including modifications to the existing services (Nasution et al., 2011) or the process of bringing new technology into use (Lukas and Ferrel, 2000), while process innovations refers to innovation in production or service delivery process (Ndubisi and Iftikhar, 2012). On the other hand, radical innovations are fundamental changes that represent revolutionary changes in technology and practice (Duchesneau, Cohn and Dutton 1980; Ettlie 1983); while incremental innovations are minor improvements or simple adjustments in current technology (Munson and Pelz 1979). Entrepreneurship orientation (EO), another concept examined frequently in context of SMEs, is defined as organization's strategic orientation toward entrepreneurial decision-making practices, managerial philosophies and behaviors (Anderson et al., 2009). Miller (1983) posited EO (without using the term entrepreneurial orientation) as a construct encompassing three sub-dimensions—innovativeness, risk taking, and pro-activeness—that must be positively correlated in order EO to be emerged. Lumpkin and Dess (1996) expanded the number of dimensions by adding sub-dimension of competitive aggressiveness and autonomy. Especially, three sub-dimensions of EO-pro-activeness, innovativeness, risk taking, have been emphasized as more relevant factors to innovation and ICT in literature. Risk taking and pro-activeness sub-dimensions of EO are indicated as significant indicators of product and process innovation (Lassen et al., 2006). Avlonitis and Salavou (2007) revealed that pro-activeness provided a substantial contribution to the new product performance.

On the other hand, adoption of ICT, is accepted to be the major factors behind innovation and entrepreneurship which makes ICTs essential for innovativeness of SMEs. According to Trendchart report, being innovative in-house, cooperative innovations and ICT expenditures are the most important indicators of innovation and entrepreneurship (as cited in Redoli et al., 2008). Exploring change in existing ICTs,

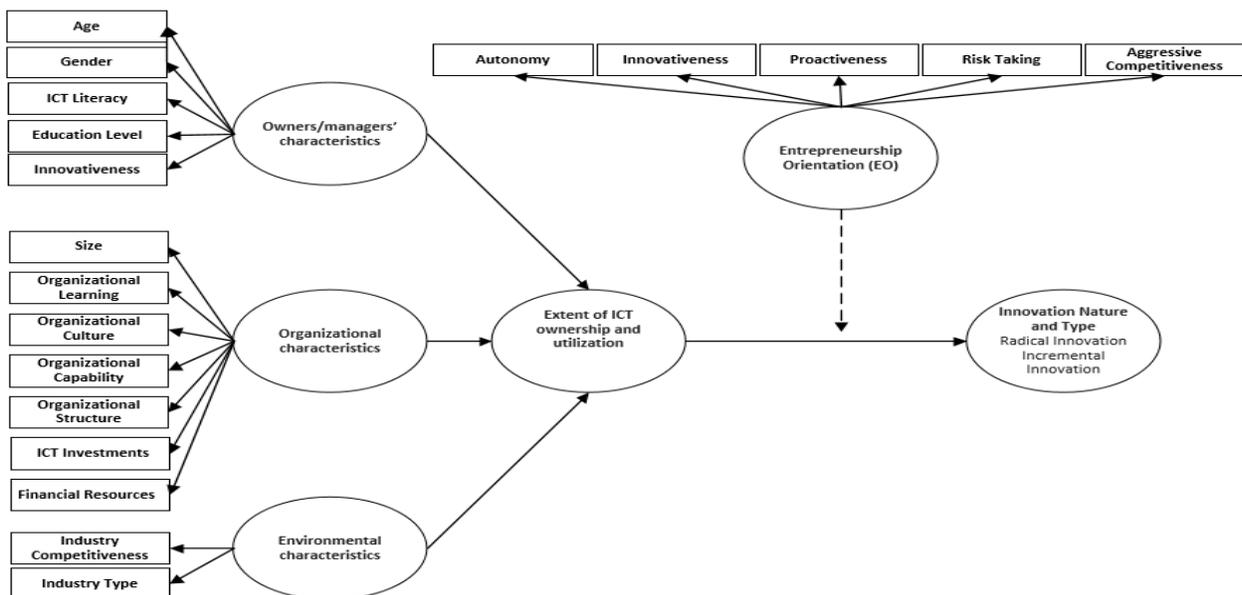
implementing advanced communication tools and IT are ways of embracing technological innovation (Tan, 2010). Enhancing technological innovation and improvement of capabilities is closely associated with the establishment of entrepreneur skills of managers/owners in small organizations. Embracement of ICT-based solutions and competitiveness with the aid of ICTs is crucial for entrepreneurship and innovativeness. Thus, Redoli et al. (2008) fostered the improvement of entrepreneur skills of employees for anticipation and encouragement ICT utilization and competitiveness.

## Methodology

The purpose of this paper is to investigate individual, organizational and environmental characteristics affecting the ICT ownership and its utilization level in SMEs. So, examining relationships among the ICT adoption, the entrepreneurial orientation (EO), and type (product-process) and nature (radical-incremental) of the innovation in SMEs constitutes another purpose of this paper. Within the scope of the study a wide range of factors influencing the ICT adoption have been identified. Perspectives and researches concentrating on IT/ICT utilization at SMEs were taken into account so as to construct a conceptual model relevant to SMEs. A framework is also suggested for the evaluation of ICT utilization level at SMEs. This framework is also special to SMEs, as it was constructed with a specific view to SME environment. In SME environment owners/managers related factors are extremely important as the owner of the company is the main decision maker. This argument makes the individual factors significantly important when evaluating the determinants of ICT utilization and its link with EO. For instance, conceptual model includes the ICT literacy and innovativeness of owners/managers in addition to a set of factors gathered from literature on SME. This is expected to be an original contribution to the literature. Because, literature review revealed that studies in the SME context approached the argument with evaluating different set of variables, and the literature is lack of a comprehensive model considering the relationship of ICT utilization with EO and their impact on the firm innovativeness. Hence, evaluating the influence of these variables on the performance outcomes in terms of radical and incremental innovation is within the scope of the conceptual model. The proposed framework will be tested in Turkish SMEs and first findings and outcomes will be explained in the oral presentation in the case of acceptance.

## Conceptual Model

A conceptual model based on the relationship between owner/manager characteristics, organizational characteristics and environmental factors and the firm-level ICT adoption in SMEs is proposed. This model is based on the findings on the relevant literature and parameters are selected from a wide range of studies. Further, it is intended to clarify the relationship among entrepreneurship orientation, ICT utilization and innovativeness. The conceptual model is presented in Figure 1 below.



### Figure 1. Conceptual Model

#### Operationalization of the Model

A questionnaire survey method will be used to collect the data for the purpose of the study. To measure the constructs, scales adopted from previous researches will be used. Resources of scales to be used in this survey are given below:

Constructs	#Item	Resources
ICT Literacy (Cognitive+Technical)	35	Markauskaite (2007)
Innovativeness	20	Jackson (1994)
Organizational Learning (knowledge acquisition, distribution, interpretation, organizational memory)	28	Nonaka et al. (1994)
Organizational Culture (Adhocracy, Hierarchy, Clan and Market Culture)	20	Cameron and Quinn (1999)
Organizational Capability ( management, production, marketing and sales, information systems, logistic, learning and external relationship capability)	36	Acar and Zehir (2009)
Organizational Structure (Mechanic and Organic Organization Structure)	16	Johari, Yahya and Omar (2011)
Entrepreneurship Orientations (Proactiveness, Aggressive Competitiveness, Innovativeness, Risk Taking, Autonomy)	21	Covin, J.G. and Slevin, D.P. (1998); Venkatraman (1989); Li, Liu and Zhao (2006); Hughes and Morgan (2007)
Competitiveness in Industry	5	Khandwalla (1977)
Innovativeness (Product/service innovation, process innovation, radical innovation, incremental innovation)	23	Gallouj and Weinstein (1997); Hertog (2000); Jansen et al.'s (2006)

**Table1. Constructs and Resources**

The survey will be conducted on owners and managers of SMEs thorough face-to-face survey administration. The owners and managers are objected because they are more knowledgeable rather than the employees about the firms' policies, procedures, strategies, culture and performance. Participants will be asked to assess their firms in terms of given items. Convenience sampling technique will be used for sampling. Obtained data will analyzed through the AMOS and SPSS statistical packet program. For the extent of ICT adoption, the following framework was developed so as to classify SMEs under 6 categories. Each SME under investigation will be analyzed based on the questionnaire designed for ICT utilization and depending on this questionnaire SMEs will be positioned to a particular level in terms of ICT adoption. Regarding the extent of use Zwicker et al. (2007) conceptualized ICT based on the purpose of its utilization and internal-external integration, decision-making and producing knowledge and innovation were proposed as sub-dimensions of ICT utilization. Based on this model Siqueira et al. (2017) developed an ICT Use Index compromising internal, external integration and decision-making. Tan (2010) classified ICT adoption based on its progression and sophistication of the implementation depending on Kotelnikov's study. According to the model ICT adoption follows these steps: Basis communications, basic IT, advanced communications (websites, e-commerce, file exchange etc.) and advanced IT (CRM, ERP etc.). Shiels, McIvor and O'Reilly (2003) technical integration, operational integration, inter-organizational integration and strategic integration concepts for assessing the extent of ICT adoption based on Waring & Wainwright's research. Following Table 2 represents the description of each stage which was adopted from literature so as to reflect the SMEs' practices. Level of adoption literature based on the specific context of SMEs guided to establish the scenarios which represent different ICT adoption levels (Table 2). Face-to-face interviews will be conducted with the managers/owners depending on the scenarios in order to identify the level of ICT adoption at that particular SME. The Table 2 includes items that will be evaluated by interviewees based on a 5 Point Likert Scale. Scores obtained from each Level will be utilized to determine the positioning of a particular organization similar to the assessment methodology of Redoli et al. (2008). It is possible for an organization to have similar scores on both levels, but this information is useful for anticipating the findings.

Level	Level of adoption	Description	Scenarios
Level_1	Basic communication	<ul style="list-style-type: none"> <li>• Basic communication tools (fixed line telephone, fax)</li> <li>• Desktop PCs or laptops with limited utilization</li> <li>• Limited Internet utilization (for individual purposes)</li> <li>• Lack of management support software (accounting, billing etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• My firm has desktop PCs and laptops. It is very seldom to utilize computers for business purposes.</li> <li>• Regarding the communication, my firm has fixed line telephone, fax and mobile phone. Internet, it is very seldom to use it for business purposes. It is usually used for general information search for individual interests.</li> </ul>
Level_2	Basic ICT utilization	<ul style="list-style-type: none"> <li>• Office automation programs</li> <li>• PCs equipped with management support software (accounting, stock control and billing etc.)</li> <li>• Limited Internet utilization (for getting information)</li> <li>• Limited e-mail utilization (some employees)</li> <li>• Static Web site</li> </ul>	<ul style="list-style-type: none"> <li>• My firm has office software tools for handling office documents with the aid of text processor and assisting storage and manipulation of office information for completing basic office tasks. PCs have software programs for assisting accounts and sales management, purchasing, payroll or inventory control.</li> <li>• Employees have internet access but it is generally used for general information search about business processes and sending e-mail. E-mail is utilized by a limited number of employees. There is a Web site having basic features such as home page, products/services information without receiving customer information.</li> </ul>
Level_3	Internal integration	<ul style="list-style-type: none"> <li>• Internal communication, information exchange and file sharing</li> <li>• Early dynamic Web site</li> <li>• Intranet (for internal communication of employees, dissemination of customer information)</li> <li>• Automation of internal processes</li> <li>• PCs with advanced databases and enterprise resources planning (ERP)</li> <li>• E-mail and Internet access (all employees)</li> </ul>	<ul style="list-style-type: none"> <li>• Most employees have PCs equipped with enterprise software applications, networking hardware/software solutions, security services. Data storage applications and network security solutions exist.</li> <li>• All employees in my firm have e-mail and internet access. Intranet is utilized for exchanging information and documents within the organization. Regarding the Web site customer access to products/services is sufficient; however order exchange with clients is limited.</li> </ul>
Level_4	External integration	<ul style="list-style-type: none"> <li>• Dynamic Web site (communication with customers/potential customers)</li> <li>• Electronic trade (B2B)</li> <li>• Automation of external processes (with customers)</li> <li>• Order or reservation systems</li> <li>• Sales support and accepting customer suggestions</li> <li>• Remote access to organization's systems (some employees)</li> </ul>	<ul style="list-style-type: none"> <li>• IT infrastructure's readiness is provided for automation of external processes with customers is provided (order exchanges, customers' feedback). Wireless networking hardware exists and some employees have remote access to enterprise systems. All business functions are supported with enterprise software including order/reservation systems, after-sales customer support.</li> <li>• In my firm, B2C e-commerce is conducted and customers can observe broadcasts, promotions. Virtual brochures and interactive search options are available. Web site supports receiving orders, enquiries and comments as well as online sales order processing.</li> </ul>

Level_5	Inter-organizational integration	<ul style="list-style-type: none"> <li>• Limited automation of external processes (with customers and suppliers)</li> <li>• B2C, C2B</li> <li>• External communication (customers, suppliers and other business partners)</li> <li>• Dynamic Web site</li> <li>• Electronic transactions</li> </ul>	<ul style="list-style-type: none"> <li>• IT infrastructure supports carrying out external communication with suppliers and trading partners. Information systems support file sharing (EDI), video conferencing and e-invoicing. Interactive communication platforms for data sharing regarding the design or basic operational issues are available. Information systems also support inventory tracking and CRM software is available. However, CRM is used for operational issues.</li> <li>• Internet is relevant to B2C and B2B e-commerce. Purchasing materials and office equipment and online file exchange is available. Most of purchases are handled via the Internet. Web site supports customers' track of shipping and delivery.</li> </ul>
Level_6	Strategic integration	<ul style="list-style-type: none"> <li>• Utilization of ICT for integration of all internal and external processes</li> <li>• Utilization of Social Media</li> <li>• Fully integration of the value chain</li> <li>• E-procurement, electronic document exchange</li> <li>• Decision support by gathering and analyzing information from other systems such as CRM</li> <li>• Sharing information regarding the performance evaluation and collaborative working</li> </ul>	<ul style="list-style-type: none"> <li>• In my firm, IS support collaborative information sharing and inventory tracking throughout the supply chain. Information is shared for planning, forecasting and improving operations. All transactions are conducted electronically. Technologies such as barcoding, RFID and EDI are widely used throughout the supply chain. Social Media is actively used.</li> <li>• For managerial purposes, I can access an interactive portal/platform that produces special reports by making data analysis possible. I can access summarized historical information from internal systems in addition to some external resources. I can utilize this information for making long-term decisions.</li> </ul>

**Table 2. Level of ICT ownership and utilization**

Findings are expected to clarify individual, organizational and environment factors affecting ICT ownership and utilization level, and to reveal the moderating effect of EO on the relationship between ICT adoption level and innovation in SMEs. In spite of a huge number of researches examining antecedents of ICT adoption; its consequences in terms of EO and innovativeness have been rarely emphasized in literature. In this respect this survey examining both antecedents and consequences of ICT adoption level of SMEs have original contribution to the literature.

## Conclusion

ICTs shifting production patterns, the way how business is conducted and communication styles undoubtedly facilitate innovation and entrepreneurship. Fong and Stiakakis et. al indicated that divergent ICT practices can lead to enhance the gap particularly between SMEs in terms of growth and productiveness (as cited in Siqueira et al., 2017). Thus, ICT practices are considered a significant indicator of innovation and entrepreneurship. SMEs are characteristically different than large companies in terms of management style, size, culture, limited resources, knowledge/skills and environment. Moreover, individual characteristics of owners/managers are significantly more important in SMEs. The goal of the proposed framework is to examine the effect of entrepreneurship orientation on the relationship between ICT adoption and innovativeness in terms of process innovation, product/service innovation, radical and incremental innovation in SMEs.

Based on previous researches and findings in literature, it can be concluded that SMEs increasing their ICT adoption levels and enhancing EO in terms of pro-activeness, innovativeness and risk-taking orientation will prone to be more productive in product and process innovation. Moreover, nature of their innovativeness will vary depending on their entrepreneurship orientation. So, in this paper, it is proposed that entrepreneurship orientation will moderate the effect of ICT adoption level on innovation nature and type of SMEs. We believe that although the framework comprehensively developed based on SME characteristics, with some modifications this framework would be generalized and become applicable to large size companies as well. The most distinguishing parameter of framework between SMEs and large companies is entrepreneurial orientation. While EO mostly depend on owner / manager for SMEs it will depend on organizational characteristics and culture for large companies. This proposed model will be tested in Turkish SMEs and first findings are expected to be presented in the oral presentation. We will also modify the framework for large companies and test it as well. One further direction of the study is to conduct comparative studies among developing countries based on the suggested framework. With full implementation of proposed framework, it will be possible to find how ICT utilization level impacts SMEs innovativeness level and what characteristics play significant role for SME innovativeness.

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