

Understanding the Level of ICT Adoption at SMEs from the Entrepreneurship Orientation, Individual Innovativeness and ICT Literacy Perspectives

Büşra Alma Çallı^{1*}, Erman Coşkun^{1,2}

¹ Sakarya University, ² MBS College of Business and Entrepreneurship, Kingdom of Saudi Arabia, * Corresponding author, busraalma@sakarya.edu.tr

Abstract

Studies of adoption and utilization level of Information and Communication Technologies (ICTs) in SME context have examined a wide range of antecedents of ICT adoption in addition to its consequences. Characteristics of SMEs are totally different in terms of resources, knowledge, skills, decision making mechanisms and authority. Limited resources and owner or manager of the company are critically important at SME context as these are the main drivers of the adoption. Thus, this study mainly focuses on the factors associated with the owners/managers of the company and merges a wide range of factors that have been mentioned by the relevant literature. However, literature lacks of studies which investigates the independent effect of Entrepreneurship Orientation (EO), ICT literacy of the owner/manager and his/her individual innovativeness. These factors are believed to be valuable metrics in explaining the level of ICT adoption at SMEs. Hence, in order to examine these factors and reveal a comprehensive evidence an empirical research was conducted among SMEs from different industries which demonstrate different levels of ICT adoption.

Keywords: ICT adoption, entrepreneurship, ICT literacy, innovativeness.

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Abstract

Studies of adoption and utilization level of Information and Communication Technologies (ICTs) in SME context have examined a wide range of antecedents of ICT adoption in addition to its consequences. Characteristics of SMEs are totally different in terms of resources, knowledge, skills, decision making mechanisms and authority. Limited resources and owner or manager of the company are critically important at SME context as these are the main drivers of the adoption. Thus, this study mainly focuses on the factors associated with the owners/managers of the company and merges a wide range of factors that have been mentioned by the relevant literature. However, literature lacks of studies which investigates the independent effect of Entrepreneurship Orientation (EO), ICT literacy of the owner/manager and his/her individual innovativeness. These factors are believed to be valuable metrics in explaining the level of ICT adoption at SMEs. Hence, in order to examine these factors and reveal a comprehensive evidence an empirical research was conducted among SMEs from different industries which demonstrate different levels of ICT adoption.

Key Words

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Introduction

From the aspect of SMEs, pace of the technological changes, changing demands of customers and shifting production patterns force keeping up with the improvements in ICTs. In developing countries, the role of the environmental conditions and uncertainties is much more significant. R&D, in-house innovations, entrepreneurial activities and philosophies, decision-making process of the owner/manager of the company as well as his/her personality traits and behaviour all provide an important contribution to the establishment of a competitive positioning and the success of ICTs. According to TÜİK statistics, SMEs' share from R&D expenditures in Turkey is 35,7%. Regarding the innovations, 26,3% of SMEs performed product/process innovations, while 43,2% experienced organizational/marketing innovations. In terms of ICTs, utilization of computers was relatively high as 93,5% of organizations with a size of 10-49 employees and 98,3% of SMEs with 50-249 employees utilized computers in 2014. For the same size categories, access of Internet's statistics was 88,5% and 96,1%, respectively. Numbers for ownership of web site and utilization of EDI were considerably low as solely 9,3% of the SMEs with 50-249 employees used EDI or conducted online transactions (KOBİ Stratejisi ve Eylem Planı, 2015-2018) These number indicate that although the ownership of ICTs is relatively typical in SME context, effective adoption and getting full benefit from ICTs cannot be achieved. In the way of accomplishment, examining the reasons behind this argument is crucial so

as to foster ICT effective ICT utilization in SMEs by developing appropriate strategies. Therefore, this study aims to explore factors that are associated with the level of ICT adoption by means of an empirical study conducted at Turkish SMEs. Although, the research goal is relatively specific, findings and results of the study demonstrated that the conceptual model proposed in this study can be applied to other developing countries as well. Moreover, further empirical tests on different sampling units can provide the generalization of the model to other countries and to various contexts.

Literature Review

Concerns regarding the security, resistance to change, fears regarding the systems' failures, limited financial resources, lack of a close partnership throughout the supply chain, inadequate technical infrastructure and putting low value and priority on ICTs are perceived impediments in utilization and adoption of ICT at SMEs (Bhagwat & Sharma, 2007). On the other hand, Bayo-Moriones and Lera-Lopez (2007) indicated that owners/managers believed that ICTs would have positive influence on productivity, cost elimination, market share, profit maximization, deployment of new products/services, quality, improvements in terms of communication, collaboration and coordination. However, at organizations that ICTs payoff cannot be anticipated well perceived barriers become the major driver of decision-making regarding the ICTs' adoption. In SMEs, ICT adoption process is influenced and directed by the CEO (who is mostly the company owner or partner) or the owners/managers of the company (Ghobakhloo, 2012). Since, their perceptions, values, personality, attitudes and characteristics are considerably important determinants of ICT adoption within the organization. Thong and Yap (1995) investigated the link between IT adoption and CEO characteristics. They mentioned perceptions and knowledge, attitudes, IT knowledge and experiences and the personal trait of innovativeness as top management related factors in SMEs. However, studies specifically examining the relationship of owners'/ managers' innovativeness as a personal trait on the level of ICT adoption in SMEs are limited. Accordingly, we hypothesize the following;

Hypothesis 1a. *Level of ICT adoption at SMEs is positively related to the individual innovativeness of the owner/manager*

Redoli et al. (2008) stated that in order to speed up their innovation capabilities, SMEs should establish the goal of entrepreneurship. As cited in Redoli et al. (2008), in-house innovations, cooperation with others for the sake of large scale innovations and ICT expenditures are defined as the key components of innovation and entrepreneurship at SMEs. The emphasis on the ICT expenditures reveals that ICT based solutions considerably drive the enhancement of innovation and entrepreneurship. Entrepreneurial activities of an organization compromise decision-making practices, methods, managerial and processes associated with entrepreneurship which is defined as

Entrepreneurship Orientation (EO) (Lumpkin & Dess, 1996). Lumpkin and Dess (1996) conceptualised the EO under five dimensions; risk-taking, innovativeness, pro-activeness, competitive aggressiveness and autonomy. Mostly, researchers investigated the risk-taking, innovativeness, pro-activeness dimensions of EO for their link with the business performance. Hughes and Morgan (2007) discovered that these three dimensions of EO are significantly correlated with the business performance at young high-technology organizations. To our knowledge, EO has never been examined from the aspect of its impact on the level of ICT adoption in SMEs. In our study, we are interested in the four dimensions of EO comprising firm innovativeness, risk-taking, pro-activeness and competitive aggressiveness. Eventually, it is hypothesized that;

Hypothesis 1b. *Level of ICT adoption at SMEs is positively related to the organizational EO in an organization*

Further studies have put emphasize on the IT knowledge, skills and experience of the owner/manager as top management associated factors (Drew, 2007; Lybaert, 1998; Fink, 1998). However, in this digital era more recent research draws attention on the concept of ICT literacy as an umbrella term that is utilized to define cognitive and technical skills associated with new age technology. Herring claimed that literacy is composed of skills, practices, ideas and implementations (as cited in Lau & Yuen, 2014). Capabilities associated with ICT literacy is two-fold; cognitive and technical (Markauskaite, 2007). To our knowledge, ICT literacy have never been examined with regard to influence on the level of ICT adoption in SMEs. Thus, depending on the arguments above the following hypothesis is formed;

Hypothesis 1c. *Level of ICT adoption at SMEs is positively related to the ICT literacy (Information, Communication and Internet literacy) of the owner/manager*

Considering the top management related factors, education and age are also examined by the researchers (Barba-Sanchez et al., 2007; Kusumaningtyas & Suwanto, 2015; Lybaert, 1998). Thus, the set of independent variables to be examined were extended based on the interest. Accordingly, the following hypotheses are developed;

Hypothesis 2a. *Level of ICT adoption at SMEs is related to the age of the owner/manager*

Hypothesis 2b. *Level of ICT adoption at SMEs is related to the education of the owner/manager*

Another set of factors associated with the level of ICT adoption is organizational. Consoli (2012) conducted a critical review on determinant factors including organizational indicators. As a result, size, human resources, organizational culture and employees' involvement were mentioned as the

factors investigated by the previous studies. Riemenschneider, Harrison and Mykytyn (2003) examined the impact of financial resources, and Dutta (1999) proposed the degree of IT investments as an influencing factor in the decision of IT implementations (as cited in Ghobakhloo et al., 2012). Depending on the arguments above, we propose the following hypotheses.

Hypothesis 3a. *Level of ICT adoption at SMEs is related to the organizational size*

Hypothesis 3b. *Level of ICT adoption at SMEs is related to the amount of ICT investments*

Moreover, in terms of environmental characteristics, industry type and industry competitiveness were included in the set of variables to be examined. These variables were examined previously (Hollenstein, 2004; Drew, 2003; Premkumar, 2003; Salmeron & Bueno, 2006).

Research Methodology

Participants and Procedure

As the theoretical background of the study reveals, research goal is to investigate the SME practices in Turkey. Thus, every organization compatible with the SME definition of legal framework was considered as a sample source. Participant were solicited through different sources within the local chambers of industry and trade and specifically an entrepreneurs' union (SAMİB) located in Sakarya. In order to gather the relevant information and capture data on owners'/managers' characteristics, owners of the firms were surveyed. In some cases, key informants that are knowledgeable about firm practices, investments and decisions contributed to the process when the owner of the company could not provide the accurate information. Using convenience sampling, participants were approached in union meetings, chamber activities and e-mail groups. In order to capture data, a web-based survey was prepared and conducted in face-to face interviews, thus questions and scenarios related to the level of ICT adoption were explained. Moreover, questionnaires were sent to potential respondents by e-mail. Some respondents did not complete the entire parts of the questionnaire (n=38), and at the end 34 eligible questionnaires were obtained among 80 potential respondents (sample size). At the end final sample size was 34.

Operationalization and Measurement

Dependent variable; Independent variable of the study is the level of ICT adoption. This is a categorical variable representing 6 categories of ICT adoption. Each category represents different levels of ICT ownership and sophistication in implementation practices. These categories were adopted based on the studies on the conceptualisation of the ICT utilization at specifically at SMEs

(Siqueira et al., 2017; Tan, 2010; Shields, McIvor & O'Reilly, 2003). Assessment of the categories depends on the constructed scenarios by authors. Each level contains two scenarios which are measured as a five-point Likert-type scale with 1=strongly disagree to 5=strongly agree. Higher scores from a particular category are indicative of belonging to that category of ICT adoption. This assessment methodology used to determine the ICT positioning of an organization among 6 levels was adopted from the methodology of Redoli et al. (2008).

Level_1	Level_2	Level_3	Level_4	Level_5	Level_6
Basic ownership & Communication	Basic ICT utilization	Internal integration	External integration	Inter-organizational integration	Strategic integration

Independent variables; Demographic information gathered comprised of gender, education, age and field of study at university. With regard to industry competitiveness participants were asked to evaluate the item of “Our business is intensely competitive” based on five-point Likert-type scale with 1=strongly disagree to 5=strongly agree. **ICT literacy;** ICT literacy scale was adopted from Lau & Yuen (2014). **Innovativeness;** Innovativeness is measured based upon the scale developed by Hurt, Joseph and Cook (1977). Turkish validity and reliability of the scale (Cronbach Alpha=0,82) was provided by the study of Kemer and Altuntaş (2017). **Entrepreneurship orientation (EO);** Scales for EO were sourced from Hughes and Morgan (2007). From sub-dimensions of EO, we used the measures of risk-taking, pro-activeness, competitive aggressiveness and innovativeness with 11 items in total which was measured with a five-point Likert-type scale with 1=strongly disagree to 5=strongly agree. **ICT investments;** Participants were asked, “Approximately, what is the amount of expenditures allocated for hardware in your company (yearly)?” with choices of no expenditures, less than 1000 TL, 1000-4999 TL, 5000-9999 TL, 10000-19999 TL and more than 20000 TL. Also, expenditures of software and service charges regarding the ICTs were questioned with same manner.

ANALYSES

Descriptive Statistics

Descriptive statistics demonstrated that all respondents were male and over the age of 30. Education level of the respondents was varied across the sample, and half of the respondents reported that they were at least holding university degree. Most of the firms within the sample of the study had 10-49

employees which constituted 32.4% of the sampling units and solely 5.9% of the firms had more than 250 employees. Number of organizations under the other size categories was approximate. Firms within the sample were from a wide set of different industrial sectors and most of them agreed on the question of industry competitiveness, thus analyses regarding these variables were not meaningful. Hence, we omitted these variables from analyses.

Level of ICT adoption

Most firms (29.4%) were in level one which basically depends on the ownership of computers and Internet within the organization. Second greatest number of sampling units were within the Level_3 which evaluates integral integration by considering automation of internal processes, existence of advanced databases and ERP applications and dispersion of Internet and e-mail utilization. Level_4 evaluated the extent of external integration through 2 scenarios based the existence of business functions supporting external integration. Level_6 represents strategic integration, fully integration of the value chain, utilization of social media effectively and adoption of decision support mechanisms. None of the firms was within this category of ICT adoption. For further analyses, Level_1, Level_2 and Level_1-2 adopters were meaningfully combined into a group so as to represent low-level of adopters, while organizations within the categories of Level_2-3 and Level_3 were defined as mid-level ICT adopters. High level of ICT adoption represented by the Level_4, Level_5 and Level_3-4 adopters.

Analysis_1

A wide range of techniques were utilized to analyse the data. In order to test the Hypothesis_1a, Hypothesis_1b and Hypothesis_1c bivariate correlations between these variables and the dependent variable were estimated. Regarding the correlations between variables, Spearman correlation coefficient values of 0.687, 0.806 and 0.712 (significant at the 0.01 level) for ICT literacy, Entrepreneurship Orientation (EO) and Innovativeness confirm the existence of strong positive correlations. Thus, the set of Hypothesis_1a, Hypothesis_1b and Hypothesis_1c are accepted as a result of the analyses. Further, One-Way ANOVA and Post-hoc testing procedures were performed so as to check the differences of means between the groups represents high-level of ICT adoption, mid-level of ICT adoption and low-level of ICT adoption. Application of Scheffe and Tamhane tests were determined based on the homogeneity of variances tests. In terms of ICT literacy of owners/managers of the organizations descriptive statistics regarding the mean of ICT scores and associated differences among groups are represented in the table below. As Levene's Test for Equality of Variances test indicated equal variances across samples ($p > 0.05$), Scheffe test was more appropriate. Based on the statistics above, mean for the ICT literacy scores of owner'/manager' is

significantly different among the following groups; low-level of ICT adopters-mid-level of ICT adopters, low-level of ICT adopters-high-level of ICT adopters and mid-level of ICT adopters-low-level of ICT adopters. No significant differences were observed between high-level of ICT adopters-mid-level of ICT adopters in terms of ICT literacy scores. Descriptive statistics and mean differences of EO are illustrated in Table 3. Mid-level of ICT adopters had significantly higher mean scores for organizational EO than low-level of ICT adopters and mean scores of high-level of ICT adopters differed significantly from organizations within the low-level of adoption category. Table 4 demonstrates the analyses regarding the mean differences of Innovativeness scores of owners/managers. Similar pattern was observed with the findings for the analyses on ICT literacy and EO scores. Significant differences again were discovered among the same groups. Mean of Innovativeness scores significantly differed among low-level of adopters and mid-level of adopters. Mid-level of adopters' innovativeness scores was higher than low-level of adopters. In a similar manner, high-level of adopters achieved higher scores on Innovativeness scale.

Analysis_2

In order to test the association between categorical variables such as age, education and level of ICT utilization, The Chi-Square Test of Independence was used. For investigating the relationship between ICT positioning of an organization and age of the owner/manager of the organization contingency tables were created. Categories of the age were combined into two categories and association of these categories with the level of ICT adoption (high-level of adoption, mid-level of adoption and low-level of adoption) was observed. Since $p > 0.05$ (our chosen significance level $\alpha = 0.05$), we do not reject the null hypothesis. Hence, there is not enough evidence to state that there is a significant relationship between the level of ICT adoption and the age of the owner/manager of the company. Regarding the education variable same analysis procedure was repeated. Education categories as a result of data requirements combine into two so as to reflect education level less than university degree and above the university degree. As p-value ($p = 0.000$) is less than our chosen significance level ($\alpha = 0.05$), we accept that there is a significant link between the groups of education and level of ICT utilization. For the effect size of a chi-square independence test, association measures were taken into account. Cramer's $V = 0.0771$ indicated the strength of the association (effect size). There is a strong link between the 2 categories of education and ICT positioning of an organization. An association between education and ICT positioning of an organization was observed ($\chi^2(2) = 20.221^a$, $p = 0.000$). Thus, hypothesis_2a was rejected and hypothesis_2b was accepted. In the case of the organizational size variable and its association with the level of ICT utilization, p-value of 0.05 revealed that there is not enough evidence to state the existence of a relationship between the categories of size (lower than 50, 50-150 and above 150 employees) and the level of ICT utilization

(low-level of adoption, mid-level of adoption and high-level of adoption). For investigating the relationship between ICT expenditures and the level of ICT investments, organizations positioned at Level_1, Level_2, Level_1-2 and Level 2-3 were combined meaningfully into a category of ICT utilization so as to reflect relatively low performing adopters. Level_3, Level_3-4 and Level_5 positioning organizations were regrouped into a single category. Investments of hardware (less than 5000 TL, 5000-9999 TL and more than 10000 TL) and its association with the 2 categories of ICT positioning was examined. 77.8% of the organizations positioned as Level_3, Level_3-4 or Level_5 reported that they had more than 10000 TL yearly expenditures of ICT hardware, whereas 11.1% of them claimed that they had less than 5000 TL yearly hardware expenditures. On the other hand, 75% of organizations positioned as Level_1, Level_2, Level_1-2 or Level 2-3 adopters as a result of their scores on each levels reported that they had less than 5000 TL hardware investments annually. Only 25% of this group stated that they had annual hardware expenditures more than 5000 TL. Chi-Square Test of Independence indicated a significant association between ICT hardware investments and ICT positioning ($\chi^2(2) = 21.767^a$, $p < 0.005$) and Cramer's $V = 0.80$ ($p < 0.05$) indicated that this was a strong relationship. In a similar manner, ICT software and relevant service expenditures and its association with the level of ICT adoption was examined. Among Level_3, Level_3-4 and Level_5 ICT adopters 88.9% reported more than 10000 annual expenditure, whereas none of the respondents among Level_1, Level_2, Level_1-2 and Level 2-3 adopters reported that amount of ICT software and service expenditure. Most of this group (56.3%) stated that approximately they had less than 5000 TL yearly expenditures. A significant association exists between the level of ICT software investments and the level of ICT utilization ($\chi^2(2) = 26.875^a$, $p < 0.005$). Cramer's V value of 0.889 ($p < 0.05$) revealed that this was a very strong association.

Summary and Conclusions

This study depends on a critical review of factors affecting the adoption and utilization of ICT in SMEs. Particularly, literature on the SMEs was investigated and a list of factors were determined. This theoretical background guided to form an evaluation framework for ICT adoption which is specific to SMEs. It was discovered that some potential influencers of the adoption have not been examined so far. For instance, EO and ICT literacy of the owner/manager studies does not exist or have been studied from a limited or indirect aspect. Thus, the findings which revealed a strong positive correlation between EO of the organization, ICT literacy score and level of ICT adoption remarkably contribute to the theory. In addition, individual innovativeness and positive correlation with the level of ICT adoption was approved. Further, hypotheses regarding the relationship of age, education of the owners/managers with the ICT utilization at SMEs were examined. In terms of age variable no meaningful results were achieved to conclude. However, education was strongly

associated with the level of ICT utilization. From the aspect of organizational variables compromising size and ICT investments, it was observed that as the organizational size increases, the level of ICT utilization also increases and this association was statistically meaningful. For the assessment of ICT investments and its relation with regard to ICT utilization, significant differences were observed between the organizations at the adoption stages of Level_1, Level_2, Level_1-2 and Level 2-3 with the organizations at Level_3, Level_3-4 and Level_5. The level of ICT expenditures for both hardware and software & services significantly among these groups. These findings positively contribute to the theory and practitioners by revealing empirical results. Based on these findings strategies for taking preventative actions at SMSs could be produced based on the level of ICT at particular organizations. For each level of ICT utilization, appropriate strategic planning could be performed so as to improve the level of ICT utilization. However, there are some limitations of this study. First of all, sample size was limited and one future direction of the study is to conduct these tests with a large and highly representative sample. Moreover, investigation of the set of variables which affects the level of ICT utilization most will be examined as well as a future work.

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Figures and Tables

Table 1

Bivariate Correlations among ICT literacy, Entrepreneurship Orientation and Innovativeness

ICT positioning				ICT_SCORE_SUM
Spearman's rho	ICT positioning	Correlation Coefficient	1.000	.687**
		Sig. (2-tailed)	.	.000
	ICT_SCORE_S UM	Correlation Coefficient	.687**	1.000
		Sig. (2-tailed)	.000	.
			EO_SCORE_SUM	ICT positioning
Spearman's rho	EO_SCORE_S	Correlation Coefficient	1.000	.806**
	UM	Sig. (2-tailed)	.	.000
	ICT positioning	Correlation Coefficient	.806**	1.000

EO_SCORE_SUM			(I) ICT positioning	(J) ICT positioning	Mean Difference (I-J)	Std. Error	Sig.
Tamhane	low level of adoption	mid level of adoption		-1.11056*	.15414	.000	
		high level of adoption		-1.17192*	.18636	.000	
	mid level of adoption	low level of adoption		1.11056*	.15414	.000	
		high level of adoption		-.06136	.21712	.989	
	high level of adoption	low level of adoption		1.17192*	.18636	.000	
		mid level of adoption		.06136	.21712	.989	
			Sig. (2-tailed)	.000		.	
	ICT positioning				INN_SCORE_SUM		
Spearman's rho	ICT positioning	Correlation Coefficient		1.000	.712**		
		Sig. (2-tailed)		.	.000		
	INN_SCORE_SUM	Correlation Coefficient		.712**	1.000		
		Sig. (2-tailed)		.000	.		

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

Table 2

Differences among groups based on ICT literacy scores

ICT_SCORE_SUM	(I) ICT positioning		(J) ICT positioning	Mean Difference (I-J)	Std. Error	Sig.
Scheffe	low level of adoption	mid level of adoption		-1.35675*	.32964	.001
		high level of adoption		-1.54235*	.29889	.000
	mid level of adoption	low level of adoption		1.35675*	.32964	.001
		high level of adoption		-.18561	.34987	.869
	high level of adoption	low level of adoption		1.54235*	.29889	.000
		mid level of adoption		.18561	.34987	.869

*, The mean difference is significant at the 0.05 level.

Table 3

Differences among groups based on EO scores

EO_SCORE_SUM	(I) ICT positioning		(J) ICT positioning	Mean Difference (I-J)	Std. Error	Sig.
Tamhane	low level of adoption	mid level of adoption		-1.11056*	.15414	.000
		high level of adoption		-1.17192*	.18636	.000
	mid level of adoption	low level of adoption		1.11056*	.15414	.000
		high level of adoption		-.06136	.21712	.989

	high level of adoption	low level of adoption	1.17192*	.18636	.000
		mid level of adoption	.06136	.21712	.989

Table 4

Differences among groups based on Innovativeness scores

INN_SCORE_SUM	(I) ICT positioning	(J) ICT positioning	Mean Difference (I-J)	Std. Error	Sig.
Scheffe	low level of adoption	mid level of adoption	-1.15149*	.30234	.003
		high level of adoption	-1.50173*	.27414	.000
	mid level of adoption	low level of adoption	1.15149*	.30234	.003
		high level of adoption	-.35024	.32089	.557
	high level of adoption	low level of adoption	1.50173*	.27414	.000
		mid level of adoption	.35024	.32089	.557