



## DIGITAL MATURITY, DIGITAL INNOVATIONS, AND DIGITAL SKILLS

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**Abstract:** Digital maturity models enable evaluating an organization’s existing positioning and capabilities for digitalization and provide identifying necessary capabilities. This study explores the current digital maturity level of small and medium-sized enterprises (SMEs) in a developing country setting by concentrating on Turkish SMEs. Despite the increasing importance of digital transformation, empirical research on factors associated with digital maturity is scarce. As a result of exploring a knowledge gap, this study concentrates on two individual factors (digital skills and risk aversion of the owner/manager) and one organizational factor (digital innovations) and their link with the digital maturity level of SMEs. The findings represent that the digital maturity level of organizations increases by the digital skills of the owner/manager, and organizations with risk-averse owners/managers are more likely to demonstrate lower levels of maturity. Besides, it is also explored that digital innovations performance is correlated with the digital maturity and digital skills of the owners/managers.

**Keywords:** Digital Maturity, Digital Innovations, Digital Skills

## DİJİTAL OLGUNLUK, DİJİTAL YENİLİKLER, VE DİJİTAL BECERİLER

**Özet:** Dijital olgunluk modelleri, işletmelerin dijitalleşme bakımından mevcut durumunun ve yeteneklerinin değerlendirilerek dijital dönüşüm yolundaki gerekli becerilerin tespit edilmesini sağlamaktadır. Bu çalışma, Türkiye’deki küçük ve orta ölçekli işletmelere (KOBİ’lere) odaklanarak gelişmekte olan bir ülke ortamındaki KOBİ’lerin mevcut dijital olgunluk düzeylerini araştırmayı amaçlamaktadır. Dijital dönüşümün artan önemine rağmen, dijital olgunlukla ilişkili faktörler üzerine yapılan ampirik araştırmalar azdır. Bu alandaki eksikliğin keşfedilmesinin bir sonucu olarak, bu çalışma iki bireysel (sahibinin/yöneticinin dijital becerileri ve riskten kaçınma) ve bir örgütsel faktöre (dijital yenilikler) ve bunların KOBİ’lerin dijital olgunluk düzeyi ile bağlantısına odaklanmaktadır. Bulgular, işletme sahibi/yöneticinin dijital becerileri ile işletmelerin dijital olgunluk düzeyinin arttığını ve riskten kaçınan işletme sahipleri/yöneticilere sahip kuruluşların daha düşük olgunluk düzeyleri sergileme olasılığının daha yüksek olduğunu göstermektedir. Ayrıca, dijital inovasyon performansının, sahiplerin/yöneticilerin dijital olgunluğu ve dijital becerileri ile ilişkili olduğu da keşfedilmiştir.

**Anahtar Kelimeler:** Dijital Olgunluk, Dijital Yenilik, Dijital Beceriler

### INTRODUCTION

The digital transformation will reshape the future of businesses. The possibilities offered by the emerging digital technologies contribute to adapting to the changing needs of organizations and customers. More effective organizations and service quality and the use of digital technologies to alter business processes will help organizations to achieve their growth goals more rapidly (Ustaoglu, 2019). Fundamental tasks inside industrial organizations’ internal processes, as well as with their value chain partners, are becoming digitized. Furthermore, they are expanding their product offering with digital

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features and providing novel data-driven services. This is a step in the direction of an entire value chain transformation. Successful businesses will eventually become digital organizations, with physical products at their center, digital platforms, and new services to complement them. According to a revolutionary and innovative vision, these digital companies will collaborate with consumers and suppliers in industrial digital networks. However, one of the major challenges industrial organizations are currently experiencing in achieving this goal is defining their transformation plan (De Carolis et al., 2017; pwc, 2016).

Furthermore, as the world becomes more integrated and digital transformation occurs, the unfathomable potential for technology and business emerges. Even though digital transformation is still in its early stages, recognizing weaknesses and strengths is critical for all businesses (Ustaoglu, 2019). Together with the digital transformation and Industry 4.0, a new concept known as digital maturity has arisen. Because there is no standard description or understanding of this process to date, there are many issues to investigate and discover associated with this research topic (Aslanova & Kulichkina, 2020). Bloomfire (2017) indicated that digitally mature organizations have an apparent digital strategy compared to organizations with a low level of digital maturity. The critical components of digital transformation are assessing digital maturity, defining a clear digital strategy, establishing a collaborative culture and powerful digital skills, and noticing the requirement for change.

Eventually, this study aims to explore the digital maturity level of organizations, by particularly focusing on SMEs in the Marmara region in Turkey. Several factors, including owner's/manager's risk aversion, digital skills, and organization's digital innovation performance, are examined for their link with the digital maturity of the organizations.

## **THEORETICAL BACKGROUND ON RESEARCH MODEL**

### **DIGITAL MATURITY**

Many maturity models have been proposed to determine and evaluate their current situation to realize this transformation. Those conceptual models provide the evaluation of the current digitalization efforts of the organizations by considering different parameters. Maturity models give an approach for evaluating and ranking the level of proficiency of businesses (Parra et al., 2019). Blatz et al. (2018) suggested a maturity model for SMEs which incorporates six dimensions: strategy and leadership, company culture and organization, IT infrastructure, data maturity, processes and operations, and product. The overall maturity level results reveal that the organizations are partially quite far apart in terms of digitalization, which shows that organizations have varied starting points for digitalization. Minonne et al. (2018) discovered plenty of digital maturity factors, including, for example, the presence of not just a vision to be realized via digitization and its prospects, but also a plan for determining how far the organization must alter itself for capitalizing on potential competitive advantages. Many maturity models consider leadership, particularly its capability to define the enterprise's position in the digital age, to be a critical component for digitalization (Minonne et al., 2018). Schuh et al. (2020) developed an Industry 4.0 maturity index by defining the different stages that organizations go through in digital transformation. These stages encompass computerization, connectivity, visibility, transparency, and adaptability. North et al. (2019) suggested capabilities, processes, organizational systems, and business models as the core components of digital maturity based on several maturity frameworks. According to North et al. (2019), a digital maturity assessment tool should focus on all of these components, and it is argued that the development of those core elements has four aspects: (1) identifying digitally-enabled growth opportunities; (2) creating a



strategy and developing an attitude for growing digitally; (3) capitalizing on digitally-enabled development opportunities; and (4) managing the resources for digitalization.

## **OWNER-MANAGER CHARACTERISTICS & DIGITAL MATURITY**

### **DIGITAL SKILLS**

Digital technologies impact not just how organizations operate but also how individuals connect and work. Organizations must make digital maturity their priority to keep up with the rapid advancements in the digital world. However, the critical strategic variables influencing digital maturity are mainly unknown (Salviotti et al., 2019). Salviotti et al. (2019) explored that digital shared vision, communication of this vision, positive view on digital technologies, and employees having digital skills are significantly related to the digital maturity of the organizations. Agile, innovative, risk-tolerant, cooperative, and learning organizations seem to be more likely to be found in digitally mature organizations. These cultural qualities serve as a foundation for driving digital transformation (Rader, 2019).

Recent research on 500 UK small businesses explored that over half of them have suffered a considerable loss of profits because of the Covid-19 epidemic. Almost 70% of company owners believe that there will be a requirement to regularly refresh their online/IT skills to keep their organizations competitive. However, nearly half of them stated they do not know where to obtain them. Hence, nonprofit skills project has created a recent freehub to enhance their online abilities and push their companies ahead, as new data indicates that approximately 75% of small business owners think that online/IT skills are vital for their organization to succeed (The Federation of Small Businesses, 2020). Recent research has associated digital technologies' utilization and adoption with the owner's/manager's digital skills and related knowledge (AlBar & Hoque, 2019; Setiowati et al., 2015). Hence, it is believed that owner's/managers' digital skills have a relationship with the organization's digital maturity.

### **RISK AVERSION**

The owners/managers of businesses must be aware of the changes in the global business environment. Without a clear vision supported by entrepreneurial activities, no organization can exist and flourish. To do so, owners/managers must first understand their skills, abilities, and management styles and the goals they want to attain. To seize the opportunities, owners/managers must take calculated risks and be proactive and innovative (Plalic, 2017). Sawaeen and Ali (2020) explored that entrepreneurial leadership ability, including visionary, risk-taking, proactivity, and opportunity-seeking, influences the organizations' performance and innovation capacity has a mediating effect on this link. A recent study examining the five most commonly discussed dimensions of entrepreneurial abilities reported a significant relation with the entrepreneur's risk control, creativity, opportunity detection, and relationship ability, and the organization's growth (Diabate et al., 2019). Lonial and Carter (2015) explored that managers' risk-taking as an aspect of entrepreneurial orientation affects the organization's performance. Since technology-based innovations have been previously associated with the organization's performance (Zhou et al., 2005), it is expected that the risk-taking attitudes of the owner/manager is linked with the digital innovations of the organizations. Hence, it is expected that the risk aversion of the owner/manager has a relationship with the organization's digital maturity.



## DIGITAL MATURITY & DIGITAL INNOVATION PERFORMANCE

Digital innovations of the organizations have been reported to be driven by digital capabilities since organizations with positive attitudes toward digitalization and capabilities to manage recent technologies will be willing and ready to implement those technologies. As a result, they will use those resources to develop new products (Khin & Ho, 2019). Consequently, it is expected that an organization's digital maturity has a relationship with its digital innovation performance.

### STRUCTURE OF QUESTIONNAIRE

The conceptual model of North et al. (2019) is transferred in a questionnaire to assess the digital maturity of the organizations. Since the primary focus of the study is to determine the factors associated with digital maturity, and those factors encompass digital skills and risk aversion of the owner/manager, as well as digital innovation performance of the organizations, elements of the maturity assessment model were chosen accordingly. These dimensions include “digital customer experience”, “understanding and developing digital customer needs”, “digitally-enabled business models”, and “digital market presence”. Capabilities associated with these elements were used as items that were rated with a five-point Likert Scale. Based on the six maturity levels as defined by (North et al., 2019), the score for each dimension was calculated by computing the arithmetic mean for the associated items for each maturity level. For the overall maturity level, the scores of levels one and two, level three and four, and level five and six were aggregated based on the relevance of the respective levels concerning low, medium, and high-level digital maturity.

Assessment of the digital skills, risk aversion, and digital innovation was performed using three constructs. Digital skills are comprised of three subdimensions (Internet, information, and computer) consistent with the ICT literacy scale of Lau and Yuen (2014). We used the risk aversion scale developed by Sharma (2010) and the digital innovation scale adapted by Khin and Ho (2019) from the measure of Paladino (2007).

### DATA COLLECTION

The survey data were collected through online and face-to-face interviews from SMEs operating in the Marmara region at the end of 2019 by using the non-probabilistic convenience sampling method. The gender, education, age, and status of 172 respondents are shown in Table 1. The majority of respondents (83%) are owners of the organization. 27% of owners have primary or high school degrees, and 68% are 42 years or older. Regarding the gender distribution, male participants constitute 78% of the sample population.

Table 1. Demographics

		Education / Gender							Total
		Primary Education	High School		University		Postgraduate		
Age	Status	Male	Male	Female	Male	Female	Male	Female	
24-29	Owner				2				2
30-35	Owner		8		3			5	16
	Senior Executive			2	1				3
	Mid-level manager		1			7			8
	Expert					2			2
36-41	Owner		4		18	5	1		28
	Senior Executive			3	1				4



42-47	Owner	2	21	6	21	2	11		63
	Mid-level manager		1			3			4
48+	Owner	5	11		17		1		34
	Senior Executive	3				2			5
	Mid-level manager				3				3
<b>Grand Total</b>		<b>10</b>	<b>46</b>	<b>11</b>	<b>66</b>	<b>21</b>	<b>13</b>	<b>5</b>	<b>172</b>

## FINDINGS

### CONFIRMATORY FACTOR ANALYSIS

The construct validity and reliability of the five dimensions in the research model were measured by confirmatory factor analysis using The SmartPLS software (Ringle et al., 2015). Table 2 shows the outer loadings of each item and Cronbach's  $\alpha$  scores, Composite Reliability, and Average Variance Extracted (AVE) values of five dimensions. According to (Hair et al., 2018:663), the outer loading should be over 0.5, ideally 0.7 or higher. As seen in Table 2, the loadings of each item are within the desired limits. The AVE should be 0.5 or higher for adequate convergent validity (Hair et al., 2018:775). In terms of composite reliability and Cronbach's  $\alpha$ , values of 0.7 or higher indicate adequate internal consistency reliability for each construct (Hair et al., 2018:776). Accordingly, two items with relatively low outer loadings were excluded from the analysis for the Cronbach's  $\alpha$  value of the Risk Aversion construct to be within the desired limits. Table 2 shows that all recommended construct reliability and validity measurements are within acceptable limits.

Table 2. Confirmatory Factor Analysis

Factors	Outer Loadings	References
<b>Computer Skills</b> [Cronbach's $\alpha$ : 0,942 ; Composite Reliability: 0,956; *AVE: 0,813]		
COML01 – I am able to set header/footer in word processor software (Microsoft Word)”	0.932	(Lau & Yuen 2014)
COML02 – I am able to plot a graph and chart using spreadsheet software (Microsoft Excel)	0.920	
COML03 - I am able to insert an animation in presentation software (Microsoft PowerPoint)	0.934	
COML04 - I am able to edit a photo using image processing software	0.875	
COML05 - I am able to set up a printer (installing printer drivers)	0.843	
<b>Digital Innovation</b> [Cronbach's $\alpha$ : 0,904 ; Composite Reliability: 0,933; *AVE: 0,779]		
DI01 - The quality of our digital solutions is superior compared to our competitors’	0.889	(Khin & Ho 2019; Paladino 2007)
DI02 - The features of our digital solutions are superior compared to our competitors’	0.940	
DI03 - The applications of our digital solutions are totally different from our competitors’	0.891	
DI04 - Some of our digital solutions are new to the market at the time of launching	0.804	
<b>Information Skills</b> [Cronbach's $\alpha$ : 0,845 ; Composite Reliability: 0,889; *AVE: 0,619]		
INFL01 - I am able to identify appropriately the needed information from question	0.624	(Lau & Yuen 2014)
INFL02 - I am able to collect/retrieve information in digital environments	0.799	

INFL03 - <i>I am able to use ICT to process appropriately the obtained information</i>	0.822	
INFL04 - <i>I am able to use ICT to process appropriately the obtained information</i>	0.783	
INFL05 - <i>I am able to judge the degree to which information is practical or satisfies the needs of the task, including determining authority, bias, and timeliness of materials</i>	0.882	
<b>Internet Skills</b> [Cronbach's $\alpha$ : 0,903 ; Composite Reliability: 0,929; *AVE: 0,721]		
INTL01 - <i>I am able to set a homepage for an internet browser</i>	0.854	(Lau & Yuen 2014)
INTL02 - <i>I am able to search for information on the internet using a search engine</i>	0.755	
INTL03 - <i>I am able to use email to communicate</i>	0.884	
INTL04 - <i>I am able to use instant messaging software to chat with friends</i>	0.814	
INTL05 - <i>I am able to download files from the internet</i>	0.930	
<b>Risk Aversion</b> [Cronbach's $\alpha$ : 0,907 ; Composite Reliability: 0,935; *AVE: 0,782]		
RA01 - <i>I tend to avoid talking to strangers</i>	0.882	(Sharma, 2010)
RA02 - <i>I prefer a routine way of life to an unpredictable one full of change</i>	0.908	
RA03 - <i>I would not describe myself as a risk-taker</i>	0.887	
RA04 - <i>I do not like taking too many chances to avoid making a mistake</i>	0.859	

Another indicator for discriminant validity is that the square root of the AVE for each construct should be higher than the correlation values of the constructs. This measurement method, expressed as the Fornell–Larcker criterion (Hair *et al.*, 2013:145), is shown in Table 3. Values shown in bold and italic indicate the square root value of AVE, while other values represent the correlation coefficient.

Table 3. Fornell - Larcker Criterion

	Computer L.	Digital I.	Risk A.	Information L.	Internet L.
<b>Computer Skills</b>	<b>0.902</b>				
<b>Digital Innovation</b>	0.788	<b>0.882</b>			
<b>Risk Aversion</b>	-0.492	-0.658	<b>0.884</b>		
<b>Information Skills</b>	0.742	0.740	-0.481	<b>0.787</b>	
<b>Internet Skills</b>	0.844	0.718	-0.431	0.825	<b>0.849</b>

Based on the digital maturity framework, which is evaluated in six different dimensions (North *et al.*, 2019), each organization's digital maturity level was determined by authors at three different levels as low, medium, and high. As a result of the evaluation, it has been determined that 11% of the companies have low-level, 50% medium-level, and 40% high-level digital maturity. The mean and standard deviation for each construct is shown in Table 4 for 172 organizations based on defined maturity levels.

Table 4. Digital Maturity Levels

Factors	Low-Level (%11)	Medium-Level (%52)	High-Level (%37)
	Mean (Standard Deviation)	Mean (Standard Deviation)	Mean (Standard Deviation)
Risk Aversion	4,26 (.32)	3,03 (.85)	2,09 (.96)
Computer Skills	1,13 (.13)	3,12 (.95)	4,00 (.51)
Internet Skills	2,44 (.39)	3,91 (.61)	4,61 (.37)



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Information Skills	2,65 (.44)	3,90 (.48)	4,44 (.38)
Digital Innovation	1,60 (.43)	3,28 (.58)	4,09 (.66)

A one-way analysis of variance (ANOVA) test was conducted with IBM SPSS software to verify the validity of the digital maturity levels. As seen in Table 5 statistically significant difference was found between all levels. Post Hoc tests conducted according to the Test of Homogeneity of Variances results showed that each construct was statistically significant according to three different categorical levels.

*Table 5. ANOVA Results of Clusters*

Factors		Sum of Squares	df	Mean Square	F	Sig.
<b>Risk Aversion</b>	Between Groups	77,331	2	38,665	52,292	,000
	Within Groups	124,961	169	,739		
	Total	202,292	171			
<b>Computer Skills</b>	Between Groups	122,302	2	61,151	104,785	,000
	Within Groups	98,626	169	,584		
	Total	220,927	171			
<b>Internet Skills</b>	Between Groups	70,712	2	35,356	133,139	,000
	Within Groups	44,879	169	,266		
	Total	115,592	171			
<b>Information Skills</b>	Between Groups	47,559	2	23,780	118,609	,000
	Within Groups	33,882	169	,200		
	Total	81,442	171			
<b>Digital Innovation</b>	Between Groups	92,930	2	46,465	127,795	,000
	Within Groups	61,447	169	,364		
	Total	154,376	171			

On two axes graphs produced by the t-SNE method, Figure 1 shows each organization's business size. The organization's size is represented as a circle in the charts, shown in various sizes. The smallest circle represents under ten employees, and the digital maturity level of each organization is shown in three different colors. It is seen in Figure 1 that as the number of employees increases, the digital maturity level increases as expected.







Figure 2 (A) shows that owners or managers of organizations with higher digital innovation performance are less risk averse. Digital innovations performance also increases by the Internet (D), information (C), and computer skills of the owners/managers (B).

## DISCUSSION AND CONCLUSIONS

This study proposed that significant differences exist in digital skills and risk aversion of owners/managers based on the digital maturity level. It was also suggested that the digital innovation performance of organizations changes with the level of digital maturity. We tested the proposed hypotheses, and the findings provided empirical evidence regarding the significant differences between different maturity levels in the context of SMEs in Turkey. Although digital skills, computer skills, or ICT literacy have been investigated regarding their effect on the adoption of particular digital technologies, some studies revealed mixed results (Dalvi-Esfahani et al., 2018). Hence, the significant relationship with digital maturity explored in this study is an important finding. In SMEs with limited resources, qualified skills, and knowledge, at most times owner/manager is the only decision-maker in the organization. For that reason, when they are more knowledgeable and competent in utilizing digital technologies, it is more likely that they will be capable of sensing and seizing the opportunities of digitalization. Risk-taking is considered an essential attitude for seizing opportunities (Palalic, 2017). To the best of our knowledge, risk-taking or risk aversion have been examined regarding their effect on different outcomes such as organizational growth (Diabate et al., 2019), firm performance (Lonial & Carter, 2015), and digital innovations (Zhou et al., 2005). Thus, revealing the link between digital maturity within the context of the study is an important finding.

Further, a limited number of studies have focused on digital innovation performance (Khin & Ho, 2019; Zhou et al., 2005), particularly as an outcome of digital maturity. This study explored that digital innovations are related to the digital maturity level of organizations as expected. Digitally mature organizations anticipating the digital customer requirements, having a digital market presence, and digital customer experiences put more effort into embracing digital technologies to improve their business models, processes, and products with new digital solutions. Eventually, digital mindset and digital skills are required for enhancing digital innovations. This finding supports the argument of (Zhou et al., 2005), who proposed that technology orientation is an essential enabler of technology-based innovations. It was also explored that digital innovations increase by the particular digital skills (Internet, information, and computer), and decrease by the risk aversion of the owner/manager. In order to foster digitalization and digital innovations, these personal factors should be focused on by the organizations and policymakers. Creating awareness for decision-makers is vital for the implementation of initiatives for digital upskilling.

## LIMITATION AND FUTURE STUDIES

Research findings should be evaluated by considering various limitations. First of all, the non-probabilistic convenience sampling method was used as the data collection method in the study. The ability of this method to represent the universe is much lower than probability-based methods. Second, in our research, the number of organizations at different maturity levels are not equal, for instance, having 52% of the observations for the medium level. Finally, sectoral differences and organization size will significantly affect the findings. It would be beneficial to consider these shortcomings and fill the relevant gaps in future studies on this subject.



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