www.irmbrjournal.com
International Review of Management and Business Research
March 2018
Vol. 7 Issue.1

The Effect Factors in the Adoption of Internet of Things (IoT) Technology in the SME in KSA: An Empirical Study

Dr. ALI BAKHIT JAAFREH
Ph.D. In Management Information System
Business Department – Shaqra University – KSA
Email: Jaafreh_ali@yahoo.com / ajaafreh@su.edu.sa
Tel: 00962795106548 / 00966534768617

Abstract

The study aims to investigate the factors that influence users' acceptance of IoT technologies, and to develop a proposed model of the adoption of IoT technology in SMB in KSA. an questionnaire survey method used to collect the data and used quantitative statistics and analysis of the questionnaire data conducted. The results confirm the robustness of the proposed model, explaining technology acceptance behavior for users in the context of IoT technologies. an extended TAM model to which national cultures dimensions (Individualism/Collectivism, Power Distance (PD), Avoidance of Uncertainty (UA), Masculinity-Femininity (MA)) are added, the study finding that a consumer's perceptions of usefulness, perceived ease of use, and National culture are predictive of user's intention to use IoT technology. Also, found the national culture impact on the perceived usefulness and perceived ease of use. This finding consistency with researcher viewpoint, which the national culture have a very important role and determine the user behavior toward to use a new technology.

Keywords: *Adoption, TAM, National Cultures, IoT, SME.*

Introduction

Today, everything is connected to the Internet. Internet of Things (IoT), as one of the disruptive technologies, is rising quickly. The Internet of Things (IoT) is a hot area needs a significant research attention. According to Gartner, "the *Internet of Things Installed Base Will Grow to 26 Billion Units by 2020* ". Also, the IoT will create incremental revenue beyond $300 billion, in 2020(Gartner, Inc. online 20/12/2017: https://www.gartner.com/newsroom/id/2636073).

The Internet of Things (IoT) has a high rate of technology change that affects a whole world (Dutton et al., 2014). The Internet of Things has many applications in business, that the firms will face a huge effect on the future of the progress of the IoT (Bui & Zorzi, 2011). Bsquare's Annual IoT Maturity Study reported nearly two-thirds (73%) of all business plans to increase their IoT investments, in spite of almost every respondent acknowledging that IoT utilizations are complex (Bsquare, 2017).

Many organizations have already identified huge opportunities offered by the IoT. According to Bonnet et al. (2014), 96 % of questioned companies stated that they are going to adopt the IoT, and 68% stated that they are already investing in the IoT. The digital transformation of industry permitted by the IoT adoption allows new ways for businesses to connect and to create value (Mourtzis et al., 2016).

By looking through the literature, the researcher found many previous studies focused on the technical side of using IoT, Such as IoT focused on architectural elements, attribute-based, and wireless sensor network (Ray, 2016; Singh et al., 2017; Gubbi et al., 2013). Despite the dramatic change by IoT influenced individual, organization, and society, but the effect of IoT not only the technical side but also affecting on End User. A few studies discussed adoption of IoT to understand the user perceptions toward using new IT technology. However, a little attention have been given to the behavioral, organizational and business issues that are essential for a better understanding of the adoption of the IoT and user perceptions about a new technology.

Adoption of a new technology still interested field in IS. Technology adoption defined as "*the stage in which a technology is selected for use by an individual or an organization*"(Carr, 1999). Many theories and models in IS field used to assess the users' perception of the adoption. One of them the Technology Acceptance Model (TAM) developed by Davis. However, the TAM model proved more powerful and able to explain the variation in the acceptance of technology better than other models (Jaafreh &Al-abedallat, 2011). A Few studies have examined the acceptance of IoT by users (Gao & Bai, 2014). Ma (2011) recommended that further study and research is vital to expanding a better understanding of what the IoT adoption would mean from the multidimensional viewpoint.

TAM model assumed that two constructs are mainly decided to predict and explaining user behavior toward using a new system. However, the researcher sees not only these two constructs but also national cultures variables have a critical drive in shaping user behavior because of the act depend on beliefs and norms of the user. A Few studies discussed that such as Jaafreh (2017). Also, a lack of exact measurement of variables suggests further work needed to increase our understanding of the adoption of IS.

Accordingly, the purpose of this research is to develop a framework of the adoption of IoT based on extending TAM to include national cultures as dimension added for the adoption of IoT by the end user, to explore whether national culture influences users' perception toward actual usage and the role national cultures in influencing the acceptance of IoT.

The aims of this Study

The important the aims of this research:

(1) To verify the proposed model based on the findings of the research to ensure its validity and reliability.
(2) To examine factors influencing User acceptance of Internet of Things Technology (IoT) guided by the Technology Acceptance Model (TAM) within the context of a Small or Medium-sized Enterprises (SME).
(3) To explore whether national culture influences users' perceptions toward acceptance a new system.

Theoretical Background

Technology Acceptance Model

Technology Acceptance Model (TAM) comprehensively tested and widely accepted among researchers in the field of IS a theoretically based model with good predictive validity. TAM is more oriented to study the human behavior by using information system.

Davis presented in 1989 the Technology Acceptance Model –TAM- (Figure.1) based on modified the Theory of Reasoned Action (TRA) to predict and explain the determinants of user acceptance of new information systems (Davis 1989). TAM used to predict and explain human behavior towards the adoption of different technologies at the individual level.

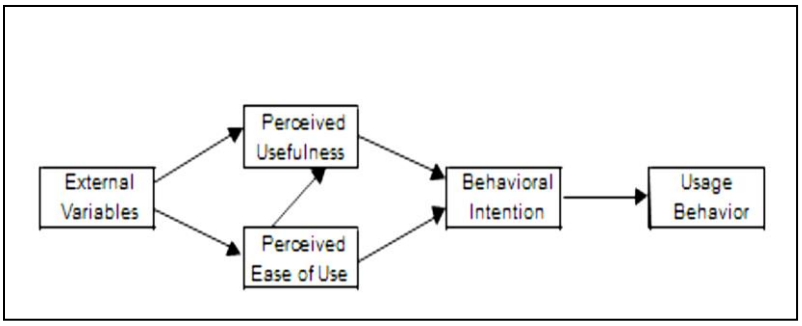

Figure.1: Technology Acceptance Model (TAM) (adapted from Venkatesh & Davis, 1996).

TAM model involved there are mainly two variables that Perceived Usefulness of IT technology and Perceived Ease of Use determine an individual's Intention to Use a system with Intention to Use performing as a mediator of actual system use. While Perceived usefulness directly impacted by perceived ease of use (Davis et al.,1989). Davis found "*the Perceived usefulness is a major determinant of people's intentions to use computers. And Perceived ease of use is a significant secondary determinant of people's intentions to use computers*" (Davis et al., 1989, P.997).

Davis designated the constructs of the TAM as follows: Perceived Ease of Use (EOU) refers to "*the degree to which a person believes that using a particular system would be free of effort*" (Davis, 1989, P.320). Davis et al. (1989) defined EOU as "*the degree to which the prospective user expects the target system to be free of effort*" (P.985).Perceived Usefulness (U): defined as" *the degree to which a person believes that using a particular system would enhance his or her job performance*"(Davis, 1989, P.320). Behavioral Intention to Use (BI):" *is a measure of the strength of one's intention to perform a specified behavior* "(Fishbein & Ajzen 1975, p. 288).

Internet of Things (IoT) Technology

The Internet of Things (IoT) allows devices interconnected any objects anytime, anywhere in the world that created a raped change in all aspects of our life. Evolution of Internet of Things provides extensive services in all sectors such as manufacturing, healthcare, and education. IoT technologies are essentially changing the way in which people interact and perceive technology. The field of the Internet of Things is still in the Infancy phase (Vos, 2015).

Many of the IoT definitions of different perspective explore some of these definitions .Internet of Things (IoT) defined as "the networking of physical objects through the use of embedded sensors, actuators, and other devices that can collect or transmit information about the objects" (McKinsey, 2014). IoT refers to a worldwide network of interconnected objects having a unique identity and communicating using standard protocols (INFSO, 2008). These objects are anything such as a Person or any physical device has the ability to transfer data over the network. IOT refers to the interconnections of the physical world of things with the virtual world of the Internet, the technology platforms, in addition to the standards commonly used to enable interconnection (Mazhelis et al., 2012).

The Internet of Things has present many new intelligent applications for roughly every sector. These applications will have a robust impact on the economy and the society. Internet of Things (IoT) is the biggest technology disruptive that will improve productivity and efficiency across different industries and services sector. The IoT described as everyday objects having internet connectivity allowing them to exchange data. McKinsey (2015) conclusion the consumers and organizations users of IoT could acquisition 90 percent of the value that IoT applications generate. The customers of organizations that

operate IoT systems get the most value in the form of saving cost, superior quality, and improved service (McKinsey, 2015).

Adoption of IoT offers numerous opportunities for an organization such as cost savings, improvements of products and services, and risk mitigation (Ebersold & Glass, 2015). The IoT is predicted to be a major IT-enabled business trend over the next 10 years (Coombs et al., 2016), and their benefits of consumers are significant (Uckelmann et al., 2011). Botta et al. (2016) the adoption of IoT and use estimated to be more common, making them important components of the Future Internet.

Nevertheless, more research needs to explore the capabilities needed to adopt the IoT in the organization. The researcher has tried to identify the factors that affect the acceptance of IoT by users. For example, The IoT applications affect users' behavior on all aspects of their daily life (Li & Wang, 2013). According to Acquity Group's research, the 7 percent of customers own a wearable IoT device and 4 percent of customers own an in-home IoT device. That showed a lack of awareness and value perception of customers toward IoT (Acquity Group, 2014) **.**Other barriers to consumer adoption of IoT are IoT adoption slow rate, Awareness of IoT and behavioral challenges, cost, security, and ease of use (Evans, 2015; Winchcomb et al., 2017). Ericsson (2015) found the most important of Barriers to IoT adoption for Danish company are handling new technologies, qualified personnel, and Employee resistance.

Other researchers developed an IoT acceptance model based on TAM and additional trust, social influence, user characteristics, and other factors. They found a strong support for the effects of perceived usefulness, perceived ease of use, social influence, and perceived behavioral control on behavioral intention to use the IoT. In addition, perceived ease of use found to affect perceived usefulness (Gao & Bai, 2013; Coandadiputra & Carissa, 2017). Müller-Seitz et al. (2009) have confirmed that PU determines technology acceptance of new services in electric appliance retail. Kang et al.(2014) used Technology Acceptance Model (TAM) incorporating Service-oriented and device-oriented functional attributes to Study Factors Affecting the Adoption of Smartphones. They found that the device-oriented functional attributes affect the adoption of smartphones regardless of users. They found Perceived Usefulness affects Behavior Intention directly and Perceived Ease of Use affects Behavior Intention indirectly via affecting Perceived Usefulness.

Roy et al. (2016) study the adoption of the Internet of Things (IoT) based innovations by urban poor communities. They found the innovation must provide outstanding service based on three factors benefits as the value of using the system to the users, the users support, and training given to users regarding system use. Kahlert (2016) found the PU, PEOU, significantly predicted intention to accept and influencing the acceptance of IoT services in retailing. Al-Momani et al. (2016) investigated the adoption of IoT services. Al-Momani et al. (2016) proposed a conceptual framework that associations the ease of use and usefulness with other factors such as social influence, trust, IT knowledge, and security and privacy for the IoT services.

Mital et al. (2017) study Adoption of the Internet of Things in India .used Theory of Reasoned Action and Technology Acceptance Model .the main findings Perceived usefulness (PU), and perceived ease of use (PEOU) had a positive and significant impact on the respondent's BI to use IOT based smart devices. Kim et al. (2017) Investigation what effect made on the perceived usefulness, perceived ease of use, intention to use and self-efficacy about the use of the smart refrigerator. They found the user who was primed about the visual cues perceived higher usefulness, ease of use, intention to use, and self-efficacy toward the smart fridge. Singh, et al. (2017) found the organizations' ability to adopt IoT for different use in their organization is positively influenced by perceived usefulness and perceived ease of use.

Kim (2016) examined the effects of social presence, perceived expertise, multiple source attribution, and specialization on the attitude toward the IoT devices and the quality of transmitted information. He found the social presence and perceived expertise as influential mediators in human–IoT interaction, and

individuals respond to a new system in a way depending on their cultural background. In addition, recommended Future research may investigate the moderating effects of the cultures in the context of IoT.

National Cultures

According to Hofstede (2011) a national culture defined as "*the collective programming of the mind which distinguishes the members of one human group from another*" (p.3). Hofstede argued these mental programming shapes shared values, beliefs, assumptions, expectations, perceptions, and behavior. A Culture is a set of unique values and beliefs that guide the behavior of people belonging to that culture (Hofstede, 2010). That indicates the national culture play main role and influences user behavior.

Hofstede identified the dimensions of national culture. These dimensions defined as follows (Hofstede, 2010): Power Distance (PD) defined as "*the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally* "(P.61). The Avoidance of Uncertainty (uncertainty avoidance) (UA) defined as" *The extent to which the members of a culture feel threatened by the uncertain or unknown situation*" (p. 191).

Individualism and Collectivism defined as follows: "*Individualism pertains to societies in which the ties between individuals are loose: everyone is expected to look after him- or herself and his or her immediate family. Collectivism as its opposite pertains to societies in which people from birth onward are integrated into strong, cohesive in-groups, which throughout people's lifetime continue to protect them in exchange for unquestioning loyalty* (P.92). Masculinity-Femininity as a Dimension of Societal Culture definition as " *A society is called masculine when emotional gender roles are clearly distinct: men are supposed to be assertive, tough, and focused on material success, whereas women are supposed to be more modest, tender, and concerned with the quality of life. A society called feminine when emotional gender roles overlap: both men and women supposed to be modest, tender, and concerned with the quality of life* "(p.140).

Tarhini et al. (2017) study the effects of culture on the adoption and acceptance of e-learning. They used the cultural variables as moderators with TAM and additional other constructs. They found the PU and PEOU impact on behavioral intention (BI) towards e-learning and significant moderating effects for the cultural dimensions. Kim et al (2016) studied the influence of national culture on the consumer acceptance of e-commerce in Russia. They used national culture dimensions as moderators with TAM. The findings showed the national cultural impact on the perceived usefulness, perceived ease of use, trust, and intention to use. Al-Hujra et al. (2011) study the Role of National Culture on Citizen Adoption of e-Government Services. They used the national culture as external variables with TAM model and found just the power distance, uncertainty avoidance had significant impacts on citizens' intention to adopt e-Government, and others culture dimensions not significantly.

Others scholars studied the National Culture dimensions as moderators with TAM the findings shown the National Culture significant effect on perceived usefulness, perceived ease of use, attitude toward use, and actual usage (Ayeh et al.,2016 ; Alshare et al.,2011;Srite & Karahanna ,2006) . Sanakulov & Karjaluoto (2017) examined the UTAUT and cultural differences on smartphone acceptance .They found the cultural differences certainly play an important role in intention formation. Especially, the collectivism/individualism as moderated constructs. Udo et al. (2016) used the UTAUT as a framework to explain user intention to use information system and confirmed the Culture plays a strong moderating role in adopting a new system.

Most the studies examined the national culture dimensions as moderator (Kim et al., 2016; Ayeh et al., 2016) .but a little examined as the independent variable (Al-Hujra et al., 2011; Jaafreh &Al-abedallat, 2011).

The national culture is an important issue in technology acceptance. This research employs Hofstadter's model because it performed a reliable and useful tool to predict and explain intention to use and behavior or actual usage. A few studies examine the relationships between national culture and dimensions of TAM model (Kim et al., 2016 ; Tarhini et al., 2017; Alshare et al., 2011 Srite & Karahanna ,2006) . However, these studies tested the national culture as a moderated variables, research finds a few studies tested the national culture as external variables, but just two dimensions, which are power distance and uncertainty avoidance (Al-Hujra , et al., 2011) .

Research Model and Hypotheses

Previous studies have shown that perceived usefulness and perceived ease of use have a mainly determine the behavioral intention to use a new system. However, only some studies investigating the role of national cultures to determine the Users' behavior and if influence on perceived usefulness and perceived ease of use. Acceptance of IoT services may influence by national cultures not only perceived usefulness and perceived ease of use. However, to the best of our knowledge, these works lack a detailed study of the adoption IoT and national cultures as determined behavioral intention and actual use. To bridge this gap, in this research, the researcher develops a framework the adoption of IoT based on the TAM model and adding national cultures as an independent variable to extend TAM.

The objective of this study is to testing factors influencing User Acceptance the Internet of Things Technology (IoT) in SME. Based on the above literature review, the researcher developed a proposed framework for extended TAM model by the national culture dimension. The researcher added the national culture as a dimension because of the major statement of Hofstadter's framework that there are shared values, Beliefs, and norms that are culture-specific and these factors can predict and explain a Human behavior and practices. The research model used to guide the study shown in Figure 2.

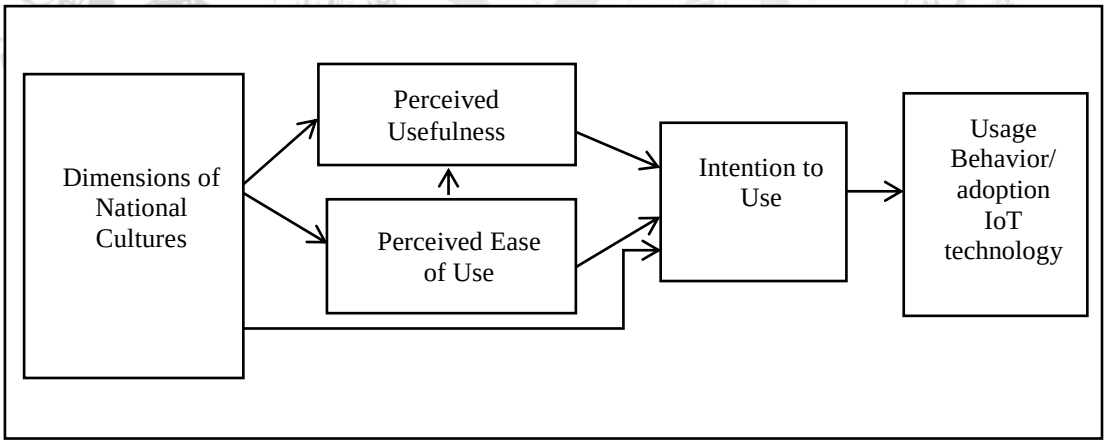

Figure.2: A Proposed Model developed by Researcher

Researchers have developed the following suggested hypothesizes to test the proposed model, which are:

H1: There is a positive relationship between national cultures and perceived usefulness.
H 1-1: There is a positive relationship between Individualism/Collectivism and perceived usefulness.
H 1-2: There is a positive relationship between uncertainty avoidance and perceived usefulness.
H 1-3: There is a positive relationship between power distance and perceived usefulness.
H 1-4: There is a positive relationship between Masculinity/femininity perceived usefulness.
H2: There is a positive relationship between national cultures and perceived ease of use

H 2-1: There is a positive relationship between Individualism/Collectivism and perceived ease of use.
H 2-2: There is a positive relationship between uncertainty avoidance and perceived ease of use .
H 2-3: There is a positive relationship between power distance and perceived ease of use .
H 2-4: There is a positive relationship between Masculinity/femininity and perceived ease of use .
H3: There is a positive relationship between national cultures and Behavioral intention to use.
H 3-1: There is a positive relationship between Individualism/Collectivism and Behavioral intention to use.
H 3-2: There is a positive relationship between uncertainty avoidance and Behavioral intention to use.
H 3-3: There is a positive relationship between power distance and Behavioral intention to use.
H 3-4: There is a positive relationship between Masculinity/femininity and Behavioral intention to use.
H4: There is a positive relationship between perceived usefulness and behavioral intention to use.
H5: There is a positive relationship between perceived ease of use and behavioral intention to use.
H6: There is a positive relationship between perceived ease of use and perceived usefulness.
H7: There is a positive relationship between behavioral intention to use and usage behavior.

Research Methodology

This study investigated user's behavioral intentions to using IoT technologies. Technology acceptance model and the national cultures used as a research framework. To evaluate the research aims, an empirical questionnaire survey method used to collect the data administered by personal delivery and e-mail. This study used quantitative statistics and analysis of the questionnaire data conducted. The survey instrument contains two sections. The first Section consists of personal and demographic information. Second Section of the survey questionnaire developed based on the relevant studies, which had verified in the past. Item scales using slight modifications to adapt them to the SME context in KAS. The variables for the current study are; perceived usefulness (6 items); perceived ease of use (6 items); behavior Intention (3 items); and usage behavior (2 items).the items for the constructs of TAM were adapted from past studies Davis (1989),Venkatesh & Davis (2000) , Venkatesh et al. (2003). The national culture (17 items) adapted from Hofstede (1980) and Kim et al. (2016), and Tarhini et al.2016).This section obtains the willingness to use IoT technologies in the future

The questionnaires measured using the 5-point Likert scale and the respondents asked to select their opinions on the items (1 for strongly disagree, 5 for strongly agree).In this study, the sample target was business leaders and staff who work in SME. 130 questioners distributed among respondents. The questionnaires give along with the introduction to make sure that respondent's responses are confidential and will use for research purpose only. The 93 questionnaires returned, 21 questionnaires were eliminated from the responses cannot be processed because they do not have a complete data needed, 72 questionnaires can be analyzed further with the response rate of 55%. The filled questioners coded and entered into the SPSS (Statistical Package for Social Sciences) to compute and analyze the data. The statistical tests used in the analysis of data included reliability, correlation, and regression analysis.

Validity and Reliability Testing

The content of the questionnaires analyzed by scholars specialized in relevant research subjects and who have questionnaire design experience. The content validity of the questionnaires checked according to the topic meaning, topic order, and legibility of the questionnaires, and revised according to suggestions. Validity test carries out to discover if the instruments suitably measure the variable. The validity test carries out using Pearson correlation with significance rate of 5%. Reliability test executed to ensure the consistency of the responses (Hair et al., 2010) and it assesses the internal consistency. The reliability of questionnaire tested using Cronbach's Alpha coefficient with at least of 0.6 mostly. Many scholars affirm that an alpha value of 0.60 or higher indicates sufficient internal reliability.

Data Analysis

A descriptive analysis performed to examine the background of the sample, as shown in Table 1.

Table 1 descriptive analysis of background of the sample

		Frequency	percent
Gender	Male	59	82
	Female	13	18
Age	Less than 21	10	14
	21 – 30	18	25
	31 – 40	19	26
	41 -50	15	21
	More than 50	10	14
Experience	Less than 5	18	25
	5 – 10	27	37.5
	More than 10	27	37.5
Education	Diploma and less	18	25
	Bachelors	40	56
	Master	8	11
	PhD	6	8

Shown the majority of respondents are male, experience more than five years, and have bachelor's degree. The result of validity test on study variables (Table 2) shows that all the instruments are valid with p-value < 5%.also below Table provides a summary of the Spearman correlation analysis that shows support a significant relationship between variables of the model.

Table 2 Pearson Correlation

Correlations									
		AD	MA	IN	PD	UA	PEoU	PU	BI
AD	Pearson Correlation	1							
	Sig. (1-tailed)								
MA	Pearson Correlation	.313*	1						
	Sig. (1-tailed)	.004							
IN	Pearson Correlation	.230*	.466*	1					
	Sig. (1-tailed)	.026	.000						
PD	Pearson Correlation	.291*	.320*	.686*	1				
	Sig. (1-tailed)	.033	.003	.000					
UA	Pearson Correlation	.387*	.243*	.671*	.506*	1			
	Sig. (1-tailed)	.028	.020	.000	.000				
PEoU	Pearson Correlation	.726*	.336*	.223*	.252*	.333*	1		
	Sig. (1-tailed)	.000	.002	.030	.032	.041			
PU	Pearson Correlation	.642*	.390*	.281*	.230*	.301*	.626*	1	
	Sig. (1-tailed)	.000	.041	.037	.038	.005	.000		
BI	Pearson Correlation	.750*	.326*	.215*	.375*	.209*	.678*	.663*	1
	Sig. (1-tailed)	.000	.003	.025	.040	.039	.000	.000	
	N	72	72	72	72	72	72	72	72
*. Correlation is significant at the 0.05 level (1-tailed).									
**. Correlation is significant at the 0.01 level (1-tailed).									

The reliability test result (Table 3) shows that all the instruments used are reliable with all Cronbach's alpha values are above 0.7, the results show that the questionnaire is reliable and valid scales for measurement of variables and suitable to use in the next analysis.

Table 3 the reliability test

	No. of items	Mean	Std. Deviation	Cronbach's Alpha
BI	3	2.5833	1.10872	.775
PU	6	3.4653	.32373	.752
PEoU	6	3.4676	.98527	.781
UA	5	3.2306	.57718	.727
PD	5	3.2833	.50990	.701
IN	4	3.0694	.61983	.710
MA	3	3.1481	1.04498	.705
AD	2	3.1042	.64425	.789

Table 3 shows the mean for all variables, which ranged between 2.5833 and 3.4676. That indicates the respondents average agreed with all questions in general.

Hypothesis Testing

In this section, the researcher measures the relationship between independent variables and dependent and put research hypothesis to test using Regression techniques with the help of SPSS software. Regression used for predicting the relationship between variables. Linear regression used to determine the strength of the relationship between dependent and another independent variable. When the effect of more than one independent variable is determined by the dependent variable the regression then becomes multiple regression.

Table 4 : Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F	Sig.
1	.751[a]	.712	.703	.21130	215.736	.000[b]

a. Dependent Variable: BI
b. Predictors: (Constant), MA, PU, PD, UA, PEoU, IN

Table 4 shown the squared multiple correlations of the various variables in the model. For the Intention to Use IoT, the value of $R^2 = 0.762$, which means the model (PU; PEoU; PD; IN; MA; UA) can explain 76% variations of the intention to use IoT. The full model statistically significantly predicted intention to Use IoT, $R^2 = 0.762$, F (215.736), $p < .05$, adj. $R^2 = .743$.

All the hypotheses supported as shown in Table 5, a summary of the results discussed in the next section.

As shown in Table (5) the national culture dimensions (Individualism/ Collectivism (IN) , Power Distance (PD), Avoidance of Uncertainty (UA),Masculinity-Femininity (MA)) have a positive and significant effect on perceived usefulness (PU), perceived ease of use (PEoU) , and intention to use(BI) IoT technology , with standardized path coefficient being (β =0.439 & sig.=0.032),(β =0.472 & sig.=.039) ,(β =0.17 & sig.=0.000) respectively. In this manner supported H1,H2,H3 as main and sub-hypothesis. This shows that the national culture contributes more than (17%, 47%, 44%) to behavior intention of IoT adoption, PU, and, PEoU respectively. Perceived usefulness (β=0.408 & sig. =0.013) and perceived ease of use (β= 0.415 & sig. =0.000) had a positive effect the behavioral intention to use IoT technologies, supporting H4 and H5,

respectively. This shows that perceived usefulness and perceived ease of use contributes more than 82% to behavior intention to use IoT technology.

Table 5 acutely presents a summary of the hypothesis testing results from Multiple Regression Analysis.

Hypotheses	Beta β	Sig.	F	R	R2	Result
H1 National cultures ➔PU	.439	.032	2.819	.380.	.193	Supported
H1-1 IN ➔PU	.125	.031				Supported
H1-2 UA ➔PU	.134	.006				Supported
H1-3 PD ➔PU	.064	.029				Supported
H1-4 MA ➔PU	.116	.022				Supported
H 2 National cultures ➔PEoU	.472	.039	2.471	.359	.129	Supported
H2-1 IN ➔ PEoU	.012	.028				Supported
H2-2 UA ➔ PEoU	.137	.036				Supported
H2-3 PD ➔ PEoU	.015	.031				Supported
H2-4 MA ➔ PEoU	.308	.038				Supported
H3 National cultures ➔BI behavior intension to use	.170	.000	215.736	.751	.712	Supported
H 3-1 IN ➔BI	.044	.042				Supported
H 3-2 UA ➔BI	.028	.039				Supported
H 3-3 PD ➔BI	.069	.036				Supported
H 3-4 MA ➔Bi	.029	.043				Supported
H4 PU ➔ BI	.0408	.013				Supported
H 5 PEoU ➔ BI	.415	.000				Supported
H 6 PEoU ➔ PU	.406	.000	45.027	.626	.391	Supported
H 7 BI ➔ AD	.650	.000	182.790	.850	.723	Supported

The results also show the significant and positive effect of perceived ease of use (β=0.406& sig. =0.000) on perceived usefulness, thereby confirming H 6, and shown that perceived ease of use can explain 63% variations of the perceived usefulness. Final, the results show the significant and positive effect of behavior intention to use on adoption of IoT technology (β =0.650 & Sig, = 0.000) with variance 72%. The results of this study are consistent with past studies (Davis et al., 1989, AL-Hujra et al., 2011, Kim et al., 2016).

Discussion

The study aims to investigate the factors that influence users' acceptance of IoT technologies in SMB in KSA. The results confirm the robustness of the proposed model, explaining technology acceptance behavior for users in the context of IoT technologies. Proposing an extended TAM model to which national cultures dimensions (Individualism/ Collectivism , Power Distance (PD), Avoidance of Uncertainty (UA),Masculinity-Femininity (MA)) are added, the study finding that a consumer's perceptions of usefulness, perceived ease of use, and National culture are predictive of user's intention to use IoT technology. Also, found the national culture impact on the perceived usefulness and perceived ease of use. This finding consistency with researcher viewpoint, which the national culture have a very important role and determine the user behavior toward to use a new technology.

In comparing path coefficients of antecedents of the behavioral intention to use IoT technology, perceived usefulness and perceived ease of use performs as the most influential predictor than the dimension of national culture. This supports previous TAM research finding perceived usefulness and perceived ease of use to be the main determinant of user's use of a technology (Davis et al., 1989). while the dimension of national culture as independent variable are secondary determinants but with lower impact on intention to use .However, this is changeable with Findings from previous studies that observed a stronger effect of

national culture as moderator variable on behavioral intention to use IoT technology (AL-Hujra et al.,2011, Kim et al.,2016). This conflict suggests the need for further research.

Conclusion and Future Work

The purpose of this study is to develop a proposed model of the adoption of IoT technology. A review of the literature showed that research in this field is still in their early stages and there is a need for more investigation. Based on the TAM model and the national cultures dimensions, developed a new model for the adoption of IoT technologies. The new model creates a better understanding of the factors influencing the acceptance of IoT systems in SMB. The norms and shared values influenced and modified positive or negative individual behavior because of these factors shaped individual culture to take action or judgment toward act.

This research offers a useful perception of the key powerful factors in users' intention and behavior to use IoT technology. The study contributes to the literature by providing empirical a new model of IoT adoption and filling the gap of incorporating national culture (Individualism/ Collectivism, Power Distance (PD), Avoidance of Uncertainty (UA), Masculinity-Femininity (MA)) into a new model. The researcher Providing national culture dimensions as a new construct that can be used to explaining and predicting adoption of a new technology, and finally evaluate TAM model.

This research can be a background for future research, which can validate the model. This model can also help companies who are implementing IoT technologies or management of companies to successfully to IoT implementation based on cultural factors and other factors in the organization.

The future research, researcher recommended to conduct more empirically studies in this field and to test a new IoT adoption model in different countries and in context.

Reference

Al-Hujra, O., Al-dalahmeh, M. & Aloudat, A. (2011).The Role of National Culture on Citizen Adoption of eGovernment Services: An Empirical Study. *Electronic Journal of e-Government*, 9 (2), 93 – 106. Available online: www.ejeg.com

Al-Momani, A., Mahmoud, M., & Ahmad, M. (2016). Modeling the adoption of internet of things services: A conceptual framework. *International Journal of Applied Research*, 2(5), 361-367. Retrieved from: http://www.allresearchjournal.com/archives/2016/vol2issue5/PartF/2-4-88-448.pdf

Alshare, K., Mesak, H., Grandon, E., &Badri, M. (2011).Examining the Moderating Role of National Culture on an Extended Technology Acceptance. *Journal of Global Information Technology Management*, 14(3), 27-53. Retrieved from http://www.tandfonline.com/doi/abs/10.1080/1097198X.2011.10856542

Ayeh, J. K., Au, N., & Law, R.(2016).Investigating cross-national heterogeneity in the adoption of online hotel reviews. *International Journal of Hospitality Management*, 55, 142-153. https://doi.org/10.1016/j.ijhm.2016.04.003

Bonnet, Buvat, & Subrahmanyam. (2014). *Monetizing the Internet of Things: Extracting Value from the Connectivity Opportunity*. Capgemini Consulting.

Botta, A., Donato, W., Persico, V., & Pescapé, A. (2016). Integration of Cloud computing and Internet of Things: A survey. *Future Generation Computer Systems*, 56, 684–700. Retrieved from http://dx.doi.org/10.1016/j.future.2015.09.021

Bsquare. (2017). *Bsquare's 2017 annual IoT Maturity Survey* , Retrieved from https://www.bsquare.com/

Bui, N. & Zorzi, M. (2011).*Health Care applications: A solution based on the Internet of Things*. In ISABEL, Barcelona, Spain, Oct. 2011.

Carr, Jr., H. (1999). Technology adoption and diffusion. Retrieved November 15, 2017, from: *http://www.au.af.mil/au/awc/awcgate/innovation/adoptiondiffusion.htm*

Coandadiputra,S.& Carissa,C.(2017).The Determinants of Behavioral Intention to Use toward T-Cash Services Provider in Jakarta and Surburban Area. *International Journal of Economics and Management Engineering*, 11 (7).

Coombs, C., Hislop, D. Barnard, S., & Ellison, I. (2016). *The impact of the internet of things on mobile workers.* 4th International Workshop on the Changing Nature of Work (CNoW), Dublin, Ireland, 11 December 2016. Retrieved from https://dspace.lboro.ac.uk/2134/23702

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-339.

Davis, F. D., Bagozzi, R. & Warshaw, P. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982-1003.

Dutton, W. H., Law, G., Groselj, D., Hangler, F., & Vidan, G. (2014). Mobile Communication Today and Tomorrow. *A Quello Policy Research Paper,* Quello Center, Michigan State University. http://dx.doi.org/10.2139/ssrn.2534236

Ebersold, K., & Glass, R. (2015). The impact of disruptive technology: the Internet of Things. *Issues in Information Systems*, 16(IV), 194-201.

Ericsson (2015).A study of the adoption of 'Internet of Things' among Danish companies. Executive summary Ericsson IoT Report (2015). Retrieved Aug. 21, 2017, from .https://www.ericsson.com/assets/local/news/2015/11/every-thing-connected.pdf

Evans, H. (2015).barriers to Successful Implementation of the Internet of Things in Marketing Strategy.*International Journal of Information and Communication Technology Research*, 5 (9). http://www.esjournals.org

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior : An introduction to theory and research*. Reading, Mass.; Don Mills, Ontario: Addison-Wesley

Gao, L. & Bai, X. (2014) .A unified perspective on the factors influencing consumer acceptance of internet of things technology. *Asia Pacific Journal of Marketing and Logistics*, 26 (2), .211-231. https://doi.org/10.1108/APJML-06-2013-0061

Gartner, Inc. (2017). The Internet of Things. Retrieved 20 Oct., 2017 from : https://www.gartner.com/newsroom/id/2636073)

Gubbi, J., Buyya R., Marusic S., & Palaniswami M. (2013). Internet of Things (IoT): A Vision, Architectural Elements, and Future Directions. *Future Gener. Comput. Syst*. 29 (7), 1645-1660. http://www.buyya.com/papers/Internet-of-Things-Vision-Future2013.pdf

Hair, J., Black, W., Babin, B. & Anderson, R. (2010). *Multivariate Data Analysis*. 7th Edition, Pearson, New York.

Hofstede G. (1980). Culture and organizations. *International Studies of Management & Organization*, 10(4), 15-41.

Hofstede, G. (2011). Dimensionalizing Cultures: The Hofstede Model in Context. *Online Readings in Psychology and Culture*, 2(1). https://doi.org/10.9707/2307-0919.1014

Hofstede, G., Hofstede, G., J. & Minkov,M. (2010). *Cultures and Organizations: Software of the Mind*. 3rd Edition, McGraw-Hill USA,

INFSO (2008). NFSO D. 4 Networked Enterprise & RFID INFSO G. 2 Micro & Nanosystems, in Co-operation with the Working Group RFID of the ETP EPoSS. Internet of Things in 2020: A Roadmap for the Future. Retrieved from : http://www.smart-systemsintegration.org/public/documents/publications/Internet-of-Things_in_2020_EC EPoSS_Workshop_Report_2008_v3.pdf.

Jaafreh, A., B (2017). Electronic Business Adoption and the National Culture: Conceptual Framework in the Saudi Arabia. *International Journal of Research in IT and Management (IJRIM)*, 7(1), 48-56. Available online at: http://euroasiapub.org.

Jaafreh, A., B. & Al-abedallat, A., Z. (2011). The Relationship between National Culture and DSS Usage in Jordanian Banking: A Proposed Conceptual Framework. *European Journal of Economics, Finance & Administrative Sciences*, 42, 68

Kahlert, M. (2016). Understanding customer acceptance of Internet of Things services in retailing: an empirical study about the moderating effect of degree of technological autonomy and shopping

motivations. *Master thesis*. Relative 11october 2017 from http://essay.utwente.nl/69944/1/Kahlert_MA_Behavioural%20Management%20and%20Social%20Sciences.pdf

Kang, Y., Lee, M., & Lee, S. (2014). Service-Oriented Factors Affecting the Adoption of Smartphones. *Journal of Technology Management & Innovation*, 9(2), 87-117.

Kim, E., Urunov, R., & Kim, H. (2016). The effects of national culture values on consumer acceptance of e-commerce: Online shoppers in Russia. *Procedia Computer Science* 91, 966 – 970. www.sciencedirect.com

Kim, K. J. (2016). Interacting Socially with the Internet of Things (IoT): Effects of Source Attribution and Specialization in Human–IoT Interaction. *Journal of Computer-Mediated Communication*, 21, 420–435. doi:10.1111/jcc4.12177

Kim, H., Lee, S., & Shin, D. (2017). Visual Information Priming in Internet of Things: Focusing on the interface of smart refrigerator. International Conference on Communication and Media: An International Communication Association Regional Conference (i-COME'16). https://doi.org/10.1051/shsconf/20173300015

Li, X. & Wang, D. (2013). Architecture and existing applications for internet of things. *Applied Mechanics and Materials*, 347(1), 3317-3321.

Ma, H.D. (2011). Internet of Things: Objectives and Scientific Challenges. *Journal of Computer Science and Technology*, 26(6), 919- 924.

Mazhelis, O., Luoma, E., & Warma, H. (2012). Defining an Internet-of-Things Ecosystem. In S. Andreev, S. Balandin, & Y. Koucheryavy(Eds.). Internet of Things, Smart Spaces, and Next Generation Networking– *Lecture Notes in Computer Science*, Volume 7469, 1-14. Berlin: Springer.

McKinsey. (2015). the Internet of Things: Mapping the Value beyond the Hype. *a report by McKinsey Global Institute*, June 2015. Retrieved 10OCT 2017 from: http://www.mckinsey.com/insights/business_technology/The_Internet_of_Things_The_value_of_digitizing_the_physical_world

McKinsey. (2014). *The Internet of Things: Sizing up the opportunity, 2014*. Retrieved 25/10/ 2017 from: http://www.mckinsey.com/insights/high_tech_telecoms _internet /the_internet_ o_things_sizing_up_ the_opportunity.

Mital, M. Choudhary, P., Chang, V., Papa, A., & Pani, A. (2017). Adoption of Internet of Things in India: A test of competing models using a structured equation modeling approach. *Technological Forecasting and Social Change*, Retrieved 9Aug. 2017 from: http://dx.doi.org/10.1016/j.techfore.2017.03.001

Mourtzis, D., Vlachou, E. & Milas, N. (2016). Industrial big data as a result of IoT adoption in manufacturing. *Procedia CIRP*, 55, 290–295.

Müller-Seitz, G., Dautzenberg, K., Creusen, U., & Stromereder, C. (2009). Customer acceptance of RFID technology: Evidence from German electronic retail sector. *Journal of Retailing and Consumer Services*, 16, 31-39.

Roy, A., Zalzala, A. & Kumar, A. (2016). Disruption of Things: A Model to Facilitate Adoption of IoT-based Innovations by the Urban Poor. *Procedia Engineering*, 159. 199-209. https://doi.org/10.1016/j.proeng.2016.08.159

Sanakulov, N., & Karjaluoto, H. (2017). A cultural comparison study of smartphone adoption in Uzbekistan, South Korea and Turkey. *International Journal of Mobile Communications*, 15 (1), 85-103. DOI: 10.1504/IJMC.2017.080579

Singh, G., Gaur, L. and Ramakrishnan, R. (2017). Internet of Things – Technology Adoption Model in India. *Pertanika Journal of Science and Technology (JST)*, 25 (3), 835 - 846. http://www.pertanika.upm.edu.my/

Srite, M., & Karahanna, E. (2006). The role of espoused national cultural values in technology acceptance. *MIS Quarterly*, 30(3), 679–704.

Tarhini, A., Mohammed, A. B., & Maqableh, M. (2016). Modeling Factors Affecting Student's Usage Behaviour of E-Learning Systems in Lebanon. *International Journal of Business and Management*, *11*(2), 299–312.

Tarhini, A., Hone, K., Liu, X., & Tarhini, T. (2017). Examining the moderating effect of individual-level cultural values on users' acceptance of E-learning in developing countries: a structural equation modeling of an extended technology acceptance model.*Interactive Learning Environments*, 2(3), 306-328. DOI: 10.1080/10494820.2015.1122635

The Acquity Group (2014). *The Internet of Things: The Future of Consumer Adoption*. Retrieved 25/11/ 2017 from https://thelbma.com/files/561-acquitygroup-IOT.pdf

Uckelmann, D., Harrison, M., & Michahelles, F. (2011). *An Architectural Approach Towards the Future Internet of Things.* Springer Publishing Company, Incorporated.

Udo, G., Bagchi, K. & Maity, M (2016). Exploring Factors Affecting Digital Piracy Using the Norm Activation and UTAUT Models: The Role of National Culture. *Journal of Business Ethics, 135*(3), 517–541. https://doi.org/10.1007/s10551-014-2484-1

Venkatesh, V., & Davis, F. D. (1996). A model of the antecedents of perceived ease of use: Development and test. *Decision Sciences*, 27(3), 451-481.

Venkatesh, V., & Davis, F., D. (2000). A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Management Science* 46(2):186-204. http://dx.doi.org/10.1287/mnsc.46.2.186.11926

Venkatesh,V.,Morris. ,Gordon B.,&Davis. (2003) .User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425-478.

Vos, M. (2015). Maturity of the Internet of Things research field: Or why choose rigorous keywords. Paper presented at *Australasian Conference on Information Systems (ACIS)*, Adelaide, Australia. Retrieved from https://acis2015.unisa.edu.au/wpcontent/uploads/2015/.../ACIS_2015_paper_147.pdf

Winchcomb,T., Massey,S., & Beastall, P.(2017) .Review of latest developments in the Internet of Things. Cambridge Consultants . Retrieved from https://www.ofcom.org.uk/__data/assets/pdf_file/0007/102004/Review-of-latest-developments-in-the-Internet-of-Things.pdf