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Consumers' Acceptance of Internet of Things Technology

Hande Begüm BUMİN DOYDUK*, Ebru Beyza BAYARÇELİK**

Abstract

Recent technological advancements entail immense changes and lead to a new era. One of the main change agents of this new era is internet of things technologies. The term "internet of things" (IoT) indicates objects having an identity and having ubiquitous connection with each other. Notwithstanding the novelty of the concept, it captured the interest of many scholars and practitioners. The subject area has not been analyzed profoundly from the consumers' point of view. Whenever potential users face a new technology, they experience an acceptation process. In this study, how this new concept is perceived by the consumers is scrutinized. Consumer perspective of IoT is studied through Technology Acceptance Model (TAM). TAM introduced perceived ease of use and perceived usefulness, as significant determinants for a potential user to have behavioral intention to use a new technology. Data were analyzed through Structural Equational Modeling (SEM).

Keywords: Internet of Things, Innovation, Technology Diffusion, Technology Acceptance Model, Consumers

Nesnelerin İnterneti Teknolojisinin Tüketiciler Tarafından Kabulü

Öz

Günümüzde son teknolojik ilerlemeler muazzam değişimleri beraberinde getirmekte ve yeni bir döneme kılavuzluk etmektedir. Bu yeni dönemin temel değişim araçlarından biri Nesnelerin İnterneti teknolojisidir. "Nesnelerin İnterneti" terimi ile nesnelerin kimliklere sahip olması ve birbirleriyle her an her yerde bağlantıda bulunması ifade edilmektedir. Söz konusu kavram çok yeni olmasına rağmen pek çok bilim insanı ve uygulamacının ilgisini çekmektedir. Ancak konunun tüketici perspektifinden incelendiği çok sayıda çalışmaya rastlanmamıştır. Potansiyel kullanıcılar kendilerine yeni bir teknoloji sunulduğunda bir kabul sürecinden geçerler. Bu çalışmada tüketicilerin Nesnelerin İnterneti kavramına bakış açıları Teknoloji Kabul Modeli (TKM) üzerinden irdelenmiştir. TKM, algılanan kullanım kolaylığı ve algılanan kullanışlılık etkenlerini,

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kullanıcıların yeni teknolojileri kullanmada davranışsal niyetlerinin önemli belirleyicileri olarak tanımlamaktadır. Veriler, Yapısal Eşitlik Modellemesi (YEM) ile analiz edilmiştir.

Anahtar kelimeler: Nesnelerin İnterneti, İnovasyon, Teknoloji Yayılımı, Teknoloji Kabul Modeli, Tüketici

Introduction

The main idea of Internet of Things (IoT) concept is the prevalent existence of interacting objects, things like Radio-Frequency IDentification (RFID), tags, sensors, and actuators by unique addressing designs (Giusto, Iera, Morabito, & Atzori, 2010).

The term "internet of things" was first used in a presentation about the benefits of radio-frequency identification made for Procter and Gamble by Kevin Ashton in 1999 (Ashton, 2009). The Internet of Things (IoT) is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment (Gartner, 2014). IoT enables analog world objects to be connected with other objects, communicate and operate ubiquitously without human interaction.

Internet started with ARPANET (Advanced Research Projects Agency Network) which provided communication among limited number of devices. The evolution of internet can be epitomized in four phases. Phase 1 is the transfer of information to the digital environment and digital access to information. Phase 2 is the collaborative use of information on digital environment and start of e-trade. In phase 3, use of social media, mobile media and cloud informatics were widespread. Phase 4 is the digital connection of things to the internet (Gündüz & Daş, 2018; Novak & Hoffman, 2015).

This new era, enabling not only virtual world but also physical world integration has many promises for the business life and also daily routines of the individuals. IoT business applications have been widespread for many sectors. Continuous tracking, real time information sharing and connection among objects make it attractive for individual users as well as the business world. The convenience and the ease of use IoT applications such as smart homes, smart appliances and wearable technology make it enticing for individuals to inaugurate these applications in their lives. This new consumer IoT market, is predicted to reach 104.4 billion USD by 2023, which is a 17.39% increase during 2018–2023 period. Recently the market is 46.3 billion USD as of 2018 (Consumer IoT market, 2019). As the forecasts shed light consumer IoT applications will be a huge market also IoT applications are and will continue to be used in marketing practices. IoT applications have been used in retail practices excessively such as Amazon Go, Dash. Smart shelves, automated checkouts, personalized discounts, beacons are the most popular IoT marketing applications that the consumers are exposed to. Consequently IoT has become an irrefutable phenomenon for marketing already.

It is very important to examine this new technology which has already a big market of applications and a huge future potential from the consumers' perspective. Consumers' acceptance of this new technology will impact both the growth of the consumer IoT devices market and how consumers will react to marketing practices which employ IoT applications.

Along with the advancements IoT provides, there are some issues that potential users still have not figured out which causes apprehension of adapting this new technology. The widespread usage of every new technology necessitates acceptance of the technology and adaption.

In this study, consumers' acceptance of IoT technology is studied through the Technology Acceptance Model (TAM). TAM has its roots from the Theory of Reasoned Action (TRA) which is one of the most influencial theories explaining the human behavior. The two main dimensions of TAM, perceived usefulness and perceived ease of use is utilized along with social influence to predict the behavior intention, the intention to use IoT applications in our case. Structural Equation Model (SEM) is used in order to analyze the effects of all dimensions simultaneously.

1. Literature Review

Internet of Things concept comprises sensing, routing and communicating devices, and cloud based applications. These devices are self-configured and can be remotely controlled (Li et al, 2011; Mital, Chang, Choudhary, Papa, & Pani, 2018; Solima, Della Perufa, & Del Guidice, 2016).

The architecture for IoT can be analyzed under 4 major layers; sensing, networking, service and interface layer (Table1).

Layers	Description
Sensing Layer	Integration with current hardware in order to realize and control the physical world and achieve data.
Networking Layer	Data transfer and support of network
Service Layer	Supply of services
Interface Layer	Supply of cooperation methods to users.

Table 1: Architecture for IoT (Da Xu, He, & Li, 2014)

A. Sensing Layer

Information among devices are realized and automatically transferred through wireless systems of sensors. An important technology for IoT is the RFID technology. With RFID technology, identification information can be transferred from a microchip to a reader through wireless communication. Since 1980's this technology has been used in certain sectors such as logistics, manufacturing, retailing etc (Sun, 2012) (Ngai, Moon, Riggins, & Yi, 2008).

B. Networking Layer

Networking layer functions as a connection among things which enables information share. Wireless sensor networks (WSNs), mesh networks, and WLAN are heterogeneous networks used for IoT information exchange.

C. Service Layer

The main role of the service layer is to define the service specifications for middleware. Middleware technology continuously integrate services and applications. It also supports IoT with cost efficiency through reuse of hardware and software. Service layer handles services related matters like data management, information sharing and communication. In service layer all service-oriented issues, like information exchange and storage, data management, and search engines are processed (Miorandi, Sicari, DePellegrini, & Chlamtac, 2012; Guinard, Trifa, Karnouskos, Spiess, & Savio, 2010). Service layer determines application requirements.

D. Interface Layer

It is complicated to continuously connect, communicate, disconnect, and operate various things. The interface layer facilitates the connection and control of things. An interface profile can be summarized as the standards of service which help the application interactions.

Apart from the above mentioned technologies, many other technologies like barcodes, smart phones, social networks, and cloud technology are utilized to support IoT (Li Q. et al, 2013). See Figure 1.

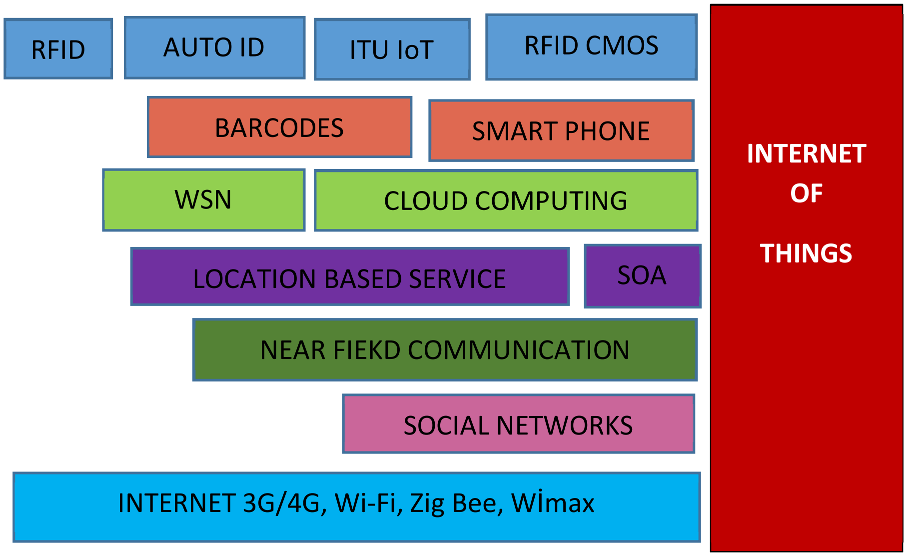

Figure 1: IoT supporting Technologies Source

The improvements in technology like wireless communication, smartphones, and sensor networks enabled more and more objects to be connected. IoT based technologies affect information and communications technology (ICT) (Figure 2).

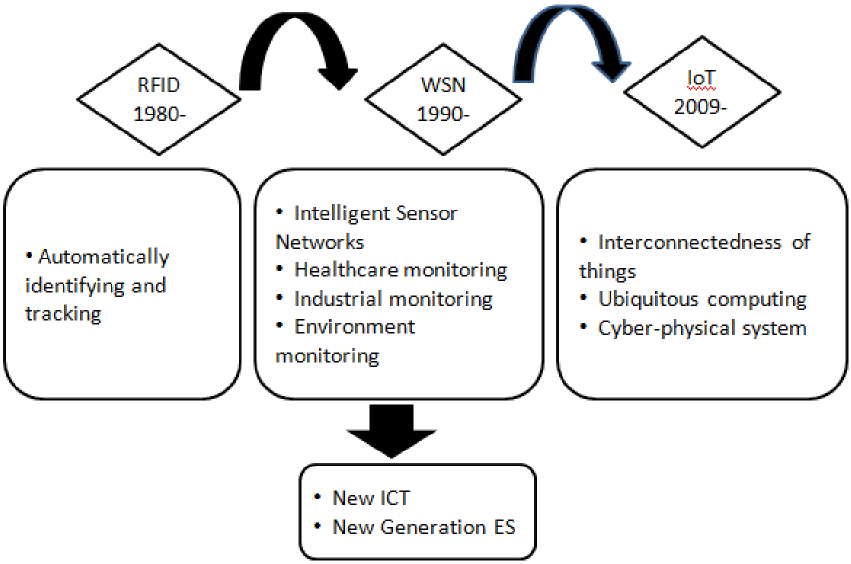

Figure 2: IoT Technologies and Effect on ICT.

IoT is and continue to be a disruptive technology that will have immense effect on both business and domestic fields (Atzori, Iera, & Morabito, 2010). As of 2018 there are 7 billion IoT devices, this number is expected to reach 10 billion by 2020 and 22 billion by 2025 (Lueth , 2018). The new technology provides not only efficiency in business and domestic life but also in new market opportunities. The global IoT market value was 151B USD in 2018. The accelerated growth of IoT stems from both the business and consumer segment. It is estimated that IoT market would reach 3,010 B USD by 2020 and nearly half of it 1.534 B USD is expected to come from the consumer segment (Gartner, 2016). The potential consumer IoT market size necessitates deeper consumer understanding.

1.1. Internet of Thing and Applications

Internet of things can be used in many areas such as; smart home, smart hotels, smart cities, scientific study applications, informatics sector applications, energy optimization applications, natural disaster prediction applications, water scarcity monitoring, agricultural production applications, manufacturing applications, service provider applications, retail applications, construction applications, transportation applications and trade applications, public sector applications, health care applications, daily usage applications and security applications. Among many industries, manufacturing and transportation are the industries that have mostly utilized IoT applications (IDC, 2017).

Anything in the supply chain, from raw material purchase to final product transportation, can be monitored real-time through IoT technologies. This provides transparency, flexibility, higher responsiveness, and cost and safety stock reduction for all actors in a supply chain. IoT based supply chain could realize 2.7 trillion USD savings through waste reduction and process efficiency (Paper, 2014) The use of RFID is already widespread for logistics industry, however new technologies also provide additional opportunities. Augmented maps, assisted driving, self –driving trucks, environmental monitoring etc enable more efficient operations.

Another industry where IoT applications are intensely used is retail industry. It is estimated that retail IoT business will grow from 14 billion USD in 2015 to 36 billion USD in 2020. Through applications such as connected vending machines, RFID tags, interactive displays, virtual closets, smart mirrors proving product related information, self-check out systems, and smart shelves the retail business will experience great change in the near future. Already Wallmart and Amazon have adopted some IoT based applications such as Amazon Dash, Amazon Go, Wallpart Pick Up Towers etc. (Marr, 2017). Although IoT applications in retail industry propose higher potential marketing value, the popularity of Personal IoT applications is higher (Maier, 2016).

Consumer IoT devices can be grouped as personal IoT and Home IoT devices. The market of personal IoT devices such as smartphones, wearables, voice assistance and smart fashion reached a value of 5.2 billion USD in 2017. Recently 600 million people use voice assistance at least once a week. The most popular Home IoT devices are hubs and controls, home appliances, smart plugs, meters, climate solutions and entertainment devices. Home IoT devices market was a 35.7 billion USD market as of 2017 which is expected to be 150.6 billion in 2020 (Sonar, 2019). Convenience, reduction of workload, and improvements in quality of life are the promises of IoT applications to consumers (Dong, Chang, Wang, & Yan, 2017). IoT applications provide efficient and effortless monitoring and control of daily domestic operations. Consumers' routine behavior will be affected with this new technology (Li & Wang, 2013). Convenience, innovativeness and usefulness are the three attributes that is expected from consumer IoT devices.

Acquity Group's 2014 survey on 2000 US consumer suggested that 30% of consumers already have or plan to buy an in-home IoT device in the next two years. Similarly the 2014 data proposed that wearable technology ownership would reach 28% (Accenture, 2014) Accenture reported that in 2016 11% of consumers wanted to buy connected home surveillance cameras. According to the 2014 report, health and fitness wearable technologies are the most valuably perceived IoT applications. The biggest obstacles to adopt IoT are the low awareness level, lack of perceived value and privacy and price concerns (Accenture, 2014).

Consumer Internet of Things (CIoT) market were the fourth largest segment among IoT markets in 2016, CIoT is only expected to be the third largest by 2020 globally. In Western-Europe Consumer IoT market is forecasted to overtake both transportation and utilities market and reach to the second spot in 2020 (IDC, 2018).

A market with such a magnitude and future potential necessitates great attention. However when IoT literature is analyzed, it is seen that mostly the technical aspects, business world applications of IoT, have been focused on. Behavioral studies focusing on the consumer perceptions, motivations, adoption process of IoT have gained much less attention (Al-Momani, Mahmoud, & Ahmad, 2016; Gao & Bai, 2014; Hsu & Lin, 2016).

Consumers with such advantages of the new technology, still have cold feet against the IoT applications. The low awareness level and the high technology behind the applications cause fear of not being able to cope up, use the applications properly. Robots taking over the control of the world have been one of the greatest fears of humans as can be seen in many science fiction movies. Understanding the work mechanisms, how to use the devices would reduce the tension of ignorance. The perception of usefulness and ease of use thus are important determinants of technology acceptance.

Besides the numerous benefits provided by the IoT applications in consumer segments, there are some challenges of this new technology. According to a number of studies, the security and privacy issues are perceived as the major challenges for consumer acceptance of the IoT applications (Coughlan et al, 2012; Kowatsch & Maass, 2012; Medaglia & Serbanati, 2010.

Consumers' adoption of IoT devices are affected by the privacy concerns (Khan W. Z., Aalsalem, Khan, & Arshad, 2016; Khan, Alsalem, Khan, & Arshad, 2017;LLC, 2015). Personal data privacy and security concerns stem from a few phenomenon. The first is the shorter lifespan of cryptographic security algorithms compared to the electronic devices. Old fashioned IoT devices would be susceptible to privacy and security attacks. As the IoT devices are connected to the systems the attacks can cause harm integrally (Kuskov, Kuzin, Shmelev, Makrushin, & Grachev, 2017; Khan, Aalsalem, & Khan, 2018). The second potential privacy risk comes up due to consumption acts such as; rent, gift, resale, borrow and retire. The data about primary user's identity, personal information and connection to other devices will be passed to subsequent users through the renting, selling, lending or giving a gift. Disposition of data or re-configuration of device should be carefully and completely done.

2. Conceptual Background and Research Hypothesis

2.1. Technology Acceptance Model (TAM)

In the last 20 years, information and communication technologies have become used more and more intensely in all areas of our lives. In particular, digital and informational advancements in Information and Communication Technology have started to make people altered to use new technologies. Adaption to use these information technologies can vary with consumers and conditions. Among the many models suggested to explain technology acceptance and usage, Technology Acceptance Model (TAM) is the most accepted model in the field of IS over the past decade (Chau & Hu, 2001; Svendsen & et. al, 2013; Venkatesh & Ramesh, 2006). Technology Acceptance Model is developed by Davis (1989) to investigate the acceptance and behavior of use of new technology. It is adapted from Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975). According to Theory of Reasoned Action, the best way to forecast the behavior is the individual's intention to complete the behavior. Technology Acceptance Model consists of two main dimensions as; "perceived ease of use" and "perceived usefulness". These dimensions are substantial factors of behavioral intention and technology use. Perceived ease of use is defined as "the degree to which one believes that using the technology will be free of effort" (Davis, 1989). On the other hand perceived usefulness is defined as "the degree to which one believes that using the technology will enhance his/her performance" (Davis, 1989). In Technology Acceptance Model, external factors such as subjective norms, quality, response time, system accessibility are also included to understand the effects on believes, attitudes and intention of individuals (Davis, Bagozzi, & Warshaw, 1989). Besides, perceived ease of use and perceived usefulness contribute like antecedent for attitudes toward using technology, than move to identify the intention to use, and lastly create the actual usage behavior (Al-Momani, Mahmoud, & Ahmad, 2016). Original Technology Acceptance Model is given in Figure 3.

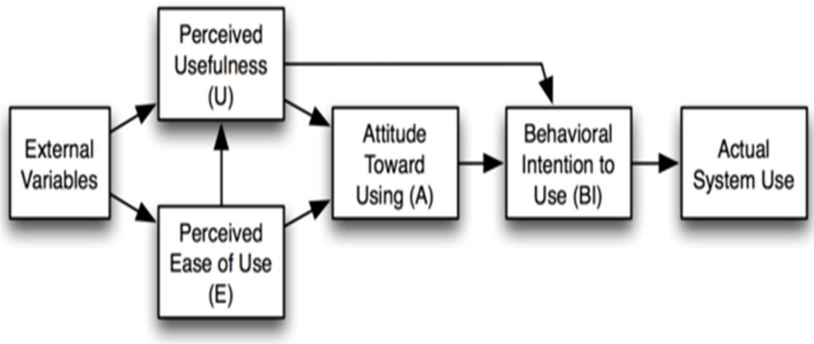

Figure 3: Technology Acceptance Model (Davis, F.D., Bagozzi, R.P. and Warshaw, P.R. ; 1989)

Technology Acceptance Model has been used in many different studies to identify acceptance of new technology such as; adoption of internet banking (Patel & Patel, 2018), Smart Grid technology (Toft , Schuitema, & Thøgersen, 2014), smart watches (Kim & Shin, 2015), wearable fitness technologies (WFT) (Lunney, Cunningham, & Eastin, 2016), mobile technology (Ooi & Tan, 2016), mobile banking adoption (Boonsiritomachai & Pitchay, 2017), the adoption of virtual reality devices (Lee, Choi, & Kim, 2018), acceptance of urban technologies (Sepasgozar, Hawken, Sargolzaei, & Foroozanfa, 2018), teachers' technology adoption (Scherera , Siddiqb, & Tondeur, 2019). Therefore, although Technology Acceptance Model was developed to predict IT system usage, TAM variables were applied to predict consumer acceptance in various technologies (Gao & Bai, 2014). Consumer acceptance is "the relatively enduring cognitive and affective perceptual orientation of an individual" (Gao & Bai, 2014, p.215) and intention to use dimension is the way of conceptualzation consumer acceptance in measurment models (Venkatesh, Morris, Davis , & Davis , 2003).

In this study, Technology Acceptance Model is chosen as the theoretical framework to explain IoT usage acceptance. TAM is validated to be a key framework for analyzing innovative and recent information-related technologies (Park, Cho, Han, & Kwon, 2017). According to theory, perceived ease of use and perceived usefulness determine the behavioral intention of using a new technology. A study which is conducted in India, compared Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB) and Technology Acceptance Model (Model) in the context of IoT usage intention. The results of this study showed that TAM and TRA models help to predict intention to use internet of things (Mital et al., 2018).

In the original Technology Acceptance Model, attitude towards the technology was included in the model. Nevertheless, Attitude toward information technology systems did not fully mediate the relationship of perceived usefulness and perceived ease of use with intention to use so Davis (1989) excluded it from the model. Consequently previous studies excluded attitude variable from Technology Acceptance Model (Agarwal & Karahanna, 2000; Gefen, Karahanna, & Straub, 2003; Dong, Chang, Wang, & Yan, 2017). In our study attitude also excluded from the model.

Our research model is developed by considering the similarities between the dimensions found in the previous studies. There are three independent variables ease of use, perceived usefulness and social influence which are derived from literature and supported by Technology Accepted Model. The three independent variables are expected to affect the intention to use of the IoT applications.

2.2. Ease of Use

The term ease of use means that it does not require great effort or is not difficult to use (Davis, 1989). The user considers the system as easy to use if the system is very useful for the job; it does not need a lot of training to learn and the system can be used without any effort. The perception that the application is easy, directs users to use and accept the system. This also means that the system will meet user expectations as user-friendly. Within this study perceived ease of use for IoT consumer refer as they feel that IoT usage is easy and user-friendly (Davis, 1989). Previous TAM studies in different fields have found that perceived ease of use has significant effect on behavioral intentions to use technology such as, e-learning (Šumak et al., 2011), mobile devices (Zhang, Zhu, & Liu, 2012) wearable technology (Lunney et al, 2016).

Blog usage which is also a relatively new IT application used by individuals was studied through the use of TAM model. Perceived ease of use was found to significant affect the attitude towards blog usage (Hsu & Lin, 2008).

Gao and Bai (2014) that investigated the effects of ease of use on intention to use IoT applications. Besides, Technology Acceptance Model argues that perceived ease of use also positively affects perceived usefulness (Hsu & Lu, 2004; Venkatesh et al., 2012; Gao & Bai, 2014; Al-Momani, Mahmoud, & Ahmad, 2016).

The hypotheses to be tested in the light of these theoretical explanations can be expressed as follows:

H1: Perceived ease of use is positively related to behavioral intention to use IOT technologies.

2.3. Social Influence:

In Technology Acceptance Model, social environment and interaction is crucial dimension that should not be ignored in decision-making process. Social Influence is important especially for consumers, who do not have much information about the usage details for newly released products and services, and who can reach reliable information via social interaction (Gao & Bai, 2014). Social influence is "users' perception of whether important people for them perceive that they should engage in the behavior" (Venkatesh et al., 2012). Davis (1989) pointed that in some cases, the users place more emphasis on the feelings of their relatives, friends rather than their own feelings, thoughts and beliefs.

Alolayan's study which explores the attitudes towards adoption of smart refrigerators in U.K, supported the relation between social influence and adaption of smart refrigerator. He found that social influence was the most important factor for the adaptation of the smart refrigerator (Alolayan, 2014). Besides, Gao and Bai (2014) argued that social influence effected the adoption of IoT technology. The study results showed that there was a significant relation between social influence on the adoption of IoT technology. Thus, the following is hypothesized:

H2: Social influence is positively related to behavioral intention to use IOT technologies

2.4. Perceived Usefulness

Davis (1989) defined perceived usefulness as the degree to which a person using a particular technology would improve the job or task performance. According to Venkatesh and colleagues, there was not any difference between the perceived usefulness in Technology Acceptance Model and the performance expectancy of The Unified Theory of Acceptance and Usage of Technology Models (Venkatesh et al., 2003& 2012). Consumers are more likely to accept new technology when companies explain the benefits and advantages of new technologies with logical arguments, which increase the perception of usefulness (Gong, Xu, & Yu, 2004). Extensive previous studies pointed that there is a positive relationship between perceived usefulness and behavioral intention to use the new technologies (Davis,1989; Zaremohzzabieh, 2015; Sepasgozar et l., 2018; Scherera et al., 2019).

In a study analyzing the online consumer behavior, the perceived usefulness was found to be a more important predictor of intended system compared to perceived ease of use (Koufaris, 2002).

From the Iot perspective, according to research conducted in the UK and the US, consumers intent to use Iot services when they perceived these new technologies as usefull (Group, 2014; Coughlan et al., 2012). Thus, the following is hypothesized:

H3: Perceived usefulness mediates the relationship between ease of use and intention to use IOT technologies.

H4: Perceived usefulness mediates the relationship between social influence and intention to use IOT technologies.

Our Research Model given in Figure 5.

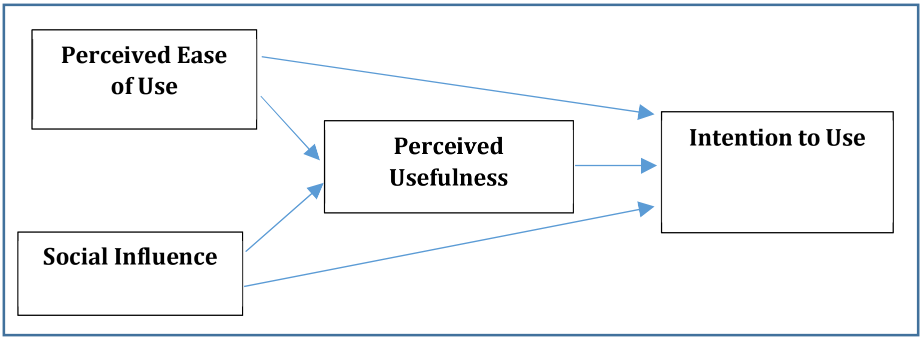

Figure 5: Research Model

3. Methodology

3.1. Participants and Data Collection

A field study was conducted employing survey method for data collection to test study hypotheses. Internet of Things technology in consumer segment is at its incipient stage. The awareness of the concept is not very high and there are limited number of popular and widespread consumer applications. Due to these deficiencies, reaching the right audience who have at least a general idea of the concept is hard. Convenient sampling was utilized and technology based firm employees were targeted, as they have a general idea of the IoT.145 people were approached by sending e-mail, which contains the explanation about the study, instructions, demographic questions and the three pages survey. They were ensured about confidentiality and informed that study results will be shared upon request. Out of 145 people 116 has responded (turn rate %80 which is acceptable). While 76% are males and all have equal or more than bachelor's degree. On average, the participants were 32.84 years old (s.d.=6.60).

3.2. Measures

Davis' (1989) TAM scales were adapted to capture perceived usefulness and perceived ease of use. Davis' model argue that perceived usefulness and ease of use are significant determinants of behavioral intention to use information technology. The instruments used to measure perceived ease of use, perceived usefulness, social influence and behavioral intention have all been validated in previous researches (Jan & Contreras, 2011; Yong Wee et al., 2011; Toft et al.,2014). TAM scale was first translated to Turkish by researchers then linguistic researcher re-translates scale items back into English to control consistency.

Perceived usefulness was measured with four items which include "using the IOT would enable me to accomplish more quickly" , "using IOT would make it easier for me", "using IOT would significantly increase the quality or output of my life" and "Overall, I would find using IOT to be advantageous".

Ease of Use was measured with three items, which include **"**learning to use IOT is easy for me", "I find my interaction with the IOT device clear and understandable" and "I think using IOT is easy".

Social Influence was measured with three item from the scale developed by Mathieson (1991), and used in (Gao & Bai, 2014). Scale items include "people who are important to me would recommend using IOT " and "people who are important to me would find using IOT beneficial" and "people who are important to me would find using IOT a good idea".

Behavioral Intention was measured by five items, which were adapted from Venkatesh (2000). Scale items include "given the chance, I intend to use IOT", "I am willing to use IOT in the near future", "I will frequently use IOT", "I will recommend IOT to others" and "I will continue using IOT in the future".

All the items in the instrument were measured on five-point Likert scales, ranging from strongly disagree (1) to strongly agree (5).

3.3. Analyses

The structural equation modelling was used to test the study of hypotheses simultaneously (Bowen & Guo, 2011), fit indexes were used as suggested by Hu and Bentler (1999) for both measurement and structural model evaluations. We tested both construct validity and reliabilities of the variables to see whether variables are eligible to use in hypotheses testing. For construct validity, we sought support for convergent and discriminant validity (Fornell& Larcker, 1981). Using the confirmatory factor analysis (CFA) we assessed, whether the items significantly load on the expected latent factors or not (convergent validity). Then, we compared competing nested models and cross-validated it by following the procedure suggested by Hair et al. (2012) for discriminant validity. Hair et al. (2012) suggests that a variable can be distinguished obtained when square root of average variance extracted (AVE) value exceeds that variable's correlations with other study variables. We compared nested models to test whether perceived usefulness and ease of use are constituting a single factor or not. Therefore, we compared three factor solutions (i) one factor, where all items load into one latent factor; (ii) three-factor, where only perceived usefulness and ease of use are combined; (iii) four-factor, where all variables are separate factors. Finally, we tested the hypotheses simultaneously in a structural model, employing all variables as latent constructs, and used bootstrapping method for testing mediating effects (Preacher & Hayes, 2008).

4. Results

4.1. Validity, Reliability and Model Comparisons

Assumption testing showed that scores of all variables are normally distributed. Table 2 shows the means, standard deviations, composite reliabilities, average variance extracted and correlations between variables.

Table 2.The means, standard deviations, reliabilities and bivariate correlations between variables

Variables	Mean	SD	CR	AVE	1	2	3	4
1.Perceived Usefulness	4.17	.765	.91	.71	**.88**			
2. Ease of use	3.64	.717	.87	.54	.706	**.83**		
3.Social Influence	3.68	.748	.93	.58	.741	.619	**.90**	
4.Intention to Use	3.94	.805	.94	.71	.841	.736	.762	**.87**

N=116. All correlations are significant at .01 level.
Diagonal values in bold are square root of AVE of the relevant variable.

To verify the convergent and discriminant validity of constructs, we run a CFA using all study variables. A four-factor model fit the data well (χ^2=110.160, df=70, CFI=.97, RMSEA=.07, SRMR=.04). Model comparisons showed that four factor model was significantly different and better than a three-factor model in which perceived usefulness and ease of use were combined ($\Delta\chi^2$=-76.07, df=3, p<.01), and was significantly better than a single-factor model in which all variables combined into one factor ($\Delta\chi^2$=-262.699.7, df=6, p<.01). So, we decided to continue with the four-factor model.

Moreover, we computed the AVE scores for each of four constructs and compare the square root of AVE's with correlation coefficients, following the Fornell and Larcker's (1981) procedure. As all of the AVE values related to variables exceed that variable's correlation with others, we found no discriminant validity issue. The composite reliabilities of these four factors were also very good. Table 1 shows the reliabilities, AVE's, square root of AVE's, correlations as well as means and standard deviations of each construct. Therefore, we concluded that we have evidence for a four-factor model indicating the distinctiveness of the constructs and stability of factor structure. The results of the CFA are displayed in Table 3 and fit indices related to the competing models were given in Table 4.

Table 3 Results of the Confirmatory Factor Analysis and Factor Reliabilities

Factors	Indicators	λ	t	α
	Pu1	0.916	15.272	
Perceived Usefulness	Pu2	0.811	11.844	0.91
	Pu3	0.908		
	eu1	0.824		
Ease of Use	eu2	0.885	10.637	0.86
	eu3	0.776	9.176	
	Si1	0.91		
Social Influence	Si2	0.935	16.373	0.93
	Si3	0.863	13.677	
	Iu1	0.888		
	Iu2	0.828	12.071	
Intention to Use	Iu3	0.88	13.942	0.94
	Iu4	0.897	14.362	
	Iu5	0.871	13.618	

λ= Standardized factor loading. α= Cronbach’s Alpha Coefficient.

Table 4. Model Fit Indexes

Models	χ^2	df	CFI	TLI	SRMR	RMSEA
Single Factor	372.859	76	.80	.76	.082	.184
Three-Factor [a]	186.232	73	.92	.89	.053	.116
Four-Factor	110.160	70	.97	.97	.042	.071
Thresholds of Fit Indexes (Hu and Bentler,1999)			*>.90*	*>.90*	*<.08*	*<.06*

[a] *Intention to use and perceived usefulness factors combined into one factor.*

Testing the Hypothesis 1 and 2, which assert that ease of use (β=.23) and social influence (β=.26) have positive relationship with intention to use were supported.

The mediational model was tested in which perceived usefulness was preceded by ease of use and social influence. The results indicated that the model fits the data very well (χ^2=110.160, df=70; CFI=.97; RMSEA=.07; SRMR=.04). While ease of use and social influence explained 65% of the variance in perceived usefulness, 78 % of total variance for intention to use was explained. No need of model improvement was seen by examining modification indices. Using SEM, we tested the mediation effect of perceived usefulness between ease of use, social influence and outcome variable of intention to use through following the bootstrap procedure suggested by Preacher and Hayes (2004). To test the mediation, we used the indirect effects which were estimated using the 2000 samples bootstrapping method with 95% bias-corrected confidence intervals. Table 4 shows the findings related to both direct and indirect effects. These findings indicate that ease perceived usefulness was positively predicted by ease of use (β=.40, SE=.101, p<.001) and social influence (β=.49, SE=.096, p<.001). Perceived usefulness was found to be positively related to intention to use (β=.48, SE=.109, p<.001). We also found that the indirect effects on intention to use from ease of use (γ=.19, SE=.083, 95% CI=.07 to .39) and social influence (γ=.24, SE=.085, 95% CI=.10 to .45) were significant.

Despite the direct effects remained significant, the percentage of indirect effects in total effects were %45 for ease of use and %48 social influence which gives a support for partial mediation. These findings indicate that perceived usefulness partially mediated the effect on intention to use. Therefore, we found that Hypothesis 3 "Perceived usefulness mediates the relationship between ease of use and intention to use" and Hypothesis 4 "Perceived usefulness mediates the relationship between social influence and intention to use" were partially supported. The paths, direct and indirect effect sizes are shown in Table 5.

Table 5: Structural Equation Paths of Mediation Model

Path	β	$SE_β$	t-value	γ	$SE_γ$	95% C.I.
Ease of Use → Perceived Usefulness	.40	.101	4.142***			
Social Influence → Perceived Usefulness	.49	.096	5.270***			
Perceived Usefulness → Intention to Use	.48	.109	4.594***			
Ease of Use → Intention to Use	.23	.095	2.651**	.19	.08	.07 - .39
Social Influence → Intention to Use	.26	.094	2.925**	.24	.09	.10 - .45

N=106, β= Standardized Direct Effect, SE=Standard Error,
γ= Standardized Indirect Effect ***p<.001, **p<.01, *p<.05

We found that ease of use and social influence have positive effects on behavioral intention and perceived usefulness (was a potential underlying mechanism in this link) intervenes these relationships significantly. Both ease of use and social influence predicted perceived usefulness an in turn perceived usefulness effected intention to use. In previous studies, similar results were attained. A study conducted in UK about the consumers' adoption of IoT in smart fridge application suggested that social influence is one of the most important factors (Alolayan, 2014). The proposition of the significant effect of ease of use on behavioral intention, was also supported by previous studies (Yong Wee et al., 2011; Gao & Bai, 2014; Abu, Yunus, & Jabar, 2015; Al-Momani, Mahmoud, & Ahmad, 2016).

5. Conclusion and Future Studies

TAM is supported in this study. Therefore it is conducive for researchers to envisage the relationships between ease of use and usefulness, social influence and the acceptance of IoT technology by users. It affirms the use of IoT applications depends on the usefulness and ease of use of the application. This study shows that TAM also can be applied to a new technology like IoT. Another point that this study sheds light is the consumer perspective of a totally breakthrough technology IoT. Most of the studies in Internet of Things have the business perspective. Among the limited number of consumer segment studies only a few have analyzed the consumer acceptance in developing countries such as Mital et al's (2018) study in India and the Gao and Bai's study in China

(2014). Developing countries with different economic, demographic and lifestyle structures differ greatly from developed ones. Consequently analyzing consumer acceptance in a consumer market like Turkey, with low technology access and comparatively low purchasing power, enables seeing the concept from a different angle.

From practitioners' point of view, as the study supports the ease of use and usefulness attributes of consumer IoT applications should be brought to fore. In marketing communication of these applications marketers should stress how easy it is to use these applications and how useful they will be for consumers should be.

Internet of things being in its nascent stage in Turkey as the awareness of the technology increases and IoT consumer applications became well known, additional parameters should be added to the model such as perceived cost, perceived convenience, relative advantage, privacy risk, perceived security, and perceived connectivity. As there is no very well-known, widespread internet of things application under a strong brand name it is hard to study the consumers' trust and perceptions about the cost, risks, convenience etc. The experience effect in terms of cognitive and affect experience should also be analyzed after the IoT application trials increase.

In this study, research data is collected from Turkish consumers, for future studies cross-cultural research can developed to investigate the cultural value on IoT technology acceptance. Besides, longitudinal studies can be conducted to find out consumer attitude toward IoT services.

REFERENCES

ABU, F., YUNUS, A. R., & JABAR, J. (2015). Modified of UTAUT theory in adoption of technology for Malaysia Small Medium Enterprises (SMEs) in food industry. *Australian Journal of Basic and Applied Sciences*, 104-109.

Accenture. (2014). *The Internet of Things: The Future of Consumer Adoption .* Accenture.

AGARWAL, R., & KARAHANNA, E. (2000). Time flies when you're having fun: cognitive absorption and beliefs about information technology usage. *MIS Quarterly*, 665-694.

AL-AJAM , A., & NOR, K. (2013). Internet banking adoption: integrating technology acceptance model and trust. *European Journal of Business and Management, 5*(3), 207-215.

AL-MOMANI, A. M., MAHMOUD, M. A., & AHMAD, S. (2016). Modeling the adoption of internet of things services: A conceptual framework. *International Journal of Applied Research*, 361-367.

ALOLAYAN, B. (2014). Do I Really Have to Accept Smart Fridges ? An empirical study. *The Seventh International Conference of Advances in Computer Human Interactions* (pp. 186-191.). ACHI 2014.

ASHTON, K. (2009). *RFID Journal.* Retrieved from That 'Internet of Things' Thing.: http://www.rfidjournal.com/articles/pdf?4986

ATZORI, L., IERA, A., & MORABITO, G. (2010). The internet of things: A survey. *Computer networks*, 2787-2805.

BOONSIRITOMACHAI , W., & PITCHAY, K. (2017). Determinants affecting mobile banking adoption by generation Y based on the Unified Theory of Acceptance and Use of Technology Model modified by the Technology Acceptance Model concept,. *Kasetsart Journal of Social Sciences* , 2452-3151.

CHAU, P. Y., & HU, P. J. (2001). Information technology acceptance by individual professionals: a model comparison approach. *Decision Sciences*, 699-719.

COUGHLAN, T., BROWN, M., MORTIER, R., HOUGHTON , R. J., GOULDEN, M., & LAWSON, G. (2012). Exploring Acceptance and Consequences of the Internet of Things in the Home. *IEEE International Conference on Green Computing and Communications* (pp. 148-155). IEEE.

DA XU, L., HE, W., & LI, S. (2014). Internet of things in industries: A survey. *IEEE Transactions on industrial informatics,*, 2233-2243.

DAVIS, F. (1989). Perceived usefulness, perceived ease of use and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340.

DAVIS, F. D. (1986). A technology acceptance model for empirically testing new end-user acceptance of information technology. *Doctoral Dissertation.* Boston: Massachusetts Institute of Technology.

DAVIS, F., BAGOZZI, R., & WARSHAW, P. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*, 982–1003.

DONG, X., CHANG, Y., WANG, Y., & YAN, J. (2017). Understanding usage of Internet of Things (IOT) systems in China: Cognitive experience and affect experience as moderator. *Information Technology & People*, 117-138.

FEATHERMAN, M. S., MIYAZAKI, A. D., & SPROTT, D. E. (2010). Reducing online privacy risk to facilitate e-service adoption: the influence of perceived ease of use and corporate credibility. *Journal of Services Marketing*, 219-229.

FISHBEIN, M., & AJZEN, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research.* PA: Addison-Wesiey.

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*, 211-231.

GARTNER. (2016, 11 10). *Gartner Says 6.4 Billion Connected "Things" Will Be in Use in 2016, Up 30 Percent From 2015.* Retrieved from Gartner: https://www.gartner.com/en/newsroom/press-releases/2015-11-10-gartner-says-6-billion-connected-things-will-be-in-use-in-2016-up-30-percent-from-2015

GEFEN, D., KARAHANNA, E., & STRAUB, D. W. (2003). Trust and TAM in online shopping: an integrated model. *MIS Quarterly*, 51-90.

GIUSTO, D., IERA, A., MORABITO, G., & ATZORI, L. (2010). *The Internet of Things.* Springer.

GONG, M., XU, Y., & YU, Y. (2004). An enhanced technology acceptance model for web-based learning. *Journal of Information Systems Education, 15*(4), 365-374.

GROUP, A. (2014). The Internet of Things : the continuation of the internet.

GUINARD, D., TRIFA, V., KARNOUSKOS, S., SPIESS, P., & SAVIO, D. (2010). Interacting with the soa-based internet of things: Discovery, query, selection, and ondemand provisioning of web services. *IEEE Transactions on Services Computing.*, 223–235.

GÜNDÜZ, M. Z., & DAŞ, R. (2018). Nesnelerin interneti: Gelişimi, bileşenleri ve uygulama alanları. *Pamukkale Üniversitesi Mühendislik Bilimleri Dergisi*, 327-335.

HANSEN, T., JENSEN, J. M., & SOLGAARD, H. S. (2004). Predicting online grocery buying intention: a comparison of the theory of reasoned action and the theory of planned behavior. *International Journal of Information Management*, 539-550.

HSU, C. L., & LIN, J. C. (2016). An empirical examination of consumer adoption of Internet of Things services: Network externalities and concern for information privacy perspectives. *Computers in Human Behavior*, 516-527.

HSU, C. L., & LIN, J. C. C. (2008). Acceptance of blog usage: The roles of technology acceptance, social influence and knowledge sharing motivation. *Information & management*, *45*(1), 65-74.

HSU, C., & LU, H. (2004). Why do people play on-line games? An extended TAM with social influences and flow experience. *Information & management, 41*(7), 853-868.

Hydra Middleware Project. (2010). *FP6 European Project .* . Retrieved from http:// 1747www.hydramiddleware.eu

IDC. (2017). Retrieved from Worldwide Semiannual Internet of Things Spending Guide : https://www.idc.com/getdoc.jsp?containerId=IDC_P29475

JAN, A., & CONTRERAS, V. (2011). Technology acceptance model for the use of information technology in universities. *Computers in Human Behavior*, 845-851.

KARAHANNA, E., STRAUB, D. W., & CHERVANY, N. L. (1999). Information technology adoption across time: a cross-sectional comparison of pre-adoption and post-adoption beliefs. *MIS Quarterly*, 183-213.

KHAN, R., KHAN, S., ZAHEER, R., & KHAN, S. (2012). KHAN, R., KHAN, S. U., ZAHEER, R., & KHAN, S. (2012, December). Future internet: the internet of things architecture, possible applications and key challenges. *10th international conference on frontiers of information technology*, (pp. 257-260).

KHAN, W. Z., AALSALEM, M. Y., KHAN, M. K., & ARSHAD, Q. (2016). Enabling consumer trust upon acceptance of IoT technologies through security and privacy model. In J. J. ParkHai, H. Jin, Y. Jeong, & M. K. Khan, *Advanced Multimedia and Ubiquitous Engineering* (pp. 111-117). Singapore: Springer.

KHAN, W. Z., ALSALEM, M. Y., KHAN, M. K., & ARSHAD, Q. (2017). Antecedents Affecting Consumer Trust Towards Adopting Internet of Things Enabled Products. *IEEE Consumer Electronics Magazine*.

KHAN, W., AALSALEM, M. Y., & KHAN, M. K. (2018). KHAN, W. Z., AALSALEM, M. Y., & KHAN, M. K. (2018, January). Five acts of consumer behavior: A potential security and privacy threat to Internet of Things. *IEEE International Conference on Consumer Electronics.* IEEE.

KIM , K., & SHIN, D. (2015). An acceptance model for smart watches Research. *25*(4), 527-541.

KOWATSCH , T., & MAASS, W. (2012). Critical privacy factors of internet of things services: An empirical investigation with domain experts. Knowledge and Technologies in Innovative Information Systems. *Mediterranean Conference on Information Systems* (pp. 200-211). LNBIP.

KUSKOV, V., KUZIN, M., SHMELEV, Y., MAKRUSHIN, D., & GRACHEV, I. (2017, 06 17). *Honeypots and the Internet of Things*. Retrieved from Ao KasperskyLab: https://securelist.com/honeypots-and-the-internet-of-things/78751/

LEE, J., CHOI, J., & KIM, J. (2018). The adoption of virtual reality devices: The technology acceptance model integrating enjoyment, social interaction, and strength of the social ties. *Telematics and Informatics*.

LI, Q., WANG, Z., LI, W., LI, J., WANG, C., & DU, R. (2013). Applications integration in a hybrid cloud computing environment: Modelling and platform. *Enterprise Informations Systems*, 237–271.

LI, X. J., & WANG, D. (2013). Architecture and existing applications for internet of things. *Applied Mechanics and Materials*, 3317-3321.

LI, X., LU, R., LIANG, X., SHEN, X., CHEN, J., & LIN, X. (2011). Smart Community: An Internet of Things Application. *IEEE Communications Magazine*, 68-75.

LLC, P. I. (2015). *Privacy and Security in a Connected Life: A Study of US, European and Japanese Consumers .* Ponemon Institute LLC .

LUETH , K. L. (2018, 8 8). *State of the IoT 2018: Number of IoT devices now at 7B – Market accelerating*. Retrieved from IoT Analytics: https://iot-analytics.com/state-of-the-iot-update-q1-q2-2018-number-of-iot-devices-now-7b/

LUNNEY , A., CUNNINGHAM, N., & EASTIN, M. (2016). Wearable fitness technology: A structural investigation into acceptance and perceived fitness outcomes. *Computers in Human Behavior, 65*, 114-120.

MAIER, M. V. (2016). The Internet of Things (IoT): what is the potential of Internet of Things applications for consumer marketing? *7th IBA Bachelor Thesis Conference.* Enschede: University of Twente.

MARR, B. (2017, 09 29). *How Walmart Is Using Machine Learning AI, IoT And Big Data To Boost Retail Performance*. Retrieved from Forbes: https://www.forbes.com/sites/bernardmarr/2017/08/29/how-walmart-is-using-machine-learning-ai-iot-and-big-data-to-boost-retail-performance/#5182fbfd6cb1

MATHIESON, K. (1991). Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior. *Information System Research*, 173-179.

MEDAGLIA, C. M., & SERBANATI, A. (2010). An overview of privacy and security issues in the internet of things. *The Internet of Things* (pp. 389-395). NY: Springer.

MIORANDI, D., SICARI, S., DEPELLEGRINI, F., & CHLAMTAC, I. (2012). Internet of things: Vision,applications and research challenges. *Ad Hoc Netw*, 1497–1516.

MITAL, M., CHANG, V., CHOUDHARY, P., PAPA, A., & PANI, A. K. (2018). Adoption of Internet of Things in India: A test of competing models using a structured equation modeling approach. *Technological Forecasting and Social Change*, 339-346.

MOON, J. W., & KIM, Y. G. (2001). Extending the TAM for a world-wide-web context. *Information & Management*, 217-230.

NGAI, E., MOON, K. K., RIGGINS, F. J., & YI, C. Y. (2008). RFID research : An academic literature review (1995–2005) and future research directions. *Int. J. Prod. Econ*, 510–520.

NOVAK, T. P., & HOFFMAN, D. (2015, 08). *HOFFMAN, D. L., & NOVAK, T. (2015). Emergent experience and the connected consumer in the smart home assemblage and the internet of things.* Retrieved from ResearchGate: https://www.researchgate.net/publication/281113605_Emergent_Experience_and_the_Connected_Consumer_in_the_Smart_Home_Assemblage_and_the_Internet_of_Things?enrichId=rgreq-5683c4ae12c70f5b0ca49fe3b8e5a2d2-XXX&enrichSource=Y292ZXJQYWdlOzI4MTExMzYwNTtBUzoyNjQ3

OOI, K.-B., & TAN, G.-H. (2016). Expert Systems with Applications. *Mobile technology acceptance model: an investigation using mobile users to explore smartphone credit card, 59*, 33–46.

PAPER, M. S. (2014). *The 'Internet of Things' Is Now Connecting the Real Economy .* Morgan Stanley.

PARK, E., BAEK, S., OHM, J., & CHANG, H. J. (2014). Determinants of player acceptance of mobile social network games: An application of extended technology acceptance model. *Telematics and Informatics*, 3-15.

PARK, E., CHO, Y., HAN, J., & KWON, S. J. (2017). Comprehensive approaches to user acceptance of Internet of things in a smart home environment. *IEEE Internet of Things Journal*, 2342-2350.

PATEL, K., & PATEL, H. (2018). Adoption of internet banking services in Gujarat: An extension of TAM with perceived security and social influence. *International Journal of Bank Marketing, 36*(1), 147-169.

SCHERERA , R., SIDDIQB, F., & TONDEUR, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. *Computers & Education, 128*, 13–35.

SEPASGOZAR, S. M., HAWKEN, S., SARGOLZAEI, S., & FOROOZANFA, M. (2018). Implementing citizen centric technology in developing smart cities: A model for predicting the acceptance of urban technologies. *Technological Forecasting & Social Change*.

SHIH, Y., & FANG, K. (2004). The use of a decomposed theory of planned behavior to study Internet banking in Taiwan. *Internet Research*, 213-223.

SOLIMA, L., DELLA PERUFA, M. R., & DEL GUIDICE, M. (2016). Object-generated content and knowledge sharing: the forthcoming impact of the internet of things. *Journal of Knowledge Economy*, 738–752.

ŠUMAK, B. H. (2011). A meta-analysis of e-learning technology acceptance: The role of user types and e-learning technology types. *Computers in Human Behavior, 26*(6), 2067–2077.

SUN, C. (2012). Application of RFID technology for logistics on internet of things. *AASRI Procedia*, 106–111.

SVENDSEN, G. B., JOHNSEN, J. A., ALMAS-SORENSEN, L., & VITTERSO, J. (2013). Personality and technology acceptance: the influence of personality factors on the core constructs of the technology acceptance model. *Behaviour & Information Technology*, 323-334.

TOFT, M., SCHUITEMA, G., & THØGERSEN, J. (2014). Responsible technology acceptance: Model development and application to consumer acceptance of Smart Grid technology. *Applied Energy, 134*, 392–400.

VENKATESH, V. (2000). Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information System Research*, 342-365.

VENKATESH, V., & RAMESH, V. (2006). Web and wireless site usability: Understanding differences and modeling use. *MIS quarterly*, 181-206.

VENKATESH, V., MORRIS, M. G., DAVIS , G. B., & DAVIS , F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478.

WANG, S., BEATTY, S. E., & FOXX, W. (2004). Signaling the trustworthiness of small online retailers. *Journal of Interactive Marketing*, 53-69.

YONG WEE, S., SIONG HOE , L., KUNG KEAT, T., CHECK YEE, L., & PARUMO, S. (2011). Prediction of user acceptance and adoption of smart phone for learning with technology acceptance model. *Journal of Applied Sciences*, 2395-2402.

ZAREMOHZZABIEH, Z. A. (2015). A test of the technology acceptance model for understanding the ICT adoption behavior of rural young entrepreneurs. *International Journal of Business and Management, 10*(2), 158-169.

ZHANG, L., ZHU, J., & LIU, Q. (2012). A meta-analysis of mobile commerce adoption and the moderating effect of culture. *Computers in Human Behavior, 28*(5).

Özet

Günümüzde son teknolojik ilerlemeler muazzam değişimleri beraberinde getirmekte ve yeni bir döneme kılavuzluk etmektedir. Bu yeni dönemin temel değişim araçlarından biri Nesnelerin İnterneti teknolojisidir. Nesnelerin İnterneti iş ve günlük hayatla ilgili pek çok uygulamayı yeniden tanımlama potansiyeline sahiptir. "Nesnelerin İnterneti" terimi ile nesnelerin kimliklere sahip olması ve birbirleriyle her an bağlantıda bulunması ifade edilmektedir. Söz konusu kavram çok yeni olmasına rağmen, vaat ettiği gelişim potansiyeli ile pek çok bilim insanı ve uygulamacının ilgisini çekmektedir. Konu ile ilgili başlıca araştırma alanları Nesnelerin İnterneti teknolojisi için ihtiyaç duyulan teknik gereksinimler, bu teknolojinin potansiyel kullanım alanları ve kullanımıyla geliştirilebilecek muhtemel iş

modelleri olarak sıralanabilir. Bu yeni teknolojinin sağladığı ve ilerde sağlayabileceği faydalar ile hali hazırda iş dünyasında farklı sektörde kullanım alanı bulmuştur. Özellikle, üretim ve lojistik sektöründe radyo frekans tanımlama sistemleri günümüzde yaygın olarak kullanılmaktadır. Yakın gelecekte daha ileri teknoloji kullanım olanakları ve olası etkilerine birçok akademik çalışmada odaklanılmıştır. Nesnelerin interneti teknolojisi uygulamaları sadece iş dünyası için değil aynı zamanda günlük yaşamda nihai kullanıcı için de büyük kolaylıklar, faydalar sağlamaktadır. Giyilebilir teknolojiler, akıl evler, akıllı sağlık uygulamaları, güvenlik sistemleri gibi birçok tüketici uygulaması son yıllarda piyasada yerini almıştır. Ancak bu konu henüz tüketici bakış açısından yeterince incelenmemiştir. Potansiyel kullanıcılar kendilerine yeni bir teknoloji sunulduğunda bir kabul sürecinden geçerler.

Son 20 yıldır, bilgi ve iletişim teknolojilerinin gelişmesi, hayatımızın birçok alanını etkilemiştir. Özellikle, İletişim Teknolojisindeki dijital dönüşüm, insanları yeni teknolojileri kullanacak şekilde değiştirmeye başlamıştır. Tüketicilerin yeni teknolojileri kullanmaya başlaması ve adaptasyonu birçok araştırmacı tarafından merak edilen ve araştırılan bilgi teknolojileri konularının başında gelmektedir. Teknoloji Kabul Modeli (TKM) ise bu araştırmalarda en çok kabul edilen ve kullanılan modeldir. TKM, Davis (1989) tarafından Nedenli Eylem Teorisinden uyarlanarak, kişilerin tutumları, algıları, inançları ve yeni teknoloji kullanımları arasındaki akışı incelemek için kullanılmaktadır. Teknoloji Kabul Modeli, iki ana boyuttan oluşur; "algılanan kullanım kolaylığı" ve "algılanan kullanışlılık". Bu boyutlar davranışsal niyet ve teknoloji kullanımı için önemli öncül faktörlerdir.

Bu araştırmada tüketicilerin Nesnelerin İnterneti kavramını nasıl algıladıkları Teknoloji Kabul Modeli (TKM) üzerinden irdelenmiştir. Bu çalışmada algılanan kullanım kolaylığı ve algılanan kullanışlılık boyutları dışında, sosyal etkileşimlerin davranışsal niyet üzerine etkileri de incelenmiştir. Araştırmada, Davis'in (1989) oluşturduğu ölçekler, Türkçeye çevrilerek kullanılmıştır. Algılanan kullanışlılık dört soru, algılanan kullanım kolaylığı üç soru ile ölçülmüştür. Sosyal etkileşim için Mathieson'ın (1991) ölçeğinden üç soru, davranışsal niyet için de Venkatesh (2000) ölçeğinden beş soru uyarlanarak anket formu hazırlanmıştır.

Araştırılan kavramın bilinirliğinin az olması nedeniyle saha araştırmasına katılımcı bulmak zor olacağından kolayda örnekleme yöntemi kullanılarak 116 kişiden anket yoluyla veri toplanmıştır. Katılımcılardan elde edilen veriler yapısal eşitlik modellemesi kullanılarak analiz edilmiştir. Yapı geçerliliğini (yakınsak ve ayrım geçerliliği) sınamak için yapılan doğrulayıcı faktör analizi sonucunda 4 faktörlü modelin (χ^2=110.160, df=70, CFI=.97, RMSEA=.07, SRMR=.04) 3 faktör ve tek faktörlü modellere göre daha iyi uyum gösterdiği bulunmuştur. Maddelerin faktör yüklerininin .78 ile .94 arasında değiştiği görülmüştür. Değişkenlerin elde edilen ortalama varyansları .83-.90 arasında değişirken güvenilirlik katsayıları Cronbach Alpha .86 ile.94 arasında değişmektedir. Bu sonuçlara göre modelin yapı geçerliliği ve güvenilirliğine yönelik destek bulunmuştur. 4 faktör ile kurulan yapısal modelin sonuçları kullanım kolaylığı (β=.40, SH=.101, $p<.001$) ve sosyal etkinin (β=.49, SH=.096, $p<.001$) kullanma niyeti üzerinde anlamlı ve pozitif etkileri olduğunu göstermiştir. Buna göre H1 ve H2 kabul edilmiştir. Aracı değişken etkisini sınamak için "bootstrapping" yöntemi kullanılmıştır. Kullanım kolaylığı (γ=.19, SH=.08, 95%CI=.07 .39) ve sosyal etkinin (γ=.24, SH=.09, 95%CI=.10 .45) kullanılabilirlik aracılığıyla kullanma niyetine anlamlı dolaylı etkileri olduğu bulunmuş, fakat direkt etkinin kaybolmadığı görülmüştür. Buna göre, her iki yol için de kısmi aracı etkinin bulunduğu belirtilerek H3 ve H4 kısmen desteklenmiştir.

Araştırma sonuçları daha önce yapılan çalışmaları destekler niteliktedir. Algılanan kullanışlılığın, sosyal etkileşim ve algılanan kullanım kolaylığının yeni teknoloji kullanım niyeti arasında kısmi aracılık etkisi görülmüştür. Literatür incelendiğinde, nesnelerin internet üzerine yapılan çalışmaların çoğunun kavramsal ya da örgütler üzerine olduğu, tüketici adaptasyonu üzerine sınırlı sayıda çalışma olduğu görülmektedir. Özellikle Türkiye *gibi gelişmekte olan ülkelerde yapılmış iki çalışmaya rastlanmıştır. Bu araştırmalar Mital (2018) ve arkadaşlarının, Hindistan'da ve Gao &Bai'nin (2014), Çin'de yaptığı tüketici adaptasyon çalışmalarıdır. Türkiye gibi gelişmekte olan ülkelerin düşük teknoloji erişimi ve nispeten düşük satın alma gücü tüketici pazarında tüketici kabulünü analiz yapmayı zorlaştırmaktadır.*

Araştırmanın en önemli kısıtı örneklem sayısıdır. Gelecekte nesnelerin kullanımı ile ilgili yapılacak çalışmalarda örneklem sayısı artırılabilir. Teknoloji Kabul Modeline algılanan maliyet, algılanan uygunluk, göreceli fayda, algılanan güvenlik gibi yeni değişkenler eklenerek çalışmalar genişletilebilir. Nesnelerin interneti uygulamalarının deneme ve kullanımı arttıkça deneyim etkisi, algılanan risk ve algılanan fiyat teknoloji kabul modeline eklenerek incelenmelidir. Ayrıca, farklı kültürlerde nesnelerin internet kullanımı, kültürlerarası çalışmalarla zenginleştirilebilir.