

Analyzing the factors affecting the use of digital signature system with the technology acceptance model

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Abstract. Digital signature is a mechanism that is becoming widespread in the world thanks to its efficiency in electronic environments. The main purpose of the research is to reveal the variables that affect the perception and behaviors of the users using the digital signature system with technology acceptance models to determine the degree of impact of each variable and conceptualize these variables under a structural model. In this regard, 463 questionnaires collected from academic and administrative personnel working at Ataturk and Gümüşhane universities were analyzed. According to analysis results, anxiety has a negative impact on perceived usefulness. It has been obtained that perceived usefulness has a positive effect on attitude, and perceived ease of use does not have a significant effect on attitude. In addition, in the adoption of digital signature technology, it has been seen that personnel actual use is affected by intention to use with a rate of 88.1%.

Keywords. Digital signature, Technology acceptance model, Theory of planned behavior, Structural equation model.

JEL. C38, M10, M15, M19.

1. Introduction

In today's developing technology and communication age, organizations are transferring a large part of their activities to digital media because they need to increase their competitiveness, move quickly, keep their business processes and costs under control, and they need new information technologies for this purpose. In recent years, The rapid development of science and technology, although it makes human life easier and has been of great importance and utility to organizations, also causes security problems such as: unauthorized access to network resources, claiming not receipt or not submission of data received or sent, adding new things to data, changing or deleting data, the transmission of information to unauthorized individuals, the denial of the data received or sent, copying of information, data and network resources, damaging to information, data and network resources (Adam, *et al.*, 1998). For these reasons, today, security becomes increasingly important. In the digital world, it is more difficult to secure the source and reliability of information, so a reliable way is needed to know how to keep up with new technologies in a successful way. Many methods have been developed to remove reliability problems.

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Digital signatures are one of the most important means of protecting and safeguarding digital data. Digital signatures provide the confidentiality, integrity, security, non-imitation, non-reusability, non-repudiation of the document or data (Bütün, 2006; Kaur & Kaur, 2012; Zhang, 2010). In the digital age, digital signature is used in different areas such as government, banking, banking, B2B, healthcare and others (Kaur & Kaur, 2012). We have chosen to work on this issue because security in the Internet and other network systems has been of great importance in recent years, and digital signatures are one of the most effective methods of ensuring this security and that information technology is being explored from a different perspective. The main purpose of the research is to determine the degree of impact of each variable by explaining the variables affecting the perception and utilization behaviors of the users using the digital signature system and making use of technology acceptance models and conceptualizing these variables under a structural model. In this direction, a structural model was created that determines the relationship and effects between the factors of perceived ease of use, perceived usefulness, facilitating conditions, compatibility, saving of time, trust, anxiety, self-efficacy, subjective norms, attitude, perceived behavioral control, intention and actual use, and Davis' technology acceptance model was used to measure the degree of impact of the said factors. The model obtained theoretically, the consistency and accuracy of the statistical data handled as a result of comparison with the aggregated data, has been tested in the actual structure.

The scope of this study consists of four literature review, methodology, findings of the study, and conclusion section. Since the study determine the factors that affect the adoption of the digital signature system, it can be thought that this study may help those who are doing new work in the future to adoption of the digital signature system.

2. Literature review

In this section of the study, studies related to technology acceptance model and digital signature are written.

2.1. Digital signature

The digital signature is defined as follows: "data appended to, or a cryptographic transformation of, a data unit that allows a recipient of the data unit to prove the source and integrity of that unit and protect against forgery e.g. by the recipient" (Ardieta, 2011). Digital Signature is a kind of electronic signature derived from the conversion of a data message using the asymmetric encryption system and the message summarizing function. In other words, the digital signature is the digital value added to the data message. (Çikrikci, 2007). The digital signature is an authentication mechanism and it is created by encrypting the hash of the message with the sender's private key (Kaur & Kaur, 2012). A digital signature is an alphabetical sequence obtained through the processing of the text transmitted by a hash, created and used by cryptographic technology, and verifying the source of the intended text and confirming whether the text has been changed (Zhang, 2010).

Public Key and Private Key are required to create a digital signature. Public-key certificate, creates the verification of the signer's identity. Anyone who wants to verify the signature can be given a public key. The combination of proof of identity and the public key results in a public key certificate. The private key is something that the individual keeps secret. A document is signed with the private key. public and private keys are mathematically related. it is necessary to keep the private key secret (Priyanka, Sindhu & Vani,2012).

Digital signatures provide important operations such as authentication, privacy, non-repudiation and integrity. Privacy ensures that data is safe from unauthorized access and manipulation of data. This means that a transaction between enterprises

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cannot be changed by a third party. Authentication proves that a person is a real person and not a third person as an intruder. Authentication is very important if there is any trust between different parties (Kaur & Kaur, 2012). It guarantees the verification of the individual signature the certificate, and shows to the receivers who was signed and included in the transaction or who actually sent the message. (Bütün, 2006). Integrity guarantees that information, data or transmissions are not changed by unauthorized, uncontrolled, accidental or malicious intent until the recipient receives it (Kaur & Kaur, 2012; Bütün, 2006). Non-Repudiation has ability to prove who participates in the process and in communication. Thus, while the message is being sent, the receiver can prove that the alleged sender has sent the message (Kaur & Kaur, 2012).

The use of digital signatures has some advantages such as increasing the speed of transactions, reducing costs, increasing security, can use officially, following easily, non-repudiation, preventing fraud and having time stamps. like all other electronic products, the use of digital signatures has some disadvantages such as having a short life and expiration, the necessity of getting a certificate and software, not having the common law in some countries, the necessity of technological compatibility, not having necessity, having legal issues, training and troubleshooting and security concerns (Priyanka *et al.*, 2012).

Zho & Xiao (2008) examined the implementation of the digital signature scheme for the e-government that they proposed in their study. The proposed scheme caused some security problems to be solved such as the trust problem between the sender and the receiver in sending electronic documents.

Chou, Cheng & Golubchik (2010) in their study investigated the performance of different online digital signature batching schemes in their work. They also provided a framework for the analysis of the performance of such various schemes. As a result, it has been shown that significant computational benefit can be achieved through batching without significant increases in the amount of additional information that must be sent to clients. They have also discovered the potential benefits of considering more advanced batching schemes.

Martiri & Baxhakua (2012) developed a digital signature scheme based on the Rabin scheme to increase the level of safety. This schema software has been developed for software distributed during the installation phase via CD or over the internet and prevent copying of software. During the installation phase, the user will be prompted to enter the password. One of the advantages of this scheme is highly dependent on the key production software.

2.2. TAM

The Technology Acceptance Model (TAM), which Davis introduced in 1986, has emerged as a powerful model (Davis, Bagozzi & Warshaw, 1989). The Theory of Planned Behavior (TPB) and Theory of Reasoned Action (TRA) and are theoretical bases for TAM (Turan & Cetinkaya, 2010). In this model of Davis (1986), the attitude and behavioral relationship of TRA is used, and also, the intention of behavior is the determinant of accepting and using a system such as the TRA, (Venkatesh & Davis, 1996). When many sources are examined, it is seen that models are developed by using technology acceptance model widely in technology studies (Davis *et al.*, 1989). Many empirical tests have indicated that the Technology Acceptance Model is a good model for describing technology adoption behaviors at a large science technology level (Gefen, Karahanna & Straub, 2003). Technology Acceptance Model has been used in terms of many technologies (word processors, electronic mail, hospital information systems), with different conditions (cultural differences), different control factors (such as gender, organizational structure) (Başgöze, 2010).

TAM is a powerful model that describes the users' behavior and focuses on the degree of adoption of new technology. The aim of TAM is to estimate and indicate the use of technology by weighing the perceived usefulness and perceived ease of use after interaction with the system. At the same time, the because of good

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description of the users' behaviors, the aim of TAM is to be sufficient and to provide a theoretical explanation for the determinants of technology adoption. In other words, the main purpose of TAM is to create a general model that can be used in organizational environments with the fewest possible factors for different information systems. The determinants of behavioral intention in TAM are the perceived usefulness and ease of use of the system. The perceived usefulness defines the belief that an individual's use of a system will increase his or her job performance. The perceived ease of use defines the belief that the individual does not need much effort in using a system. The perceived ease of use is the determinant of both attitude towards use and perceived usefulness (Venkatesh & Davis, 1996). External factors have an impact on perceived usefulness and ease of use.

Eriksson, Kerem & Nilsson (2005) used technology acceptance model to collect surveys from 1803 internet banking users. It was determined that 56% of the participants were male, 45.5% were under the age of 35, and 53% did not have university education level. As a result of the study, trust is the effective on the perceived usefulness and perceived ease of use for the use of the Internet banking system, while the perceived ease of use is more strongly affective. The perceived ease of use has an impact on the perceived usefulness for use of the internet banking system. The perceived usefulness has an impact on the actual use of the system for use of the Internet banking system.

Guriting & Ndubisi (2006) used technology acceptance model to collect surveys from 133 online banking users. It was determined that 47.4% of the participants were male, 69.1% were under the age of 39, and 47.3% had graduate and Postgraduate education level. As a result of the study, it has been found that the perceived usefulness and perceived ease of use have direct and strong effects on the intention to adopt the online banking system. It has also been found that through perceived usefulness and perceived ease of use, prior general computing experience and computer self-efficacy have an indirect impact on intention.

Magni & Pennarola (2008) conducted a survey on 189 people who using a newly applied technology. In this study, it was determined that team-member exchanges, leader-member exchanges and organizational support were positively related to perceived usefulness and perceived ease of use. At the same time, emotional attachment has a positive effect only on perceived usefulness, and perceived benefit and perceived ease of use have an impact on intention to use.

Lin, Fofanah & Liang (2011) collected 276 questionnaires by e-mail from 14 March 2008 to 26 May 2008 from citizens using the system on e-government acceptance in the Gambia country. As a result of the study, the quality of knowledge and perceived ease of use on perceived usefulness; perceived ease of use on attitudes and intention on use attitudes have effects.

Özen, Çam & Pourmousa (2017) conducted 463 questionnaires on the academic and administrative personnel working at Atatürk and Gümüşhane universities in order to determine the factors affecting user behavior to adopt the e-government system with theory of planned behavior and technology acceptance model. According to the results of the analysis, anxiety has a negative effect on perceived usefulness and perceived ease of use. Trust has no significant effect on perceived usefulness and perceived ease of use. As another finding; perceived usefulness was found to be the most important factor on attitude factor with a rate of 69.2%.

3. Methodology

3.1. Models and hypotheses

Hypotheses of the research and the variables in the model were determined using various scientific sources in the literature survey. In models investigated, it has been found out that Hung, Chang & Yu (2006) study of the theory of planned behavior and the technology acceptance model, has a suitable theoretical framework for the purpose of study. In addition, this model was created by

considering the variables in the said Model and using of many studies (Hung, Chang & Kuo, 2013; Mahadeo 2009; Alrowili, Alotaibi & Alharbi, 2015; Suki 2010) that measure acceptance of new technology. Fig. 1 illustrates the research model for digital signature services acceptance, as constructed based on TAM. By evaluating whether the dimensions of the variables included in the model are suitable for researching, the model of study is expanded with new and appropriate factors. In these studies, 17 different hypotheses will be tested in the research. The factors affecting the adoption of digital signature technology for this purpose are presented as follows.

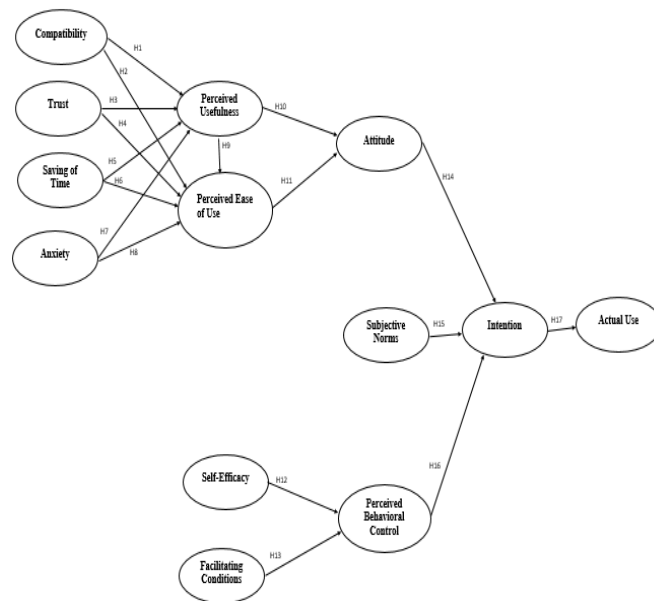


Figure 1. The Research Model

H1: The higher level of compatibility affects positively the perceived usefulness in adoption digital signature services.

H2: The higher level of compatibility affects positively the perceived ease of use in adoption digital signature services.

H3: The higher level of trust affects positively the perceived usefulness in adoption digital signature services.

H4: The higher level of trust affects positively the perceived ease of use in adoption digital signature services.

H5: The higher level of saving of time affects positively the perceived usefulness in adoption digital signature services.

H6: The higher level of saving of time affects positively the perceived ease of use in adoption digital signature services.

H7: The higher level of anxiety affects negatively the perceived usefulness in adoption digital signature services.

H8: The higher level of anxiety affects negatively the perceived ease of use in adoption digital signature services.

H9: The higher level of perceived usefulness affects positively the perceived ease of use in adoption digital signature services.

H10: The higher level of perceived usefulness affects positively the attitude in adoption digital signature services.

H11: The higher level of perceived ease of use affects positively the attitude in adoption digital signature services.

H12: The higher level of self-efficacy affects positively the perceived behavioral control in adoption digital signature services.

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H13: The higher level of facilitating conditions affects positively the perceived behavioral control in adoption digital signature services.

H14: The higher level of attitude affects positively the intention in adoption digital signature services.

H15: The higher level of subjective norms affects positively the intention in adoption digital signature services.

H16: The higher level of perceived behavioral control affects positively the intention in adoption digital signature services.

H17: The higher level of behavioral intention affects positively the actual use in adoption digital signature services.

3.2. Scope and method

A questionnaire was applied to 550 academic and administrative personnel working at Ataturk and Gümüşhane universities between 1.02.2016 and 10.03.2016. 494 questionnaires were taken into consideration in the study by taking out incorrect and incomplete questionnaires. The first part of the questionnaire consists of 7 questions to determine the demographic characteristics of the academic and administrative personnel. In the second part of the survey, a total of 52 questions examine the factors involved in theory of planned behavior and the technology acceptance model. The questionnaire questions were prepared on the 5-point Likert-type scale of 1: Strongly Disagree, 2: Disagree, 3: Undecided, 4: Agree, 5: Strongly Agree.

3.3. Assessment tool of the study

Although many of the variables and factors included in the research model were used in different researches, it was thought that the scales to be used in the research model should be rearranged in a way appropriate to this research because the subject and the main mass are different. Table-1 shows which studies were obtained the scale items used in the study.

Table 1. Research scale items and literature utilized

Factor	Variables	Literature Utilized
Trust	T1, T2, T3, T4	Hung <i>et al.</i> , (2006), Duyck <i>et al.</i> , (2008), Wu <i>et al.</i> , (2011).
Anxiety	A1, A2, A3, A4	Walczuch, Lemmink & Streukens (2007), Saade & Kira (2007), Tung, Chang & Chou (2008), Duyck <i>et al.</i> , (2008).
compatibility	C1, C2, C3	Hung <i>et al.</i> , (2006), Agag & El-Masry (2016), Lin (2007), Mahadeo (2009).
Saving of Time	ST1, ST2, ST3	Alrowili <i>et al.</i> , (2015)
Perceived Ease of Use	PEU1, PEU2, PEU3, PEU4, PEU5	Davis (1989), Lederer <i>et al.</i> , (2000), DeLone & McLean (2003) Saade & Bahli (2005), Hung <i>et al.</i> , (2006), Wu <i>et al.</i> , (2011), Anderson & Schwager (2004).
Perceived Usefulness	PU1, PU2, PU3, PU4, PU5, PU6, PU7	Davis (1989), Venkatesh & Davis (1996), DeLone & McLean (2003), Anderson & Schwager (2004), Mohd & Mohamad (2005), Hung <i>et al.</i> , (2006), Wu <i>et al.</i> , (2011).
Intention	I1, I2, I3, I4, I5, I6	Hung <i>et al.</i> , (2006), Anderson & Schwager (2004), Lin <i>et al.</i> , (2011), Mohd & Mohamad (2005),
Attitude	AT1, AT2, AT3, AT4, AT5	Lin (2007), Hung <i>et al.</i> , (2006), Wu <i>et al.</i> , (2011),
Facilitating Conditions	FC1, FC2, FC3	Hung <i>et al.</i> , (2006), Lin (2007), Wu <i>et al.</i> , (2007), Duyck <i>et al.</i> , (2008), Mahadeo (2009).
Actual Use	AU1, AU2, AU3, AU4	Lederer <i>et al.</i> , (2000), DeLone & McLean (2003), Lin (2007), Mahadeo (2009).
Self-efficacy	SE1, SE2, SE3	Hung <i>et al.</i> , (2006), Kim & Mirusmonov (2010), Lin (2007), Sharma, <i>et al.</i> , (2016), Oostrom, Dimitri, Born & Molen (2013).
Subjective Norms	SÖN1, SN2, SN3	Schierz, Schilke & Wirtz (2010), Lin (2007),
Perceived Behavioral Control	PBC1, PBC2, PBC3	Lin (2007), Hung <i>et al.</i> , (2006).

3.4. Data and analysis of information

Multivariate statistical analysis was used to analyze the collected data. Cronbach Alpha Coefficient method which is the internal consistency analysis method was used to test the reliability of the scale of the study. In addition, confirmatory factor analysis was used to test the validity of scales. After the validity and reliability of the scales were determined, the hypotheses have been tested with Structural Equation Model. Information about the analysis of the study and the results of the analysis will be provided by SPSS 22.0 and AMOS 20.0 package program.

4. Findings

4.1. Demographic findings

When the research is evaluated by the demographic profile of the participants, the frequency and percentage distributions are discussed in Table 3.4. Academic and administrative personnel participants in the research were 76.7% male, 47.4% in the age range of 23-35, 70.9 married, 23.1% research assistants and 76.1% in the Postgraduate level. 82.2% of participants use more than 4 hours of computer per day and 60.9% more than 4 hours per day internet.

Table 2. Demographic Profile of the Respondents

Variable		Count	Percentage
Age	23-35	234	47.4
	36-48	158	32.0
	49-61	95	19.2
	62 and older	7	1.4
Gender	Female	115	23.3
	Male	842	83.5
Marriage status	Single	144	29.1
	Married	350	70.9
Title	Prof. Dr.	73	14.8
	Assoc. Prof. Dr.	43	8.7
	Assist. Prof. Dr.	101	20.4
	Lecturer	28	5.7
	Res. Assist.	114	23.1
	Specialist	14	2.8
	Director- Administrative Staff	23	4.7
	Personnel- Administrative Staff	98	19.8
Education	High School	13	2.6
	Associate's Degree and Bachelor's Degree	105	21.3
	Postgraduate	376	76.1

Computer and internet experiences of the academic and administrative personnel participating in the study are shown in Table 3 in the scope of the study.

Table 3. Computer and internet usage information of the participants

Variable		Count	Percentage
Computer usage hours per day	< 2 h	13	2,6
	2 h - 3 h	75	15,2
	4 h -5 h	162	32,8
	5 h>	244	49,4
internet usage hours per day	< 2 h	60	12.1
	2 h - 3 h	133	26.9
	4 h -5 h	116	23.5
	5 h>	185	37.4

4.2. Results of the reliability and validity analyses

The Cronbach Alfa value of study is 0.868. in the study confirmatory factor analysis was used because confirmatory factor analysis was used to investigate hidden structures at each stage of the scale development process in a measurement method such as questionnaire. As a result of the confirmatory factor analysis, the most appropriate factors for the variables of the research were obtained.

4.3. Structural equation analysis results of the model

Table 4 shows the compliance measures of the research model. structural equation analysis was used to examine whether the effects between variables in the model were valid. In the structural equation model of the study, goodness of fit indexes was used for the decision to accept or reject the model. The decision of accepting or rejecting the structural equation model is taken using the measures of goodness of fit. These indexes are explained by numerical values that determine how well the data obtained. The model goodness of fit measures was found $\chi^2 = 1867, 498$; $df = 866$; $\chi^2 / df = 2,156$; $RMSEA = 0.048$; $GFI = 0.904$; $AGFI = 0.837$; $CFU = 0.936$; $NFI = 0.914$; $TLI = 0.927$; $RFI = 0.872$.

Table 4. Results of the model goodness-of-fit

Fit Index	Ideal Fitness Values	Acceptable Fitness Values	Results in this study
χ^2	($P > 0,05$) is desired.		1867,498
χ^2 / df	$\chi^2 / df \leq 2$	$\chi^2 / df \leq 5$	2,156
RMSEA	$0.00 < RMSEA < 0.05$	$0.05 < RMSEA < 0.10$	0,048
GFI	$0.95 < GFI < 1.00$	$0.90 < GFI < 0.95$	0,904
AGFI	$0.90 < AGFI < 1.00$	$0.80 < AGFI < 0.90$	0,837
NFI	$0.95 < NFI < 1.00$	$0.90 \leq NFI < 0.95$	0,914
TLI	$0.95 < TLI < 1.00$	$0.90 \leq TLI < 0.95$	0,927
CFI	$0.95 < CFI < 1.00$	$0.90 < CFI < 0.95$	0,936
RFI	$0.90 < RFI < 1.00$	$0.85 < RFI < 0.90$	0,872

The results provide some support for the structural model that was suggested and presented in Figure 3. Standard regression coefficients are shown in the path analysis where the inter-relationships between the variables in the model.

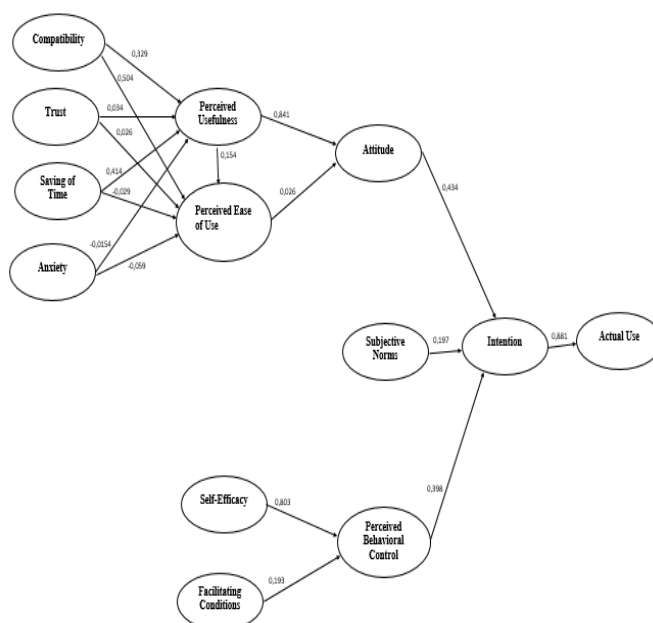


Figure 2. Model regression directions and standard regression loads

When the values of goodness of fit are examined, it can be said that the model of the study shows a good fit and be among the recommended acceptable fit values. 17 hypotheses are included in the model of the study. When the regression coefficients, P values ($p < 0,05$) and t values ($t \geq 1,65$) of the hypotheses predicted in the study's model are examined, the results are written as follows in the table 5. Table 5, shows the values to be used in evaluating the hypothesis with standard and non-standard loads, whether the relationships in model were in the desired direction and whether they were significant. In this evaluation, all relationships are

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examined and the p value of the AMOS program are utilized for each of them. Hypotheses were one-way in the negative or positive direction, so one-tail test values were evaluated. Therefore, $p < 0.05$ was considered to be significant.

Table 5. *Evaluation of the hypotheses of the model*

Structural Relationships	Standard Loads	Standard Error	Critical Ratio t values	P-values	Hypothesis Result
Variables Affecting Perceived Usefulness Factors					
H1:	0,309	.045	6,719	000	Supported
H3:	0,034	.035	0,886	0,376	Not Supported
H5:	0,414	.053	9,157	000	Supported
H7:	-0,154	.035	-3,575	0,009	Supported
Variables Affecting Perceived ease of Use Factors					
H2:	0,504	.071	7,967	000	Supported
H4:	0,026	.051	0,545	0,586	Not Supported
H6:	-0,029	.081	-0,494	0,622	Not Supported
H8:	-0,059	.047	-1,205	0,228	Not Supported
H9:	0,154	.068	2,616	000	Supported
Variables Affecting Attitude Factor					
H10:	0,841	.083	11,782	000	Supported
H11:	0,026	.042	0,611	0,541	Not Supported
Variables Affecting Perceived Behavioral Control Factor					
H12:	0,803	.069	12,227	000	Supported
H13:	0,193	.061	4,771	000	Supported
Variables Affecting Perceived Intention Factor					
H14:	0,434	.041	8,488	0,000	Supported
H15:	0,197	.030	5,440	0,000	Supported
H16:	0,398	.036	8,420	0,000	Supported
Variables Affecting Actual Use Factor					
H17:	0,881	.119	8,585	0,000	Supported

Table 5 shows that 12 of 17 hypotheses were significantly supported and 5 hypotheses was not supported by the data. In summary, compatibility, saving of time and anxiety are identified as the main determinants of perceived usefulness toward digital signature services. compatibility and perceived usefulness are the main determinants of the perceived ease of use. perceived usefulness is identified as the main determinants of attitude toward digital signature services. Self-efficacy and facilitating conditions are the main determinants of perceived behavioral control. Subjective Norms, attitude and perceived behavioral control are the main determinants of intention to accept digital signature services. Intention is the main determinants of actual use. Aside from the above hypotheses, the results indicate that trust did not significantly affect perceived usefulness toward digital signature services in this study. Time, trust and anxiety did not significantly affect perceived ease of use. perceived ease of use did not significantly affect attitude.

5. Conclusion

The growing of ICT is causing new technologies to emerge. Some of the emerging new technologies provide more data security to institutions, organizations, individuals and the state. At the same time, it is the request of all persons and organizations that the documents are converted into working and individual-specific and their contents cannot be changed at all. For this reason, institutions and organizations are striving to protect their employees, customers and individuals against information and data theft with applications that provide more data security. At the same time, these applications reduce the costs of institutions and organizations and customers and keep archives in the digital environment and facilitate access. Today, digital signatures are one of the techniques used for high security in institutions and organizations. For this reason, the desire to use digital signatures is seen by more people and organizations.

In this study, we examined the factors affecting the digital signature system and the adoption of the system in Atatürk and Gümüşhane universities. In Atatürk and Gümüşhane universities, the newly established digital signature shows new rules

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and new methods for academic and administrative personnel. The newly established system has been found to be a bad idea by some personnel and an excellent idea by some.

When 17 hypotheses of study for the purpose of determining the factors affecting the behavior of users using the digital signature system of the study are evaluated:

In terms of the content factors of communication on perceived usefulness toward digital signature services, significant effects of compatibility were observed with $p=0.000$ and the regression coefficient = 0,309 values. This means that, compatibility feeling of administrative and academic personnel at Atatürk and Gümüşhane universities towards using digital signature system affects positively their perceived usefulness towards adoption of digital signature. A unit increase in user's compliance increases the perceived usefulness by 30.9%.

In terms of communication content factors on perceived ease of use toward digital signature services, significant effects of compatibility were observed with $p=0.000$ and the regression coefficient = 0,504 values. This means that, compatibility feeling of administrative and academic personnel at Atatürk and Gümüşhane universities towards using digital signature system affects positively their perceived ease of use towards adoption of digital signature. A unit increase in user's compatibility increases the perceived ease of use by 50.4%.

Regarding the relations between trust and perceived of usefulness toward digital signature services empirically not being supported by the data with a $p = 0,376$, $p > 0,05$ values, in partial describing the reason for this we can actually say that, in Atatürk and Gümüşhane universities academic and administrative personnel are unstable about trusting the digital signature system. Because users do not trust the digital signature system, they cannot detect the system's perceived of usefulness.

Regarding the relations between trust and perceived ease of use toward digital signature services not being empirically supported by the data with a $p = 0,584$, $p > 0,05$ values, in partial describing the reason for this we can actually say that in Atatürk and Gümüşhane universities academic and administrative personnel are unstable about trusting the digital signature system. users can not detect the system's perceived ease of use since they do not trust the digital signature system.

In terms of communication content factors on perceived of usefulness digital signature services, significant effects of saving of time were observed with $p=0.000$ and the regression coefficient = 0,414 values. This means that, saving of time feeling of administrative and academic personnel at Gümüşhane and Atatürk universities towards using digital signature system affects positively their perceived of usefulness towards adoption of digital signature. A unit increase in user's saving of time increases the perceived usefulness by 41.4%.

Regarding the relations between saving of time and perceived of ease of use toward digital signature services not being empirically supported by the data with $p = 0,622$, $p > 0,05$ values, a partial explanation for this may lie in the fact that, saving of time feeling of academic and administrative personnel at Atatürk and Gümüşhane universities towards using digital signature system was not thought to ease of the use system.

In terms of communication content factors on perceived of usefulness digital signature services, significant effects of anxiety were observed with $p=0.009$ and the regression coefficient = -0.154 values. This means that, anxiety feeling of administrative and academic personnel at Atatürk and Gümüşhane universities towards using digital signature system affects negatively their perceived of usefulness towards adoption of digital signature. A unit increase in user's anxiety decreases the perceived usefulness by 15.4%.

Regarding the relations between anxiety and perceived of ease of use toward digital signature services empirically not being supported by the data with a $p=0.228$, $p > 0,05$ values, in partial describing the reason for this we can actually say that, anxiety feeling of administrative and academic personnel at Gümüşhane and

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Atatürk universities towards using digital signature system was not thought to ease of the use system.

In terms of communication content factors on perceived ease of use digital signature services, significant effects of perceived of usefulness were observed with $p=0.000$ and the regression coefficient = 0.154 values. This means that, perceived of usefulness feeling of administrative and academic personnel at Atatürk and Gümüşhane universities towards using digital signature system affects positively their perceived ease of use towards adoption of digital signature. A unit increase in user's perceived of usefulness increases the perceived ease of use by 15.4%.

In terms of the content factors of communication on attitude digital signature services, significant effects of perceived of usefulness were observed with a regression coefficient = 0,841 and $p=0.000$ values. This means that, perceived of usefulness feeling of administrative and academic personnel at Atatürk and Gümüşhane universities towards using digital signature system affects positively their attitude towards adoption of digital signature. A unit increase in user's perceived of usefulness increases the attitude by 84.1%.

Regarding the relations between attitude and perceived of ease of use toward digital signature services not being empirically supported by the data with a $p=0.541$, $p > 0,05$ values in partial describing the reason for this we can actually say that, Atatürk and Gümüşhane universities of academic and administrative personnel 's sense of ease of use towards the digital signature system cannot believe that it affects the user's attitudes of the system.

In terms of communication content factors on perceived behavioral control digital signature services, significant effects of self-efficacy were observed with $p=0.000$ and the regression coefficient = 0,803 values. This means that, self-efficacy feeling of administrative and academic personnel at Atatürk and Gümüşhane universities towards using digital signature system affects positively their perceived behavioral control towards adoption of digital signature. A unit increase in user's self-efficacy increases the perceived behavioral control by 80.3%.

In terms of communication content factors on perceived behavioral control digital signature services, significant effects of facilitating conditions were observed with $p=0.000$ and the regression coefficient = 0,193 and values. This means that, facilitating conditions feeling of administrative and academic personnel at Atatürk and Gümüşhane universities towards using digital signature system affects positively their perceived behavioral control towards adoption of digital signature. A unit increase in user's facilitating conditions increases the perceived behavioral control by 19.3%.

In terms of communication content factors on intention digital signature services, significant effects of attitude were observed with $p=0.000$ and the regression coefficient = 0,434 values. This means that, attitude feeling of administrative and academic personnel at Atatürk and Gümüşhane universities towards using digital signature system affects positively their intention towards adoption of digital signature. A unit increase in user's attitude increases the intention by 43.4%.

In terms of communication content factors on intention digital signature services, significant effects of subjective norms were observed with $p=0.000$ and the regression coefficient = 0,197 values. This means that, subjective norms feeling of administrative and academic personnel at Atatürk and Gümüşhane universities towards using digital signature system affects positively their intention towards adoption of digital signature. A unit increase in user's subjective norms increases the intention by 19.7%.

In terms of the content factors of communication on intention digital signature services, significant effects of perceived behavioral control were observed with $p=0.000$ and the regression coefficient = 0,398 values. This means that, perceived behavioral control feeling of administrative and academic personnel at Gümüşhane

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and Atatürk universities towards using digital signature system affects positively their intention towards adoption of digital signature. A unit increase in user's perceived behavioral control increases the intention by 39.8%.

In terms of communication content factors on actual use digital signature services, significant effects of intention were observed with $p=0.000$ and the regression coefficient = 0,881 values. This means that, intention feeling of administrative and academic personnel at Atatürk and Gümüşhane universities towards using digital signature system affects positively their actual use towards adoption of digital signature. A unit increase in user's intention increases the actual use by 88.1%.

According to the results of the analysis, in the adoption of digital signature systems, the time was determined as the most important determinant of the perceived usefulness with a rate of 41.4%. it was found, that in the adoption of digital signature systems, compatibility was determined as the most important determinant of the perceived ease of use with a rate of %50,4. also in the adoption of digital signature systems, perceived usefulness was determined as the most important determinant of the attitude with a rate of %84,1. It was found in this study that the impact of self-efficacy with a rate of % 80,3 on perceived behavioral control was stronger than that of facilitating conditions. also in the adoption of digital signature systems, attitude factor was determined as the most important determinant of the intention with a rate of %43,4.

This study has several limitations that need to be considered. First of all, because the digital signature has begun new to be implemented in the university of Atatürk and because the academic and administrative personnel do not have full control over the implementation, they have not a broad and secure perspective. For this reason, it is thought that if the research is done again after a while better and more reliable results will be obtained when compared to the results obtained. Furthermore, the effects of demographics on the use of the digital signature system have not been examined in this study. In future studies, the effects of computer and internet usage, gender, age, title and education, can be investigated. lastly, the data of the researcher is restricted to Atatürk and Gümüşhane universities only. For this reason, it is possible to make more comparative and general results for the adoption of the digital signature system by analyzing more university staff in the country in the future.

Appendix

Goodness of Fit Measures of the Confirmatory Factor Analysis of the Factors in Model

	χ^2	χ^2 /df	RMSEA	GFI	AGFI	CFI	NFI	TLI	RFI	C. Alpha
Perceived of Usefulness	44.280	3.872	0.074	0.958	0.913	0.972	0.976	0.981	0.958	0.907
Perceived Ease of Use	6.217	3.214	0.052	0.987	0.972	0.996	0.998	0.990	0.983	0.903
Attitude	18.327	4.214	0.078	0.998	0.965	0.991	0.985	0.965	0.974	0.856
Intention	19,832	2,325	0,068	0,968	0,957	0,962	0,974	0,925	0,912	0,847
Actual Use	1,132	0,258	0,041	0,997	0,984	0,998	0,987	0,939	0,919	0,745
Compatibility	3,258	0,698	0,057	0,999	0,947	0,968	0,968	0,947	0,907	0,745
Trust	7,522	3,238	0,082	0,992	0,953	0,992	0,990	0,979	0,987	0,769
Saving of Time	3,458	0,657	0,067	0,997	0,967	0,987	0,979	0,956	0,923	0,858
Anxiety	2,274	0,287	0,012	0,998	0,978	0,998	0,999	0,998	0,985	0,725
Subjective Norms	1,647	0,347	0,047	0,999	0,984	0,998	0,997	0,997	0,984	0,708
Perceived Behavioral Control	1,421	0,587	0,054	0,978	0,973	0,987	0,990	0,992	0,928	0,756
Facilitating Conditions	2,278	0,924	0,066	0,999	0,995	0,997	0,992	0,999	0,936	0,889
Self-efficacy	2,987	0,025	0,009	0,997	0,985	0,987	0,997	0,989	0,945	0,721

References

- Adam, N.R., Dogramaci, O., Gangopadhyay, A., & Yesha, Y. (1998). *Electronic Commerce: Technical, Business, and Legal Issues*. Prentice-Hall, Inc.
- Agag, G., & El-Masry, A.A. (2016). Understanding the determinants of hotel booking intentions and moderating role of habit. *International Journal of Hospitality Management*, 54, 52-67. doi. [10.1016/j.ijhm.2016.01.007](https://doi.org/10.1016/j.ijhm.2016.01.007)
- Alrowili, T.F., Alotaibi, M.B., & Alharbi, M.S. (2015). Predicting citizens' acceptance of m-government services in Saudi Arabia an empirical investigation, *System Conference (SysCon), 9th Annual IEEE International*.
- Anderson, J.E. & Schwager, P.H. (2004). SME adoption of wireless lan technology: applying UTAUT model. *Proceedings of the 7th Annual Conference of the Southern Association for Information Systems*, (pp.39-43).
- Başgöze, P. (2010). *Teknoloji Kabul modelinin teknolojik yatkınlık ve marka kredibilitesi değişkenleri eklenerek genişletilmesi: satın alma eğilimine uyarlanması*. (Yayımlanmamış Doktora Tezi). Ankara: Hacettepe Üniversitesi Sosyal Bilimler Enstitüsü
- Bütün, İ. (2006). *Kör sayısal imza sisteminin geliştirilmesi ve uygulanması*. (Unpublished Master's Thesis). Ankara: Hacettepe Üniversitesi Fen Bilimleri Enstitüsü.
- Chou, C., Cheng, W.C., & Golubchik, L. (2010). Performance study of online batch-based digital signature schemes, *Journal of Network and Computer Applications*, 33, 98-114. doi. [10.1016/j.jnca.2009.12.001](https://doi.org/10.1016/j.jnca.2009.12.001)
- Çıkrıkçı, M. (2007). *Dağıtım ve Ulaştırma Süreçlerinde Elektronik İmza*. (Yayımlanmamış Yüksek Lisans Tezi). İstanbul: İstanbul Ticaret Üniversitesi Fen Bilimleri Enstitüsü.
- Davis, F.D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340. doi. [10.2307/249008](https://doi.org/10.2307/249008)
- Davis, F.D., Bagozzi, R.P., & Warshaw, P.R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, 35(8), 982-1003. doi. [10.1287/mnsc.35.8.982](https://doi.org/10.1287/mnsc.35.8.982)
- DeLone, W.H. & McLean, E.R. (2003). The DeLone and McLean model of information systems success: a ten-year update. *Journal of Management Information Systems*, 19(4), 9-30. doi. [10.1080/07421222.2003.11045748](https://doi.org/10.1080/07421222.2003.11045748)
- Duyck, P, Pynoo, B., Devolder, P., Voet, T., Adang, L., & Vercruyse, J. (2008). User acceptance of a picture archiving and communication system. applying the unified theory of acceptance and use of technology in a radiological setting, *Methods of Information Medicine*, 47, 149–156. doi. [10.3414/ME0477](https://doi.org/10.3414/ME0477)
- Eriksson, K., Kerem, K., & Nilsson, D. (2005). Customer acceptance of internet banking in Estonia. *International Journal of Bank Marketing*, 23(2), 200-216. doi. [10.1108/02652320510584412](https://doi.org/10.1108/02652320510584412)
- Gefen, D., Karahanna, E., & Straub, D.W. (2003). Trust and TAM in online shopping: An integrated model. *MIS Quarterly*, 27(1), 51-90.
- Guriting, P., & Ndubisi, N.O. (2006). Borneo online banking: Evaluating customer perceptions and behavioural intention. *Management Research News*, 29(1/2), 6-15. doi. [10.1108/01409170610645402](https://doi.org/10.1108/01409170610645402)
- Hernández-Ardieta, J.L. (2011). *Enhancing the reliability of digital signatures as non-repudiation evidence under a holistic threat model* (Doctoral dissertation, Ph. D. dissertation, University Carlos III of Madrid).
- Hung, S.Y., Chang, C.M., & Kuo, S.R. (2013). User acceptance of mobile e-government services: An empirical study, *Government Information Quarterly*, 30, 33-44.
- Hung, S.Y., Chang, C.M., & Yu, T.J. (2006). Determinants of user acceptance of the e-Government services: The case of online tax filing and payment system, *Government Information Quarterly*, 23, 97-122. doi. [10.1016/j.giq.2012.07.008](https://doi.org/10.1016/j.giq.2012.07.008)
- Kaur, R., & Kaur, A. (2012). Digital signature. *International Conference on Computing Sciences*, 295-301.
- Kim, C., & Mirusmonov, M. (2010). An empirical examination of factors influencing the intention to use mobile payment, *Computers in Human Behavior*, 26, 310-322. doi. [10.1016/j.chb.2009.10.013](https://doi.org/10.1016/j.chb.2009.10.013)
- Lederer, A., Maupin, D.J., Sena, M.P., & Zhuang, Y. (2000). The technology acceptance model and the world wide web, *Decision Support Systems*, 29, 269–282. doi. [10.1016/S0167-9236\(00\)00076-2](https://doi.org/10.1016/S0167-9236(00)00076-2)
- Lin, H.F. (2007). Predicting consumer intentions to shop online: An empirical test of competing theories, *Electronic Commerce Research and Applications*, 6, 433-442. doi. [10.1016/j.elerap.2007.02.002](https://doi.org/10.1016/j.elerap.2007.02.002)
- Lin, F., Fofanah, S.S., & Liang, D. (2011). Assessing citizen adoption of e-Government initiatives in Gambia: A validation of the technology acceptance model in information systems success, *Government Information Quarterly*, 28(2), 271-279. doi. [10.1016/j.giq.2010.09.004](https://doi.org/10.1016/j.giq.2010.09.004)
- Magni, M., & Pennarola, F. (2008). Intra-organizational relationships and technology acceptance, *International Journal of Information Management*, 28(6), 517-523. doi. [10.1016/j.ijinfomgt.2008.01.002](https://doi.org/10.1016/j.ijinfomgt.2008.01.002)
- Mahadeo, J.D. (2009). Towards an understanding of the factors influencing the acceptance and diffusion of e-government services, *e-Journal of e-Government*, 7(4), 381-392.

Journal of Economics Bibliography

- Martiri, E., & Baxhaku, A. (2012). Monotone digital signatures: an application in software copy protection, *Procedia Technology*, 1, 275-279. doi. [10.1016/j.protcy.2012.02.058](https://doi.org/10.1016/j.protcy.2012.02.058)
- Mohd, H., & Mohammad, S.M.S. (2005). Acceptance model of electronic medical record, *Journal of Advancing Information and Management Studies*, 2(1), 75-92
- Oostrom, J.K., Dimitri, V.L., Born, M.P., & Molen, H.T. (2013). New technology in personnel selection: How recruiter characteristics affect the adoption of new selection technology, *Computer in Human Behavior*, 29, 2404-2415. doi. [10.1016/j.chb.2013.05.025](https://doi.org/10.1016/j.chb.2013.05.025)
- Özen, Ü., Çam, H., & Pourmousa, H. (2017). Examination of the factors effective in the use of the e-government system with the technology acceptance model. *Journal of Social and Administrative Sciences*, 4(3), 250-265. doi. [10.1453/jsas.v4i3.1441](https://doi.org/10.1453/jsas.v4i3.1441)
- Priyanka, Y., Sindhu, S., & Vani, T. (2012). Digital signature. *International Journal of Engineering and Management Sciences*, 3(2), 115-118.
- Saade, R., & Bahli, B. (2005). The impact of cognitive absorption on perceived usefulness and perceived ease of use in on-line learning: an extension of the technology acceptance model, *Information & Management*, 42, 317-327. doi. [10.1016/j.im.2003.12.013](https://doi.org/10.1016/j.im.2003.12.013)
- Saade, R.G., & Kira, D. (2007). Mediating the impact of technology usage on perceived ease of use by anxiety, *Computers & Education*, 49, 1189-1204. doi. [10.1016/j.compedu.2006.01.009](https://doi.org/10.1016/j.compedu.2006.01.009)
- Schierz, P., Schilke, O., & Wirtz, B. (2010). Understanding customer acceptance of mobile payment services: An empirical analysis, *Journal of Electronic Commerce Research and Application*, 9, 209-216. doi. [10.1016/j.elerap.2009.07.005](https://doi.org/10.1016/j.elerap.2009.07.005)
- Sharma, S.K., Al-Badi, A.H., Govindaluri, S.M., & Al-Kharusi, M.H. (2016). Predicting motivators of cloud computing adoption: A developing country perspective, *Computer in Human Behavior*, 62, 61-69. doi. [10.1016/j.chb.2016.03.073](https://doi.org/10.1016/j.chb.2016.03.073)
- Suki, N.M., & Ramayah, T. (2010). User acceptance of the e-government services in malaysia: structural equation modelling approach, *Interdisciplinary Journal of Information, Knowledge, and Management*, 5, 395-413.
- Tung, F.-C., Chang, S.-C., & Chou, C.-M. (2008). An extension of trust and tam model with IDT in the adoption of the electronic logistics information system in his in the medical industry, *International Journal of Medical Informatics*, 77, 324-335. doi. [10.1016/j.ijmedinf.2007.06.006](https://doi.org/10.1016/j.ijmedinf.2007.06.006)
- Turan, A.H., & Çetinkaya, Ö. (2010). Bürolarda teknoloji kabul ve kullanımı: Geliştirilmiş teknoloji kabul modeli ile bir model önerisi ve sekreterler üzerinde ampirik bir değerlendirme, *Akademik Bakış Dergisi*, 1-16.
- Venkatesh, V., & Davis, F.D. (1996). A model of antecedents of perceived ease of use: development and test. *Decision Sciences*, 27(3), 451-481. doi. [10.1111/j.1540-5915.1996.tb00860.x](https://doi.org/10.1111/j.1540-5915.1996.tb00860.x)
- Walczuch, R., Lemmink, J., & Streukens, S. (2007). The effect of service employees' technology readiness on technology acceptance. *Information and Management*, 44(2), 206-215. doi. [10.1016/j.im.2006.12.005](https://doi.org/10.1016/j.im.2006.12.005)
- Wu, C.S., Cheng, F.F., Yen, D.C., & Huang, Y.W. (2011). User acceptance of wireless technology in organizations: a comparison of alternative models, *Computer Standards & Interfaces*, 33, 50-58. doi. [10.1016/j.csi.2010.03.002](https://doi.org/10.1016/j.csi.2010.03.002)
- Zhang, J. (2010). A study on application of digital signature technology. *International Conference on Networking and Digital Society*, 498-501. doi. [10.1109/ICNDS.2010.5479249](https://doi.org/10.1109/ICNDS.2010.5479249)
- Zho, N., & Xiao, G. (2008). The application of a scheme of digital signature in electronic government, *International Conference on Computer Science and Software Engineering*, 618-621. doi. [10.1109/CSSE.2008.929](https://doi.org/10.1109/CSSE.2008.929)



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