

Adoption Intention of Digital Signature in INDIA

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Abstract

Purpose: *The main purpose of writing this paper is to understand the significance and problems related to Digital Signature. The usage of Digital Signature is not so popular in India but it has been widely used worldwide to complete the documentation work online rather than manually. Although Digital Signature are gaining popularity but it is still lacking in our country India. In this paper an introduction of Digital Signature will be focussed along with some of key factors that may affect the adoption intention of Digital Signature.*

Research Methodology: *This is an exploratory cum descriptive research in which the findings of factors have been done using models UTAUTAM model [1] (Extended UTAUT model). On the basis of these factors a structured questionnaire has been developed using Google forms and the sample size taken to conduct the survey is 100. A total of 75 respondents turned out to be useful for doing analysis. The respondents are from Delhi Technological University and friends who are working in corporate sector. Snowball sampling technique has been used to conduct the study. To do the analysis part SPSS has been used and cronbach's alpha values were being checked in order to do factor analysis.*

Findings: *On the basis of analysis it has been found that PEOU, PU, PR, FC are the factors that are contributing as the factors affecting adoption intention of Digital Signature in India.*

Managerial Implications: *This study will help all the institutions, public and private companies to have an insight view of Digital Signature so that they can use digital signatures in their respective organisation.*

Keywords: *Digital Signature, UTAUTAM Model, Adoption Intention.*

1. INTRODUCTION

Cryptography is the branch of cryptology dealing with the design of algorithms for encryption and decryption, intended to ensure the secrecy and/or authenticity of message. The DSA was proposed in August 1991 by the U.S. [2]. Cryptographers have been studying electronic signature technologies for decades since the discovery of one-way functions [3]. Several electronic signature schemes are proved to be secure under some complexity theoretical assumptions. They proposed a simple server-based electronic signature system in which a small number of common private keys were used. Another work was done on designing an off-line signature verification

system based on a displacement extraction method in which a questionable signature is compared with a corresponding authentic one. To qualify as equivalent to a handwritten signature, a digital signature must be based on a qualified certificate (A *certificate* is a binding to a person, digitally signed by a trustworthy authority and containing data and a public key.) and must be created by a secure signature-creation device. The qualified certificate is necessary to ensure that the key used to sign the data is genuine and linked uniquely to the person carrying out the signature process. It is issued by a trusted certificate authority (CA) certified by a national or European body. While not mandated by the EU directive, secure signature-generation devices are typically realized as a combination of a smart card, a card reader, and a software component running on the user's computer. The smart card holds the user's public-private key pair and the qualified certificate. When signing a document (e.g., a contract or a tax report), the software component shows all relevant information on the user's display. The user can then initiate the signature process in which the data (or a hash of the data) is sent to the smart card. After entering a secret pass code (or PIN), the smart card first uses the private key that it stores to sign the received input value and then returns the signature output to the program for further processing.

For a digital signature to be secure following points must not be violated:

1. It should be unique to the subscriber affixing it. A digital signature is unique and is based upon the message that is signed and the private key of the signer.
2. It should be capable of identifying such subscriber. What this implies is that the digital signature should be verifiable by the public key of the signer and by no other public key.
3. It should be created in a manner or using a means under the exclusive control of the subscriber. This implies that the signer must use hardware and software that are completely free of any unauthorized external control.
4. It should be linked to the electronic record to which it relates in such a manner that if the electronic record were altered, the digital signature would be invalidated. All standard software programs used to create digital

signatures contain this feature. Without this feature the whole purpose of creating digital signatures would be defeated.

A digital signature is a method for the Internet which is similar to traditional signatures. People sign their true names on papers in traditional signatures. No one can forge other signatures as it is difficult to imitate others handwritings. To provide a digital signature, it uses the known public key cryptosystem. Each one has a pair key, private key and a public key. The private key is kept secret and the public key is made public. A sender can sign an electronic document known as a digital signature using his/her private key and a receiver can verify the digital signature by the sender's public key. No one can forge others' digital signatures as the private key is safe guarded. A digital signature scheme has the following properties [4, 5, 6]:

- 1) Only the sender can sign an electronic document.
- 2) The receiver can verify the validity of the digital signature.
- 3) No one can forge the digital signatures of others.
- 4) It can achieve integrity. An attacker should not be able to substitute a false document for a legitimate one.
- 5) It can achieve non-repudiation. A sender should not be able to deny that he/she sent a document.

2. LITERATURE REVIEW

In order to write the literature for this paper many papers have been reviewed, although it's a new topic of its kind and not many literatures has been found on the same topic. We worked primarily on the factors that are affecting the adoption intention of digital signatures. To analyse the factors two models have been used which are UTAUT model and TAM model. The literature on adoption is primarily organized around themes such as adoption models (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980; Venkatesh and Davis, 2000; Davis, 1989; Rogers, 1995; Habib, 2005; Lie and Sorensen, 1996). The Theory of Reasoned Action (TRA), developed by (Fishbein and Ajzen, 1975) and (Ajzen and Fishbein, 1980) [7] consists of three variables: behavioural intention (BI), attitude (A) and subjective norm (SN). The theory has been revised and extended by Ajzen himself into the Theory of Planned Behaviour (TPB). This extension involves the addition of a major predictor, perceived behavioural control, to the model. TPB is further extended to Decomposed TPB (DTPB) by incorporating innovation diffusion factors such as relative advantage, compatibility, risk and significant influence of others. Davis (1989) expanded the Theory of Reasoned Action (TRA) to the Technology Acceptance Model (TAM) by incorporating factors like perceived usefulness (PU) and perceived ease-of-use (PEOU). The Unified Theory of Acceptance and Use of Technology (UTAUT) is a technology acceptance model formulated by Venkatesh et al. (2003) based on a review of the theory of reasoned action, the

technology acceptance model, the motivational model, the theory of planned behaviour, the combined theory of planned behaviour /technology acceptance model, the model of personal computer utilization, the diffusion of innovations theory, and the social cognitive theory. The UTAUT theory holds that four key constructs—namely, performance expectancy, effort expectancy, social influence and facilitating conditions—are direct determinants of usage intention and behaviour. Gender, age, experience and voluntariness of use are related to mediate the impact of the four key constructs on usage intention and behaviour. The theory has been tested for the adoption of information and communication technologies and mobile commerce. Compared to other theories, the UTAUT theory was found to be more relevant for studying the adoption of mobile commerce. Cheng et al. (2008) studied the adoption of Internet banking using the UTAUT model, the DeLone & McLean (D&M) model, and the concept of trust. A comprehensive model was developed and empirically examined by them in China [8]. A sample of 313 intended users of Internet banking was used to test UTAUT for adoption of technology, information and service quality. Trust, risk, locus of control and uncertainty were studied towards intention. Except effort expectancy and information quality, the rest of the parameters were significant towards intention. Jun et al. (2008) identified the facilitating and moderating factors in the adoption of on-line and mobile banking in Korea. They argue that usefulness, ease of use, innovativeness, social influence, quality and cost were significantly related to the adoption of on-line and mobile banking; whereas on-line banking service type, social influence and cost were found to be moderators for the adoption of digital signature. Dewan, Low and Land (2009) studied previous adoption models and proposed their own model wherein reasoning, referencing and contextual factors affecting choice were suggested for the adoption of mobile banking. Cheah et.al (2011) argue that Factors such as perceived usefulness (PU), perceived ease of use (PEOU), relative advantages (RA) and personal innovativeness (PI) were found positively related with the intention to adopt mobile banking services. However, social norms (SN) were the only factor found insignificant. Pedersen (2005) carried out a study in North America and Europe on the adoption of mobile Internet services [9]. He found that TAM, Decomposed TPB and the domestication model are important from the social and technical perspectives. Further, usefulness and subjective norm were significant towards the attitude to use m-commerce. Facilitating conditions were restricted to the resources used. Self-efficacy and operator influence on facilitating conditions were not tested in his research. Rao and Troshani (2007) established user predisposition (i.e., knowledge, compatibility and perceived enjoyment), behavioural control and innovativeness, image, perceived usefulness, perceived ease of use, internal and external social influence, facilitating conditions (i.e., promotion, security and privacy) as important drivers for digital signature service adoption.

2.1. TAM Model

TAM is tailored to IS contexts and was designed to predict information technology acceptance and usage on the job. Unlike TRA, the final conceptualization of TAM excludes the attitude construction in order to better explain intention parsimoniously. TAM2 extended TAM by including subjective norm as an additional predictor of intention in the case of mandatory settings (Venkatesh and Davis, 2000). TAM has been widely applied to a diverse set of technology and users. TAM model consists of two factors which are

PU- Defined by Fred and Davis as degree to which a person believes that using a particular system would enhance his/her job.

PEOU- Davis defines this as degree to which a person believes that using a particular system would be free from effort. The major upgrades of this model were TAM2 (Venkatesh and Davis 2000 & Venkatesh 2000) and TAM3 (Venkatesh and Bala 2008) that was proposed in context of e-commerce with an inclusion of the efforts of trust and perceived risk in system.

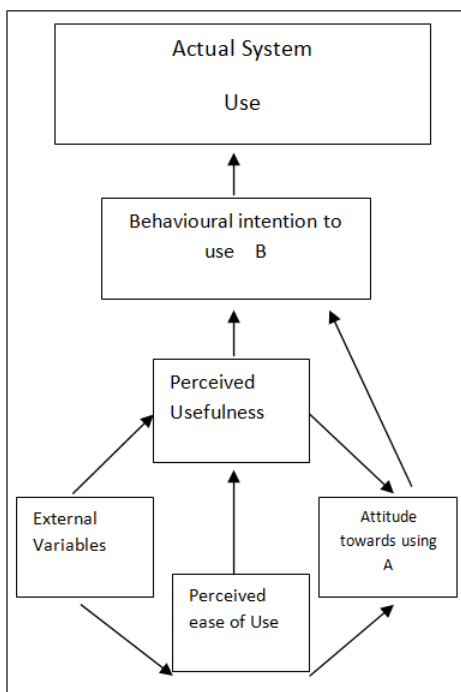


Fig. 2: TAM Model Version 1 (Davis 1989)

2.2. UTAUT Model

This model was an extended version of previous 8 models of usage and acceptance of technology which were TAM, TRA, Motivational model, TPB, Combined theory of planned behaviour and TAM, Model of personal computer use, Diffusion of innovations theory, Social cognitive theory [10]. This model consists of following 4 factors:-

1. Performance Expectancy- Degree to which an individual believes that using the system will help him or her to attain gains in job performance.
2. Effort Expectancy- Degree of ease associated with the use of the system.
3. Social Influence- Degree to which an individual perceives that important which others believe he or she should use in the system.

These 3 factors are the direct determinants of usage intention and behaviour.

4. Facilitating Condition- Degree to which an individual believes that an organisational & technical infrastructure exists to support use of system. It doesn't have significant influence on behavioural intention.

This factor is a direct determinant of user behaviour gender, age, experience and voluntariness.

3. RESEARCH METHODOLOGY

Firstly UTAUT and TAM model has been used to conduct the study which can be termed as UTAUTAM model of usage and acceptance of technology.

3.1. Research Instrument and sample

The factors PEOU, PU, Perceived risk, Performance expectancy, Facilitating Conditions & Social influence has been used to develop the questionnaire for the study that contains 19 questions was formed. The first part of the questionnaire contains the subject's demographic information such as gender, age, educational qualification and family monthly income. The next section consists of the questions that are being considered to validate the factors being selected in which the respondents were asked to mark their level of agreement or disagreement using a 5 point Likert scale.

3.2. Questionnaire

On the basis of literature and the model a structured questionnaire have been developed that covers all the factors on a 5 point likert scale. The questionnaire consists of 5 points ranking which are 1 for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree and 5 for strongly agree to determine the factors effectively. All the variables are also being discussed in the model.

3.3. Validity and Reliability

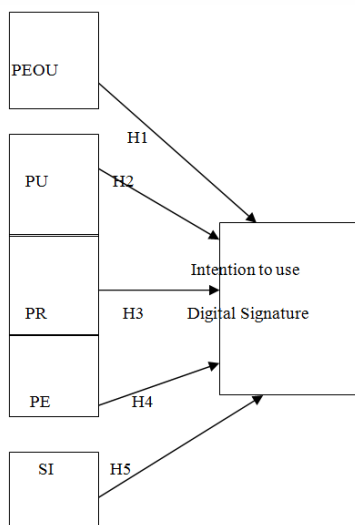
In this research we attempted to examine the factors that affect consumers' adoption of digital signature by employing a modified TAM model. The TAM model is developed in order to verify the relations between the dependent variables and independent variables and test the hypotheses. SPSS analysis technique was used to assess the validity and reliability for each factor that affect the intention to use digital signature.

The reliability is referring to the consistency of a measure, and a test is considered reliable if the tester gets the same result repeated trails [11]. There are many types of reliability including inter-ratter reliability, Test-retest reliability, parallel-forms Reliability and internal consistency reliability. On the other hand, [11] defines the validity as the extent to which a test measures what it claims to measure. The validity and reliability of the model have been checked using SPSS analysis for each factor that is affecting mobile banking adoption. Internal consistency reliability test has been used in this paper and the values of cronbach's alpha for various factors are shown in the Table 1.

Table 1: Internal Consistency Reliability Test Values

Factors	Cronbach's Alpha
PEOU	.753
PU	.871
PR	.809
PE	.792
FC	.694
SI	.870

All the alpha values of the factors are above .7 which is clearly indicating that these factors are contributing factors as per the questionnaire and as per [11] this value above or equal to .7 is acceptable hence it gives a good internal reliability test values.



Now after analysing the values of cronbach's alpha we can conclude that the facilitating conditions is not the appropriate factor, so we took the other factors further to make model that affects the adoption intention of digital signature.

3.4. Hypotheses Testing

H1: More is the PEOU more is the intention to use digital signature.

H2: More is the PU more is the intention to use digital signature.

H3: Lower the risk more is the intention to use digital signature.

H4: More is the PE more is the intention to use digital signature.

H5: More the social influence more is the intention to use digital signature.

Table 2: Hypotheses Test Results

Hypotheses	Standardization coefficient	Significant	Acceptance/ Rejection
H1	.30	.012	Accepted
H2	.29	.020	Accepted
H3	.24	.022	Accepted
H4	.35	.030	Accepted
H5	.07	.061	Rejected

Hypotheses 5 have standardization coefficient lower than .1 and also the significance value is more than .05 which doesn't sit fit under the values given in [12] which leads to rejection of this hypotheses and this factors is not contributing as a factor leading to digital signature adoption.

All the other hypotheses fits the test as per[12] so those factors can be taken as the factors affecting digital signature adoption.

3.5. Respondent's Profile

The male respondents are 45 in number while female are 30 in number that is percentage of male respondents is more. The family monthly income of 20 person is less than 75,000, 35 is between 75,000- 1,50,000 and the rest have above 1,50,000. All of the respondents are below 30 years of age and have graduation and above as educational qualification.

4. CONCLUSION AND FUTURE SCOPE

On the basis of cronbach's alpha values it can be clearly said that 5 out of 6 factors are affecting the adoption intention of digital signature. Facilitating condition is the one which is not being considered by the respondent's as the affecting factor. So perceived ease of use, perceived usefulness, perceived risk, social influence are the factors that are affecting the adoption intention of digital signature as their alpha values are greater than 0.7 [11]. In the future scope large scale study can be conducted also some more factors may be considered as the

factors affecting digital signature adoption. Also the survey has been done on the students of DTU who all are not the user of digital signature so this can act as major limitation of this paper.

Also the hypotheses 1-4 stands accepted as per [12] and the last hypotheses that the more social influence will leads to more intention to adopt digital signature stands rejected.

So in order to make digital signature more popular some steps need to be taken like:-

- Government should start the digital signature in all its work.
- Companies must adopt the digital signatures.
- Government also needs to give some policies in the benefit of digital signature adoption.

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