E-GOVERNMENT ADOPTION MODEL BASED ON THEORY OF PLANNED BEHAVIOR: EMPIRICAL INVESTIGATION

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ABSTRACT

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The e-government phenomena has become more important with the ever increasing number of implementations world wide. A model explaining the e-government adoption and the related measurement instrument –a survey– had been developed and validated in this study. In a post technology acceptance model (TAM) approach, theory of planned behavior (TPB) was extended to fit the requirements of e-government context. The adoption of student loans service of the higher education student loans and accommodation association (KYK) was investigated to obtain data for empirical validation. The instrument was administered to over four-hundred students and partial least squares path modeling was employed to analyze the data. The results indicate that the model was an improvement over TAM in terms of predictive power. The constructs investigated in the study successfully explained the intention to use an e-government service.

Keywords: E-Government, Citizen Adoption, Adoption Models, Structural Equation Modelling, Partial Least Squares Path Modelling

ÖZ

PLANLI DAVRANIŞ TEORİSİNE DAYALI BİR E-DEVLET BENİMSENMESİ MODELİ: AMPİRİK İNCELEME

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E-devlet fenomeni sayısı dünya çapında her geçen gün artan uygulamalarıyla daha da önemli hale gelmektedir. Bu çalışmada e-devletin vatandaşlar tarafından benimsenmesini açıklayan bir model ve modelle bağlantılı bir ölçüm aracı –bir anket– geliştirildi ve doğrulandı. Teknoloji Benimsenmesi Modeli (TBM) sonrası bir yaklaşım içerisinde, Planlı Davranış Teorisi (PDT) e-devlet kapsamına uyacak şekilde geliştirildi. Yüksek öğretim kredi yurtlar kurumu (KYK) öğrenci kredileri servisi modelin deneysel doğrulamasında veri sağlamak için kullanıldı. Ölçüm aracı dörtyüzün üzerinde öğrenciye uygulandı ve elde edilen veri parçalı en küçük kareler yol modelleme ile doğrulandı. Sonuçlar modelin TBM üzerine tahmin gücü açısından bir ilerleme olduğunu ve modelde kullanılan yapıların bir e-devlet servisini kullanma niyetini başarıyla açıkladığını ortaya koydu.

Anahtar Kelimeler: E-Devlet, Vatandaş Benimsemesi, Benimseme Modelleri, Yapısal Denklem Modelleme, Parçalı En Küçük Kareler Yol Modelleme

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To one particular tabby cat...

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LIST OF ABBREVIATIONS

D-TPB Decomposed TPB

DOI Diffusion of Innovations

EFA Exploratory Factor Analysis

G2C Government to Citizen

IT Information Technologies

ICT Information and Communication Technologies

KYK Higher Education Student Loans and Accomodation Association

LS Least Squares

LV Latent Variable

ML Maximum Likelihood

MV Manifest Variable

PBC Perceived Behavioral Control

PDT Planlı Davranış Teorisi

PEU Perceived Ease of Use

PLS-PM Partial Least Squares Path Modeling

pls-pm Partial Least Squares Path Modeling Package in R

PU Perceived Usefulness

ROI Return on Investment

sem Structural Equation Modelling Package in R

SEM Structural Equation Modelling

SSK Social Insurance Association

TACT Target, Action, Context, Time

TAM Technology Acceptance Model

TBM Teknoloji Benimsenmesi Modeli

TG Trust in Government

TI Trust in Internet

TPB Theory of Planned Behavior

ULS Unweighted Least Squares

CHAPTER 1

INTRODUCTION

The aim of this study is to develop a model for prediction and explanation of the citizens' adoption behavior regarding the use of government-to-citizen (G2c) e-government services. This chapter introduces the e-government phenomena and the role of e-government adoption in successful implementations.

The application of information technologies (IT) to the government services has given rise to e-government. E-government has several benefits; increased efficiency, increased availability of these services, reduced costs and extremely high return on investment ratios being the most evident ones [5, 6]. As these benefits has become more apparent, the number of countries employing e-government services began to increase, such that among the 192 countries surveyed in the UN e-government survey there was not one country that did not employ some form of e-government [6]. The financial reports also support these findings. The IT spendings of western European countries on e-government are expected to reach $50 billion by the end of 2009 [7]. This world wide trend is also evident in Turkey. OECD e-government studies on e-government in Turkey reported that the spendings on e-government initiatives have been rising since 2001 [5].

The expected return on investment[1] (ROI) for e-government projects are extremely high. For example, the estimated investment for an e-government project

[1]The ratio of the benefits generated to the costs incurred

in social insurance association (SSK) was 2.4 million TL whereas the estimated return on the same project was 1.8 billion TL [5]. But these ROI values can only be actualized if the projects are successful. Unfortunately, the success rates have been reported to be low. Studies conducted in Manchester University, UK found out that only 15% of the e-government projects achieved all of their established goals [8]. The main determinant of success for G2C services is the utilization of these services. The utilization of services is a measure of adoption of the service by citizens. UN report lists the reasons behind low adoption of e-government services as:

- Usefulness
- Content Accessibility
- Lack of Trust
- Lack of Confidentiality
- Social and Cultural Issues
- Inadequate Infrastructure
- Inadequate Delivery of Services

The reasons listed above have also been noted in the e-government adoption literature. The e-government adoption models try to predict and explain the use of e-government phenomena. A discussion on these models can be found in Section 2.1.2. The usability and accessibility have long been known to influence the adoption of technological artifacts [1]. It is a well established fact that the two most important factors in the use of an innovation are the *usefulness* and the *ease of use* of said innovation [3]. The uncertainty in on-line interactions are known to be lessened by trust and the role of trust and confidentiality in on-line interactions was a subject well studied [9, 10]. International nature of this phenomenon had caused the social and cultural issues and the unique infrastructural differences

among the countries to be investigated [11]. Considering the significant amount of resources spent on e-government projects, each failed project means significant amount of tax payer money going to waste. E-government adoption models can identify the factors leading to adoption by citizens. This information could then lead to more successful e-government projects.

In this study, an e-government adoption model for G2C services has been developed. As discussed in Section 2.4 existing models used in current literature lack the extendibility and explanatory power. In order to produce a model that can form the basis of future studies in the field, care was taken to ensure that the model was easily customizable and had significant explanatory power. The scientific nature of the study required sound theoretical foundations and rigorous validation of the model. The model was based on Theory of Planned Behavior (TPB) [4, 12] as an effort to build a strong model fit to serve in the post TAM era. All modifications to the model was theoretically justified. For empirical validation, a measurement instrument had also been developed and validated alongside the model. For the statistical validation of the model and the instrument, second generation multivariate analysis tools had been employed.

The study progressed as follows. A literature review uncovered the need for an improved model of e-government adoption. The model was developed to satisfy the need. A measurement instrument to empirically evaluate the model was developed. Data was collected; and the reliability and the validity of the instrument was tested through instrument validation. The validity of the model was tested through model validation. The model and the instrument was altered in model modification step. The modified instrument and the model was validated and the hypotheses testing was done on the altered model. Figure 1.1 displays the progression of the study.

This chapter introduced the e-government, the problem of e-government adoption and the study conducted in this thesis. The next chapter –Chapter 2– will delve deeper into the e-government adoption models by providing a review of pre-

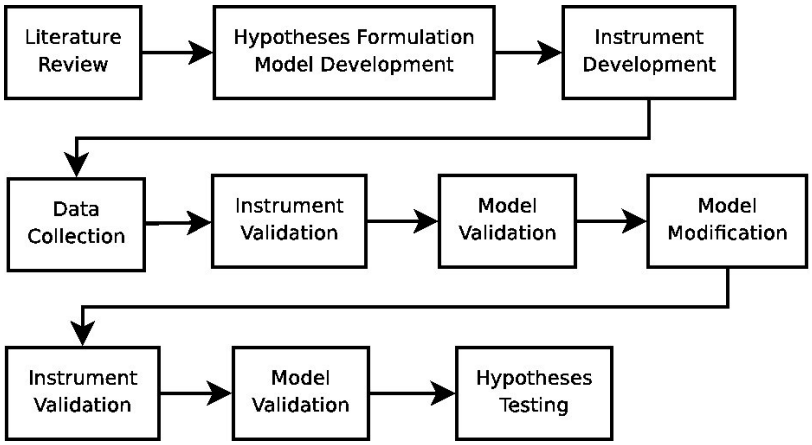

Figure 1.1: The progression of the study

vious work on e-government adoption models and related literature. Chapter 3 builds on the literature discussed in Chapter 2 and details the procedure of model development. The details on the methods employed in instrument development and the statistical techniques used for the validation of the model and the instrument are also discussed in the same chapter. Chapter 4 provides the results of statistical analysis and discusses the findings. Finally, Chapter 5 presents the conclusions.

CHAPTER 2

LITERATURE REVIEW

This chapter puts forth the previous work done in the literature on the e-government adoption and on related fields. Section 2.1 provides an overview of adoption models used both in general and in e-government context. Section 2.2 focuses on trust construct which had seen wide employment in e-government studies. Section 2.3 gives an insight into local factors that might affect the citizens' adoption behavior. Finally, Section 2.4 discusses an alternative to the general trend in technology adoption models which is also adopted in this study and provides insight into theory of planned behavior (TPB).

2.1 Adoption Models

There are various models for the adoption of technological novelties in the literature. Most common of these general models are discussed in Section 2.1.1. For specific technologies or implementations of novelties, such as e-commerce or e-government, these models are generally taken as a base and extended using various constructs that are deemed relevant to the subject. E-government adoption literature has also followed a similar path. Section 2.1.2 discusses previous literature on e-government adoption.

2.1.1 General Models

These general models are often referred to as technology adoption models. Perhaps the most widely known is the Technology Adoption Model (TAM) [1], yet other models have seen acceptance in IS domain such as Diffusion of Innovations (DOI) [2] and Uniform Theory of Acceptance and Use of Technology (UTAUT) [3].

An evaluation of these models reveals that, similar constructs can be observed in each model, under different names. Most prevalent of these constructs are the usability [1] and the functionality [2]. These constructs also consistently showed strong effects on intention to use and actual use in the broadest set of contexts.

Technology Adoption Model

Davis' seminal work the Technology Acceptance Model is known as the only commonly accepted theory in IS domain [13]. Despite its prevalence in IS domain, TAM takes its roots from a theory in psychology; Theory of Reasoned Action (TRA) [14]. TRA is a theory that explains human behavior. Davis took TRA and modified it to explain the technology adoption behavior. According to Davis, adoption of an IT artifact depends on two basic constructs; Perceived Usefulness (PU) and Perceived Ease of Use (PEU). Perceived usefulness is the perception of additional performance gained by the use of the system in question. Perceived ease of use is the perceived reduction in the effort required to carry out the task by using the system in question. Perceived usefulness and perceived ease of use determine the intention to use the system which in turn has an effect on the actual system use. It has been found later on, that perceived ease of use was also an antecedent of *perceived usefulness* and was partially mediated over the later [1]. In all the years since its conception in 1986 it has been validated time and

[1] Perceived ease of use of TAM [1], technical complexity of DOI [2], effort expectancy of UTAUT [3]

[2] Perceived usefulness of TAM [1], relative advantage of DOI [2], performance expectancy of UTAUT [3]

again almost to certainty [13].

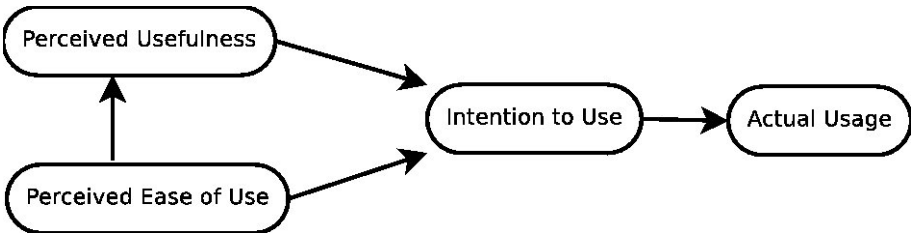

Figure 2.1: Technology Acceptance Model [1]

Diffusion of Innovations

Diffusion of innovations theory stems from sociology and was not initially conceived as a model for technology adoption but as a model for innovation in general. Moore and Benbasat carried the theory over to the the IS domain and expanded it to include eight independent constructs: voluntariness, relative advantage, compatibility, image, ease of use, result demonstrability, visibility, and trialability [2]. This model is a direct model[3]. This makes the model suitable for testing with first generation multivariate analysis techniques. Even though the model offers a comprehensive set of constructs, later work found out that the factors consistently came up in DOI studies were technical compatibility, technical complexity, and relative advantage [15].

Uniform Theory of Acceptance and Use of Technology

Venkatesh and others reviewed and empirically compared the existent literature on IT adoption and formulated the Uniform Theory of Acceptance and Use of Technology [3]. The resulting model included Performance Expectancy, Effort

[3]No mediating latent variables in the model.

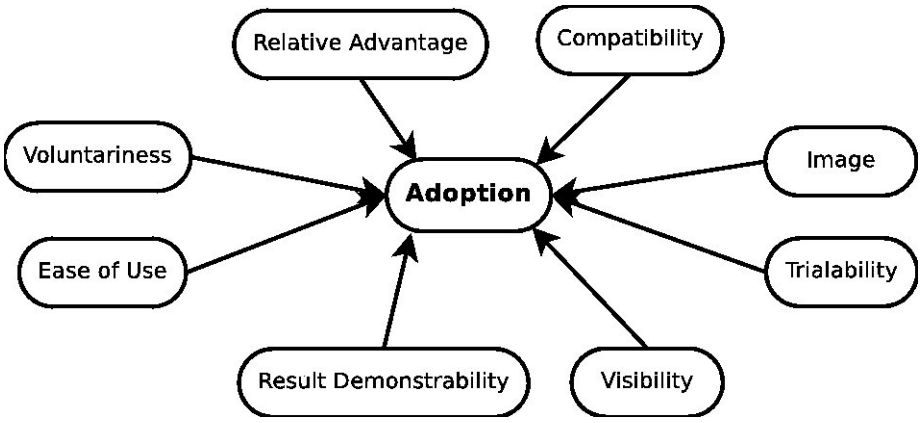

Figure 2.2: Diffusion if Innovations [2]

Expectancy, Social Influences and Facilitating Conditions as constructs. Demographics and voluntariness were also included in the model as moderators. The resulting model was an improvement over the existing models yet with the additional constructs of facilitating conditions and the social influences, the resulting model was not dissimilar to the TPB discussed in Section 2.4.

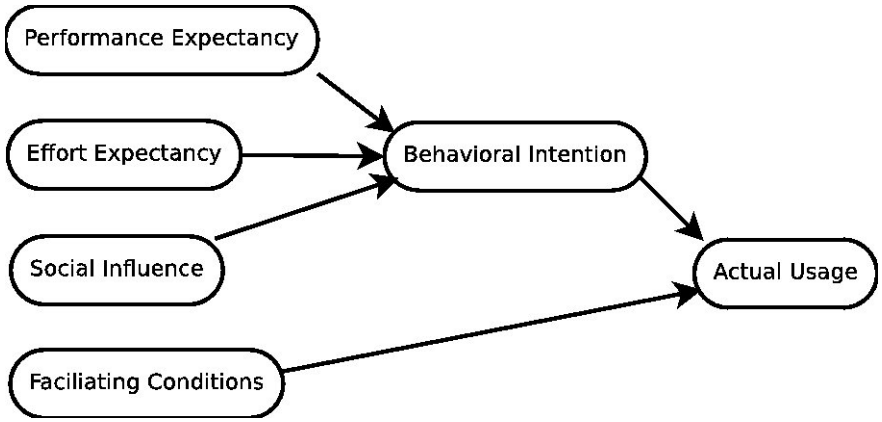

Figure 2.3: Uniform Theory of Acceptance and Use of Technology [3]

2.1.2 E-government Adoption Models

The models developed for e-government adoption are generally based on one of the models listed in Section 2.1.1. This is quite logical, considering that e-government is itself a technology artifact. These models usually extend the technology adoption models by the inclusion of various additional constructs to account for the multi disciplinary nature of the field. Due to the close relations between the fields and the relative maturity of e-commerce literature, the studies in e-government adoption have been known to follow the studies in e-commerce [16, 17]. Even though the e-commerce literature is not discussed openly in this section, the resemblances are pointed out with references given to e-commerce articles in the following sections.

Table 2.1 lists some e-government adoption studies, the models used as the basis and the additional constructs included in those studies. The articles listed in Table 2.1 were chosen to reflect some trends in the literature. A brief review of the literature on e-government adoption reveals that TAM was the model that was utilized most often in the literature [13]. Trust has also seen frequent use in many studies regarding e-government adoption. This is also true for e-commerce [10, 18, 19]. The frequent use of trust is probably due to its being a salient factor in online interractions.

[16], [22] and [23] were notable since their move away from TAM reflects a recent trend in IS. DOI, UTAUT and TPB have been employed in its stead. This trend will be discussed in detail in Section 2.4.

[11] displayed an interesting effort into a cross cultural study on e-government. Skills and Access –discussed in more detail in Section 2.3– were integrated into TAM to reflect a country's position in digital divide. Using the information and communication technology penetration for comparison among two countries provided a tangible and easily employable measure of local differences.

[16] integrated TAM constructs and Trust into DOI. Unfortunately DOI already had constructs similar to TAM constructs (relative advantage and ease of

Table 2.1: Base Models and Additional Constructs in Previous Studies

Study	Base Model	Additional constructs
Carter and Belanger, 2005 [16]	DOI	PU, PEU, Trust
Carter and Weerakkody, 2008 [11]	TAM	Trust, Skills and Access
Gefen et. al., 2002 [20]	TAM	Social Influence, Trust and Risk
Warkentin et. al., 2002 [21]	TAM	Trust, Risk, PBC
AlAwadhi and Morris, 2008 [22]	UTAUT	-
Hung et. al., 2006 [23]	D-TPB	PU, PEU, Risk, Trust, Personal Innovativeness, Compatibility, External Influence, Interpersonal Influence, Self-Efficacy, Facilitating Conditions

use) and the constructs overloaded each other out. The end result was simply DOI extended by trust. This study exemplifies how disregarding the theoretical foundations of constructs in a model distorts the results. [24] warns against such implementations.

[21] extended the TAM with PBC, trust and risk. The use of PBC is notable since it is in an effort to upgrade TAM's basis from TRA to TPB. The end result was similar to UTAUT with social influence construct replaced by trust and risk.

[23] used the decomposed variant of TPB and integrated DOI constructs trust and risk into the model an approach similar to the one adopted in this study and [19]. The total number of constructs however rendered the path strengths of constructs rather weak and the final model reached through the use of modification indices did not have any theoretical support to the relations investigated and did not resemble TPB in anyway.

Returning back to factors influencing e-government success listed by the UN report discussed in Chapter 1, it can be seen that the additional constructs in these models cover a significant amount of them. Usefulness and *access*ibility,

being the most basic determinants of technology adoption had been investigated in all of the studies. Lack of trust and confidentiality had been investigated in studies [16, 11, 20, 21, 23]. The infrastrucute, and service delivery had been investigated in [11].

2.2 Trust

As exemplified in the Section 2.1.2 *trust* is the most common construct that is integrated into the e-government adoption models. Trust eases the transactions in uncertain situations by reducing the perceived complexity of the situation [18]. The level of uncertainty in on-line interactions has made trust a significant factor for both e-commerce [9] and e-government [25] adoption studies. The literature provides various descriptions and approaches to trust none of which is agreed upon [9, 10].

There are two approaches in defining trust: defining trust as a unitary concept or as a combination of several concepts. Rotter represents the classical approach by defining trust as a unitary concept [26]. According to Rotter trust is the expectancy that the word of the trustee is reliable. While Rotter's work is still used (see [16, 11]), the concept of trust as a unitary construct has long been debated [9]. Both [9] and [10] discussed below exemplify the approach to trust as a combined construct.

Defined whether as a unitary concept or a combination of concepts, trust has several different types. One point of distinction is the distinction based on context. The effect of the environment and situation in which the transaction takes place is named institutional trust whereas the effect of trustee is named as party based trust.

McKnight et. al. conducted a study based on TRA [9]. They reviewed literature and identified fifteen beliefs relating to trust. Eleven of these beliefs clustered under three major trusting beliefs, integrity, benevolence and competence. The approach in their work is an example of defining trust as a combined construct

and is suitable for party based trust.

Institutional trust used in on-line interactions is another example of trust as a combined construct. The institutional trust reflects the trust caused by the situational normality and structural assurances. Situational normality refers to the feeling of trust stemming from the perception that everything operates as it should. Structural assurances on the other hand refer to the guarantees and legal recourse that make the environment more reliable [10].

Risk comes to mind as a natural extension to trust, yet studies could not arrive at consistent results on the effect of risk (see [18, 25]). The direction of the relation between trust and risk is also controversial. These two constructs may mediate each others' effects.

2.3 Local Factors

Reflecting on the international nature of the e-government phenomena, there are inter-cultural comparison studies. The models aiming for inter-cultural comparison generally include constructs to account for the local factors [27, 11]. Although there are well known examples of inter-cultural research such as Hoefstede's cultural dimensions or Schwartz's value inventory [28], the integration of these into a measurement instrument is hard and the results obtained from previous studies based on these might not be compatible with the sample at hand. Thus a more measurable and tangible scale to account for differences among countries was needed. This led Carter and Weerakkody to use IT penetration to compare UK and US [11]. Carter and Weerakkody theorized that the countries' position in digital divide effects the IT penetration which in turn effects the citizens' ability to use computers and the availability of computers. Yet, in cases where IT penetration is too deep, the IT artifacts and their effects might become invisible [11]. The citizens' computer *skills* and *access* to computers are easily measurable and are tangible measures.

Even though Carter and Weerakkody used these measures for inter-cultural

comparison, these measures were more general in nature and differed even among the members of different social strata in the same country. The true marvel of IT penetration evidenced by the social capital and the infrastructural adequacy was that it was an indicator of local factors and enabler of the use of e-government services.

2.4 Theory of Planned Behavior as an Alternative

While TAM has seen wide acceptance and use in information systems literature, its dominion has not been without resistance. Benbasat and Barki have noted the limitations of TAM in terms of extendibility and explanatory power [13]. The argument against the explanatory power arose from the overly simplistic structure of the model. Many researchers have proven that -as Benbasat and Barki put it - "usefulness was useful" in affecting intentions, but TAM did not provide any insights into what usefulness was nor provided any mechanism to do so later on if the researcher wished. This formed the basis for the second argument against TAM, the extendibility. TAM did not include any extension facilities and the researchers aiming to extend the model needed to justify this in terms of TAM. Over the years, as the limitations of TAM became clear, researchers either extended the existing model or moved to other models such as UTAUT or DOI for the explanatory power. While it is true that these models do have more explanatory power, they too do not provide default extension mechanisms. As noted in [13] UTAUT was very similar to the Theory of Planned behavior with the inclusion of social influence (subjective norms in TPB) and facilitating conditions (perceived behavioral control -PBC- in TPB) but lacked the salient belief mechanism of extension. Remembering that TAM was based on TRA - the antecedent of TPB - Benbasat and Barki suggested using TPB instead of other models for the sake of the extendibility. This study adopted that approach and used TPB as the base of the model developed.

Theory of Planned Behavior is a theory in social psychology, explaining hu-

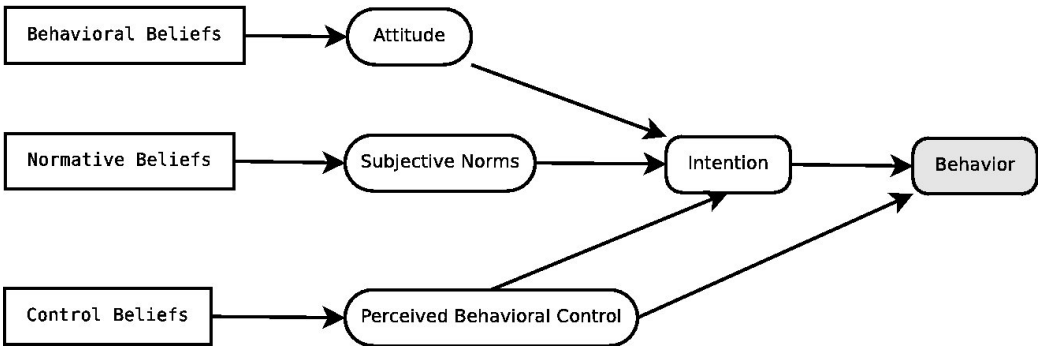

Figure 2.4: Theory of Planned Behaviour [4]

man behavior defined in context [4]. Ajzen defines Theory of Planned Behavior as an extension of the Theory of Reasoned Action [14] – which formed the foundations of TAM – developed to overcome the issues in the original theory related to person's control over the behavior in question. The actual performance in TRA was dependent only on the motivation of the individual and the person's capability and the availability of resources had nothing to do with the performance. In TPB however, actual performance of a behavior is affected by the capability and the motivation of the individual. Figure 2.4 displays the constructs and relations in TPB.

Intentions are a major determinant of actual performance in the theory of planned behavior and their role in predicting actual performance has been empirically validated [18]. Intentions capture the motivational factors that drive a person to perform a behavior. In a sense, intention is a measure of effort an individual is ready to exert to accomplish a behavior. The intention to perform a specific behavior is preceded by attitudes, subjective norms and perceived behavioral control [4]. The weights of each construct in determining the intention depends on the context and the nature of the behavior in question yet intentions can only effect the behavior to the extent that the person's actual behavioral control allows them to.

The role of attitudes is to capture the individual's evaluation regarding a spe-

cific behavior whereas subjective norms capture the social pressure on performing or not performing the behavior. The attitudes have been proven to influence the intentions. Subjective norms however have played a controversial role in online settings. Venkatesh et. al. found social norms to be significant (and slightly at that) only in mandatory settings or for the initial use of the system where the experience is low [3].

Availability of resources and opportunities – actual behavioral control – required to perform the specified behavior dictate the actual performance to the extent that the person in question is motivated to try. Perceived behavioral control – the differentiating point of TPB – measures the perceived difficulty of performing a specific behavior. Ajzen likens his PBC construct to Bandura's self-efficacy construct [4]. Yet in time studies managed to identify another factor determining the PBC, controllability. Perceptions of self-efficacy related to the individuals' judgments of their abilities where as controllability refers to the individuals' judgments of the availability of resources. Ajzen answered claims against the unitary nature of PBC by stating that even though PBC is composed of separable components it is still a unitary construct [12]. According to the same article, both self-efficacy and controllability belief items must be included in PBC measures. In TPB, PBC effects the performance both directly and through intentions, but the size of the direct effect is proportional to the compatibility between perceived and actual control.

The constructs detailed so far –Intentions, Attitudes, Subjective Norms and Perceived Behavioral Control– suffice for the prediction of behavior. Thus, they are called the predictor variables[4].

The explanatory power of the model stems from the inclusion of salient beliefs into the model. The salient beliefs provide the researchers with the ability to

[4]The parts making up a model are generally referred to as constructs. However Ajzen called these, variables. Moreover, in SEM literature they are generally referred to as latent variables. Throughout this text, construct, variable and latent variable have been used interchangeably based on the context

investigate the relevant factors and their effects on the behavior. Three types of these salient beliefs each pertaining to a higher level construct exist; behavioral beliefs which influence attitudes, normative beliefs which influence the subjective norms and control beliefs which influence the perceived behavioral control [4]. The salient beliefs consist of belief composites. The belief composites have a dual nature; each belief composite is a factor of the subjective probability and the subjective impact of the belief they are measuring. So, for a belief composite item in a TPB questionnaire, two questions are asked: the probability of occurrence and the impact. For the behavioral beliefs the probability of occurrence is the belief strength and the impact is outcome evaluation. In control beliefs these are translated into control belief strength and control belief power.

This chapter has discussed the previous work done in technology adoption models, e-government adoption models and the model used as a base for the model developed in this study. Chapter 3 details the development of the model proposed in this study, the measurement instrument and the statistical tools used for the validation of both.

CHAPTER 3

RESEARCH METHODOLOGY

The aim of this chapter is to communicate the theory behind the model developed and the methods and procedures employed in this study. Section 3.1 elaborates the basic hypotheses and the theoretical foundations of the model developed. The processes and methods regarding development of the measurement instrument are discussed in Section 3.2. Finally Section 3.3 introduces the statistical methods used to analyze the data gathered in this study.

3.1 Model Development

Due to the reasons discussed in Section 2.4, the use of TPB as a base model was decided. The model proposed in this study is an extension of TPB into the e-government setting. The constructs, *perceived usefulness*, *perceived ease of use*, *trust in internet*, *trust in government*, *skills* and *access* are integrated as salient beliefs. The linkages among these constructs were provided in the form of a collection of hypotheses, Figure 3.1 shows the hypothesized relationships. The actual performance of behavior could not be measured since it required a longtitutional study with a limited sample. This was not possible due to the time constraint imposed by the master's process and sample size constraints imposed by the statistical technique employed. The role of intentions on actual perfor-

mance has been reported to be a strong predictor of actual usage [3, 4]. Ajzen suggested eliciting salient beliefs through a separate survey study, however in order to evaluate the most common constructs in e-government adoption literature that suggestion is disregarded. No belief types were integrated through subjective norms construct, since the subjective norms have been known to play a non significant role in on-line interactions [3].

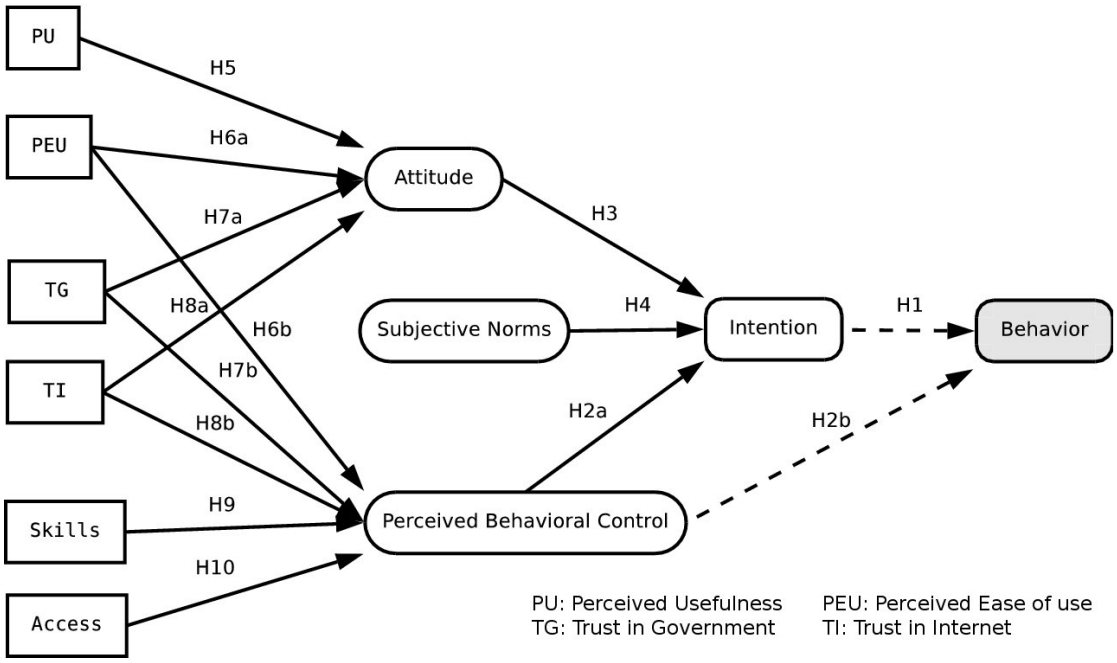

Figure 3.1: The Proposed Model

3.1.1 Predictor Constructs

The predictor variables[1] form the foundations of TPB. The relationships among these constructs have been taken as they were envisaged by Ajzen [4] and were provided in the form of the hypotheses below. More information on predictor variables, their relations and TPB in general can be found in 2.4.

[1]Intention, attitude, subjective norms, perceived behavioral control

H1 † The intention to use an e-government service positively influences the actual usage of the service.

H2a Perceived Behavioral Control over using an e-government service positively influences the intention to use the service.

H2b † Perceived Behavioral Control over using an e-government service positively influences the actual usage of the service.

H3 Attitude towards using an e-government service positively influences intention to use the e-government service.

H4 Subjective norms regarding the use of an e-government service will have a positive effect towards the intention to use the service.

3.1.2 Salient Beliefs

The constructs discussed in this section were integrated into the model as salient beliefs. The discussion on salient beliefs and their role in TPB can be found in Section 2.4. The constructs are categorized according to their domain of origin. Detailed literature on the constructs can be found in Chapter 2.

Technology Acceptance Beliefs

As discussed in Section 2.1.1, functionality and usability have consistently showed strong effects on intentions. Thus functionality and usability were integrated into the model as *perceived usefulness* and *perceived ease of use*.

Perceived Usefulness: In G2C context, *perceived usefulness* of using an e-government service is the extent to which a citizen believes, using the e-government service would enhance her efficiency. The effect of PU on attitude had empirically been shown by [1]. Hence, the following:

†Due to practical reasons regarding data collection these two hypotheses could not be tested in this study.

H5 Perceived Usefulness of an e-government service will have a positive effect on the attitude toward the use of e-government service.

Perceived Ease of Use: Perceived ease of use in G2C setting, pertains to how much a citizen believes the use of an e-government service will be free of effort. [1] has shown that PEU influenced intentions over attitudes. Based on this, the following is proposed:

H6a Perceived Ease of Use of an e-government service will have a positive effect on the attitude toward the use of e-government service.

Bandura's self efficacy forms the basis of both PBC in TPB [4] and PEU in TAM [1], therefore the two constructs are theoretically connected. In other words, both constructs relate to a reduction in the amount of effort required. Thus the following was proposed:

H6b Perceived Ease of Use of an e-government service will have a positive effect on the perceived behavioral control of the e-government service.

Trust Beliefs

Party Based Trust: The party based trust in G2C setting refers to trust in the government institution providing the e-government service. This construct is referred to as Trust in Government (TG) [11]. Trust plays a role in the attitudes of the citizens by enhancing their expectations of the outcomes. [14] formulates attitudes as a factor of outcome expectations and outcome values. Thus by manipulating expectations it is possible to manipulate attitudes. The role of party based trust on attitudes has been empirically shown in [19] for e-commerce setting.

H7a Trust in government will have a positive effect on the attitude toward the use of e-government service.

Trust has generally been known to reduce the perceived complexity of a transaction [10]. The reduced complexity could translate into increased perceived control over the situation.

H7b Trust in government will have a positive effect on the perceived behavioral control of using an e-government service.

Institutional Trust: Institutional trust refers to a perception of safety caused by the environmental conditions – structural assurances and situational normality – surrounding the transaction. The environment in which the transactions take place in G2C settings is generally the internet. Thus this construct was named Trust in Internet. The proposed hypothesis for *trust in government* were based on the nature of trust itself and are expected to hold for *trust in internet* also.

H8a Trust in internet will have a positive effect on the attitude toward the use of e-government service.

H8b Trust in internet will have a positive effect on the perceived behavioral control of using an e-government service.

Beliefs on Local Factors

Skills: Skills construct refers to the ability of a person to use technology. As laid out in [24], the perceived behavioral control construct is a unitary construct combining self efficacy and locus of control. Beliefs of a citizen regarding her abilities to use a technology, directly relates to the self-efficacy and should have an effect on PBC.

H9 Having the *skills* to use a computer will have a positive effect on the perceived behavioral control of an e-government service.

Access: Access construct refers to how easily a person can *access* technology. Beliefs of a citizen regarding his capacity to *access* technology, directly relates to the locus of control and should have an effect on PBC.

H10 Having *access* to computers will have a positive effect on the perceived behavioral control of an e-government service.

3.2 The Setting of the Study and Instrument Development

The student loans service of "higher education student loans and accomodation association" (KYK) was chosen to validate the model. This service was a G2C service geared towards students. This decision was based on the readily available student sample at hand. KYK is the governmental body responsible for the dormitory accommodation and student loans provided by the government in Turkey. The association provides several services related to its field. In order to to narrow down the scope, only the loan services were investigated. Two types of loans are provided by the association, one paying part of the tuition fee and the other as a direct contribution to the student herself. The students can *access* loan announcements, inquire on their loan id's, payment and payback details through the KYK website.

Ajzen, being disturbed by the flaws in the implementations of his theory in the literature wrote a guideline on the TPB instrument development [24]. In this study, the measurement instrument was developed in accordance with Ajzen's suggestions. The measures employed in this study were drawn from the literature and adopted into the study to fit the context of the study and the requirements of TPB. Table 3.1 shows the sources for items included in the study. Items for predictor variables[2] were adopted from [12]. Items for technology acceptance were adopted from [1], the trust items were adopted from [9] and local factors items were adopted from [11].

Ajzen points out that arbitrarily combining items from various studies might harm the internal consistency of the model. To prevent this, the compatibility

[2]Intention, attitude, subjective norms, perceived behavioral control

Table 3.1: Items Used in Instrument and Their Sources

Measurement Items	SOURCE
Predictor Variables	Ajzen, 2002 [12]
Technology Acceptance	Davis, 1989 [1]
Trust	McKnight et. al., 2002 [9]
Local Factors	Carter and Weerakkody, 2008 [11]

of the items in the study was ensured by structuring them to reflect a specific behavior defined in terms of Target, Action, Time and Context (TACT) as suggested by Ajzen. The behavior in question in our study was defined as: "Using the kyk.gov.tr web page to get loan payment details during the semester". All predictor variable items were rewritten to reflect this behavior. Since the items for salient beliefs were to be integrated into the model as belief composites they had to be rewritten to be compatible with TPB belief composites. This required writing two separate questions for each item, one measuring the likelihood and the other measuring the impact of the occurrence described by the item, as discussed in Section 2.4. In accordance with Ajzen's guidelines, two separate trust measures were developed for each trust belief, one for behavioral beliefs and one for control [24].

Five point likert scales were employed for all items, with 1 denoting a negative answer and 5 a positive answer. The items were presented to the respondents in random order to reduce the effects of method halo [29]. The questionnaire also collected basic demographic data through 5 questions. The resulting items were reviewed to ensure that the meaning was preserved through adoption and translation to Turkish. In the end of the instrument development, a total of 81 questions, including the demographic items, were in the first version of the questionnaire. As suggested in [24, 30], multiple questions for each variable were developed which were then refined through the pilot study.

Apart from the questionnaire, the instrument also included a familiarization

task. The familiarization task was only applied to respondents without prior experience with the KYK web site to acquaint these users with the site. The task consisted of simple discovery tasks to familiarize the user to KYK and e-services provided by KYK and detailed descriptions of each key e-services. The final state of the instrument can be found in the Appendix Appendix C:.

Since our research involved human participation for the data collection phase the approval of the Practical Ethics Research Board at the Middle East Technical University has been taken (See Appendix Appendix B:))

3.3 Data Collection and Analysis

This section details the methods used for data collection and analysis.

3.3.1 Pilot Study

A pilot study was conducted to test and refine the measurement instrument on a convenience sample of fifty people and thirty-two valid responses were acquired (response rate 64%). The pilot data was analyzed to see if there was any difference between the respondents that had previous experience with the system and the ones that had not. Welch's two sample T-test was used with a confidence interval of ninety-five percent on all items in the scale. None of the items showed a statistically significant difference, so the two samples were statistically the same. This meant that the responses from people with no prior experience with the system could be used in analysis.

Cronbach's alpha was calculated for the questionnaire items to test the internal consistency of the items measuring the same construct. According to [31] a factor loading between seventy to eighty percent, points to a good internal consistency whereas a loading above eighty percent indicates an excellent internal consistency. The α tests revealed that all constructs except for one had alpha values above seventy percent, revealing that all constructs had good internal con-

sistency. The instrument was refined to increase the α values, after which nine items were removed from the instrument.

Factorial validity could not be assessed at pilot study stage because of the sample size requirements [32].

The questionnaire was altered to eliminate any possible misunderstandings due to wording. Description of some tasks and minor wording details in survey items have been altered according to the feedback from the subjects. The items reducing the α value of their constructs were also removed, leaving 63 questions in the questionnaire.

3.3.2 Data Collection

The altered instrument was administered to 392 people on-line over a period of two months. The sample consisted of under-graduate, graduate students and university graduates – the target audience of the KYK web services. The instrument was administered seperately to the graduate students and the rest via different medium. For the graduate students, the instrument was filled as part of their class activirty. The respondents were not given any credits for this and the participation was voluntary. The rest of the participants received the instrument through facebook social networking application. Average response rate was 55.1% and a total of 216 valid responses were returned. Out of 216 respondents 145 were female, 71 male. The age of respondents ranged from 18 to 32 with a mean of 22.47 and a median age of 21. 32% of the respondents reported an average daily internet use of 1-3 hours, followed by 25% with a daily internet use of 7 hours or more. 32% of the respondents reported that they did not use any services over the internet whereas 53% reported that they used internet to use e-government services. Of the 216 respondents 65% reported previous use of the KYK services.

3.3.3 Data Analysis

Among the various methods of analysis, the second generation multivariate tools (SEM, PLS-PM) are steadily becoming the norm in IS. Gefen et. al. conducted a review of articles published in the three major journals of IS domain and concluded that the use of second generation techniques had been increasing since 1990's [33]. This is due to some clear advantages second generation techniques hold over the first generation techniques (multiple regression, PCA, cluster analysis). These advantages can be listed as:

- Previous knowledge can be incorporated into the analysis for confirmatory purposes.
- Unobservable constructs and abstract concepts can be modeled
- Measurement errors can be accounted for in the model.

The best part is that all these can be done in a single run of the analysis (in contrast to multiple runs in multiple regressions analysis). The model developed in this study is based on abstract constructs based on prior theory, furthermore these constructs are interlinked - making the first generation tools impractical. Thus the use of these second generation multivariate tools was most appropriate for the model at hand.

Structural Equation Modeling Procedure and Requirements

A brief introduction to the second generation multivariate tools and their requirements have been made in this section. The second generation multivariate tools generally go under the name of Structural Equation Modelling (SEM). SEM analysis is described as a cross between factorial analysis and path analysis because it is based on two models. A measurement model – akin to confirmatory factor analysis (CFA) – with manifest variables[3] (MV) is used to estimate latent

[3]The items in a questionnaire for example.

variables[4] (LV) which in turn will be used in the structural model to estimate the relations among these LVs – the path analysis [32].

There are two types of SEM, covariance based and partial least squares (PLS) based SEM, both of which can currently be carried out in R statistical computing environment [34]. Covariance based SEM with maximum likelihood (ML) estimation can be carried out by the sem package [35] and PLS based SEM can be carried out by pls-pm package [36]. The covariance based SEM provides results generalizable to the population whereas the results of PLS based SEM –also referred to as PLS path modelling (PLS-PM)– are more geared towards making predictions based on the data. The values for paths can be fixed in covariance based SEM whereas PLS-PM provides no such functionality. Despite its statistical powers, the covariance based SEM is also more stringent in comparison to PLS-PM in terms of requirements. A typical SEM analysis is generally conducted in seven steps [32] and each step comes with several unique requirements that have to be met.

The first step in SEM analysis is the model specification. The model is specified by formulating the hypothesized relations based on previous theories. This step is carried out in section 3.1 of this study. It is crucial to base the analysis on the previous theory due to the confirmatory nature of the technique. The relationships in SEM do not imply causality, and without theoretical support no inferences can be made about the relations. A model can be represented either as a list of equations or a path diagram but the path diagram is generally preferred due to the communicative power. A simple SEM path diagram can be seen in Figure 3.2. The LVs are generally depicted in the path diagrams as circles or ellipses whereas the MVs are depicted as squares or rectangles. Arrows indicate relations among these variables but these relations do not necessarily imply causality. The arrows tagged with β form the structural model whereas the arrows tagged with λ form the measurement model. The direction of arrows in the measurement model indicate the type of relationship between MVs and LV. If the arrows in the

[4]Abstract concepts such as emotions, which are not directly measurable.

measurement model originate from LV, then the MVs are said to be reflective – reflecting upon the effects of a common factor – else, the MVs are formative – forming a common factor.

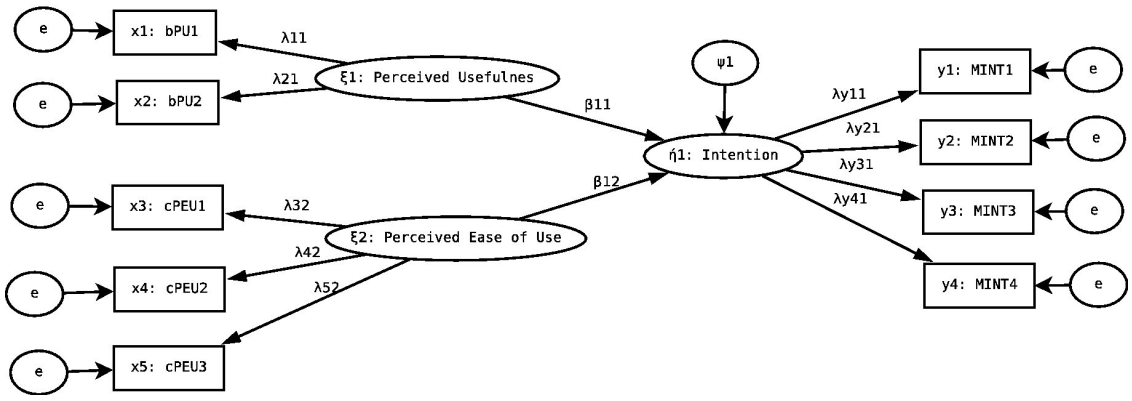

Figure 3.2: A Simple SEM Path Diagram

Second step in covariance based SEM is the model identification. For a model to be analyzable, it shall be over-identified [30]. A model is over-identified when the data provides more information then the information being estimated. In practical terms, the number of data items[5] must be higher than the number of parameters to be estimated[6] [32]. Having at least three MVs for each LV is a useful heuristic to ensure model identification [30]. Models in PLS-PM are always identified and model identification is not an issue in PLS-PM.

Third step is related to the data requirements. Structure of data, sample size, multicollinearity, normality, missing data are all factors in SEM.

Sample size requirements vary according to the type of SEM analysis to be implemented. The sample size requirements for covariance based SEM are also much higher in comparison to PLS based SEM. That is the reason why PLS-PM is referred to as poor man's SEM. Recommended sample size for covariance based

[5]The number of correlations in the correlation matrix

[6]Error variances and factor loadings, etc.

SEM is 10-20 observations per parameter to be estimated, with a bare minimum of 150 cases whereas PLS-PM requires only 10 observations per parameters to be estimated in the most complex construct alone with a recommended minimum of 45 [33]. PLS-PM with sample sizes as low as 6 has been used in the literature [37].

Multicollinearity disrupts both methods. Strong correlations (>.85) among items cause redundancy and as a result unreliable path loadings [32]. While not effecting the overall fit or the prediction power of a model, multi-collinearity might blur the relationships among constructs. This issue can be lessened in PLS-PM through the use of PLS regression on the prediction of path coefficients [37].

ML estimation, the defacto standard in covariance based SEM, is known to be problematic with non-normal data [33, 32]. The data must be multivariate normal for SEM using ML estimation whereas PLS based SEM is known to be more robust against deviations from normality.

The covariance and correlation matrices used in both types of SEM cannot be computed in the existence of missing data. The missing data should either be removed or imputed before the analysis.

The fourth step is the estimation of the model using the statistical software. The type of estimator (ML, LS, PLS, ULS, etc...) to used is based on the whether the structure of the data was normal or non-normal. At this step, the measurement model is analyzed with CFA with the chosen method of estimation to ensure factorial validity[7] of the model and proper adjustments are made to the measurement model to increase factorial validity. Some researchers also suggested using EFA for a deeper understanding of data structure [38].

Fifth step is to review the model fit and interpret the results. The model is reviewed to ensure the strength of path loadings are satisfactory, the predictive power of the model is strong and the fit indice for the overall model is good. Unfortunately, the goodness of fit indices (GFI) are not as common in PLS-PM

[7]The items load together highly only on the factor proposed, a combination of convergent and discriminant validity.

as in covariance based SEM but when all MV are taken as reflective a GFI can be used.

Sixth step is to modify the model to increase the model fit, path coefficients and explanatory power. Some researchers argue against this on the basis of loosing theoretical support. If the modification indices are followed blindly, disregarding previous theory, this might lead to conclusions that are specific to data at hand. Thus in this stage any modifications shall be firmly supported by theory.

Seventh step is comparison of alternate models. The alternate models based on plausible theory are tested and compared to the proposed model. The strength and significance of paths, the total variance explained by each model and the goodness of fit indices are compared.

The results of statistical methods discussed in this chapter are provided in Chapter 4.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter presents the results and discussion of the statistical analyses conducted on the data. The seven step SEM procedure discussed in Section 3.3.3 has been followed in analyzing the data. The model specification step had been carried out in 3.1 and the use of PLS-PM removed the necessity of model-identification. Section 4.1 contains the analyses conducted to ascertain if the data met the requirements of SEM and continues the SEM conduct from step three. The actual results of estimation was provided in Section 4.2. The modifications to the model and the estimation of the parameters of this new model are discussed in Section 4.3 and Section 4.4. The comparison of alternate models had been carried out in Section 4.4.4. The final section of this chapter (Section 4.5) sums up the final model and discusses the results. Model identification step is skipped since the data discussed in Section 4.1 was unsuitable for covariance based variation of SEM.

4.1 General Properties of the Data

After the data collection stage the data was imported into R statistical computation environment [34] for analysis. The first step was to remove the outliers since outliers are known to have serious adverse effects in SEM [32]. The detection of

outliers was carried out as follows: a script written by the author detected cases where all items had the same value. This process revealed four outliers which were removed from the dataset.

$$Skewness = \left[\frac{\sqrt{n \times (n-1)}}{n-2}\right] \times \frac{m_3}{m_2^{\frac{3}{2}}} \quad \text{(Equation 4.1)}$$

$$Kurtosis = \left[\frac{(n-1)(n+1)}{(n-2)(n-3)}\right] \times \frac{m_4}{m_2^2} - 3\left[\frac{(n-1)^2}{(n-2)(n-3)}\right] \quad \text{(Equation 4.2)}$$

Figure 4.1: Formulas for calculation of critical values for skewness and kurtosis

Once the outliers had been removed the data was tested for normality. The skewness and kurtosis values (see Table 5.1) generally indicated a negatively skewed leptokurtic distribution for most of the items. The critical value of skewness is 0.34 and kurtosis is -0.54 for low bound and 0.79 for high bound. Standard formulas were used for the calculation of critical values. These formulas can be found in Figure 4.1[1]. These values are for a sample size of 200 at 0.05 significance level. Skewness and kurtosis values of all items were also above critical values for their sample size, proving that the data was not univariate normal. Furthermore, Shapiro-Wilk test for multivariate normality [40] returned a p value smaller than 2.2e-16, which proved that the data was not multivariate normal. The attempts to transform data into normality failed.

There were two options for the missing data, (1) excluding the cases with missing values – and loosing precious sample size – or (2) imputing the missing values. The sample size for the original data after the removal of outliers was 212, once the cases with missing values were excluded this sample size fell to 172. Due to sample size concerns related to covariance based SEM; the data was imputed using MICE package in R [41]. Multivariate imputations by chained equations (MICE) has been shown to perform better than regression based imputation

[1] At least one formula should be provided in theses writen in latex as suggested in [39]

methods in [42]. T-test values for bootstrap samples indicated that imputed and missing values excluded data was not statistically different. We ran all the tests including SEM analysis on both imputed and missing values removed data.

The correlations among items and constructs were inspected to check for multi-collinearity. As suggested in [43, 44] the correlation matrix of the raw data is provided in Appendix Appendix F:. Upon inspecting the table, strong correlations (>.85) were observed among attitude items 1 and 2 and Intention items 1 and 3. These strong correlations might cause redundancy in the future steps but are not enough to seriously influence the results. The rest of the items had mild correlations among items of the same measurement group (e.g., among behavioral belief items, among predictor variable items). It has been infered that this was due to the method halo caused by the instrument. If the measurement instrument is inspected, it can be noticed that all the questions share the same sentence structure. This was due to the suggestions of Ajzen [24]. Ideally the correlation among the items should only be based on the latent construct that combines them, yet by formating the sentences to reflect TACT an additional correlation due to the sentence structure comes into existence. This is more evident in the items of the same measurement group since the measurement groups differ with each by what they measure. This means the items in a measurement group shares an even more similar sentence structure, hence the additional correlation. Ajzen probably based his suggestions on the first generation multivariate analysis techniques and never noticed that formating the questionnaire items this way might give way to multicollinearity. Due to the correlations the path loadings in the structural model were blurred. This was more evident in covariance based SEM implementation[2] due to ML estimation scheme. The modifications to the model reduced the effects multicollinearity by minimizing the unwanted correlations.

Exploratory Factor Analysis (EFA) was then applied separately to predictor

[2]The models were tested with both PLS-PM and covariance based SEM, but only the results of PLS-PM were provided.

variable, behavioral belief and control belief items to gain an overall understanding of the data as suggested in [38] but EFA results were not deemed conclusive and were further tested by confirmatory factor analysis (CFA) later on. Even though Principal Component Analysis (PCA) and EFA had been known to produce similar results, true factor analysis with varimax rotation was preferred over PCA because PCA produces higher loadings since it does not separate unique variance from shared variance[45]. According to the kaiser criterion only the factors with eigenvalues above one should be retained. The inspection of the eigenvalues revealed that retaining four factors for predictor variables and control beliefs and five factors for behavioral beliefs were sufficient. These findings were in line with the expectations. Please refer to the scree-plots for the exploratory factor analysis for the factors and their respective eigenvalues(see Figure 4.2).

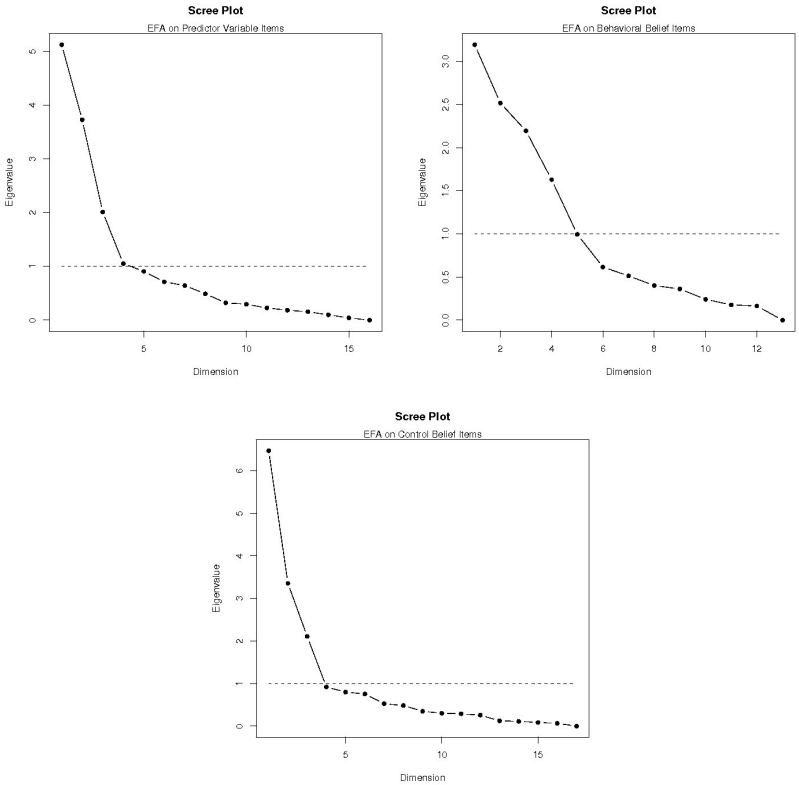

Figure 4.2: EFA: Factors against Eigenvalues

Further inspection of the EFA results were carried out through the factor loading tables. To ease the understanding, the factor loadings below 0.35 were not displayed and the loadings of the items to their respective factors are shown in bold. In general a loading above .60 is considered to be strong whereas loadings as low as .40 are deemed acceptable. If an item is loading more strongly to a factor other than the factor it is supposed to load on or if it is loading on multiple factors equally, then the item is deemed weak [45].

Table 4.1: Factor Loadings for Predictor Variable Items

Items	Factor1	Factor2	Factor3	Factor4
INT1	**0.77**			
INT2	**0.61**			
INT3	**0.82**			
INT4	**0.56**		0.46	
ATT1	0.38	0.40	**0.62**	
ATT2	0.43	0.40	**0.74**	
ATT3	0.36		**0.66**	
ATT4	0.66			
SN1	0.38		0.36	**0.39**
SN2			0.49	**0.48**
SN3	0.47			**0.41**
SN4				**0.71**
PBC1		**0.75**		
PBC2		**0.63**		
PBC3		**0.65**	0.36	
PBC4		**0.72**		

The factor loadings for the predictor constructs were mostly in line with the expectations. As can be seen in Table 4.1 all items except ATT4 had strong loadings in their respective constructs. The attitude items had a mild cross

loading on intention. The subjective norm items were seriously cross loading to other factors and had low loadings to their factor indicating problems about factorial validity.

Table 4.2: Factor Loadings for Behavioral Belief Items

Items	Factor1	Factor2	Factor3	Factor4	Factor5
bPU1				**0.53**	
bPU2				**0.61**	
bPEU1			**0.64**		
bPEU2			**0.78**		
bTG1	**0.65**				
bTG2	**0.77**				
bTG3	**0.60**	0.41			
bTG4	**0.52**	0.44	0.38		
bTI1		**0.62**	0.38		
bTI2		**0.64**			
bTI3		**0.69**			
bTI4				0.49	**0.42**
bTI5					**0.86**

The factor loadings for behavioral belief items can be seen in Table 4.2. The results again, reveal that the expected factor structure is pretty much achieved. bTI4 and bTI5 loading into a separate factor is the only evident problem with factor loadings. Upon the inspection of questionnaire items, these two items were found to be the situational normality component of institutional trust and have a different structure than the rest of the items in the construct which accounts for the problems in factor structure.

Table 4.3 reveals two problems in the factor structure. The first problem is the cross-loading of perceived ease of use items. Like subjective norm items, these items also have low loading weights on their corresponding factor. The second

Table 4.3: Factor Loadings for Control Belief Items

Items	Factor1	Factor2	Factor3	Factor4
cPEU1	0.42	0.46		**0.44**
cPEU2	0.38	0.34		**0.72**
cPEU3	0.46	0.35		**0.53**
cTG1		**0.69**		
cTG2	0.36	**0.68**		
cTG3		**0.73**		
cTG4		**0.65**	0.36	
cTG5		**0.70**		
cTI1			**0.56**	0.42
cTI2		0.38	**0.71**	
cTI3			**0.83**	
cTI4	0.67			
cTI5	0.58			0.43
cSK1	**0.71**			
cSK2	**0.68**	0.35		
cACC1	**0.76**			
cACC2	**0.76**			

problem is again with the situational normality items cTI4 and CTI5 which load with local factors instead of institutional trust factor. Except for these two minor problems, the factor structure is as expected.

4.2 Testing the Initial Model with SEM

Section 4.1 laid out the general properties of the data at hand. According to the results, the sample sizes were 172 for complete cases and 212 for imputed data, with non normal distributions, furthermore the correlations among items while not being particularly alarming, were considerable. Based on the data requirements of SEM; the use of PLS based SEM was deemed appropriate. The results of the analysis were validated according to the guidelines laid out in [29]. According to [29] there is an order of precedence among types of validity such that an instrument must first be validated before the internal validity and consequently statistical conclusion validity can be discussed.

The instrument validity in PLS can be assured through investigation of convergent validity, discriminant validity, internal consistency and unidimensional reliability [33]. Internal consistency or reliability deals with the accuracy of measurements of an instrument and has traditionally been measured with Cronbach's α. Ideally a construct should measure one and only one concept, that is the unidimensional validity of the construct. Convergent validity means that the items theorized to form a construct should have a shared communality – like having high correlations with one another – whereas discriminant validity means that the items forming up a construct can be distinguished from items of another construct – like having low correlations with items of other constructs.

The hypothesized model discussed in Section 3.1 was tested initially, both with imputed and original data. There were small differences between the two results and since the sample size of 172 of the non imputed data was enough for PLS-PM analysis the results of non imputed data were provided. All manifest variables used in this model were reflective and factorial fitting scheme was used

with standardized values in estimations. Please refer to Figure 4.3 for a path diagram of the proposed relations among constructs.

4.2.1 Instrument Validity

Table 4.4: Unidimensionality and Reliability Measures for the Initial Model

Constructs	MVs	eig.1st	eig.2nd	α
cACC	2	1.76	0.23	0.87
cSK	2	1.72	0.27	0.84
cTI	5	3.18	**0.79**	0.86
cTG	5	3.55	0.51	0.90
cPEU	3	2.31	0.39	0.85
bTI	5	3.2	**0.71**	0.86
bTG	4	2.96	0.45	0.89
bPEU	2	1.72	0.27	0.84
bPU	2	1.65	0.34	0.79
PBC	4	2.92	0.41	0.88
SN	4	2.55	0.53	0.81
ATT	4	3.18	0.43	0.92
INT	4	3.07	0.40	0.90

The reliability measures for this initial model are provided in Table 4.4 along with uni-dimensionality measures. An alpha value above .70 is deemed sufficient for confirmatory research while an alpha value greater than .95 would signal unwanted correlations [33]. All constructs had α values above 0.70 and below 0.95 meaning that the items measured the construct reliably [31]. In PLS-PM package the unidimensional reliability is measured through a simple factor analysis. If the analyzed set of items are uni-dimensional, then the first vector would have high

eigenvalues and the eigenvalue of the second vector would be smaller than one [46]. The eigenvalue of second vector has consistently been found to be below 1 for all constructs, indicating a unidimensional structure for every construct. The institutional trust items were in fact composed of two sub-components – situational normality and structural assurances – and this was evident in the relatively high second vector values.

Table 4.5: Correlations among latent variables and AVE values for initial model

	cACC	cSK	cTI	cTG	cPEU	bTI	bTG	bPEU	bPU	PBC	SN	ATT	INT
cACC	1.00	0.74	0.71	0.57	0.70	0.53	0.42	0.38	0.52	0.35	0.24	0.31	0.28
cSK	0.74	1.00	0.70	0.60	0.66	0.57	0.49	0.48	0.53	0.37	0.26	0.32	0.32
cTI	0.71	0.70	1.00	0.68	0.73	0.76	0.54	0.50	0.60	0.34	0.22	0.30	0.25
cTG	0.57	0.60	0.68	1.00	0.68	0.61	0.73	0.60	0.56	0.28	0.19	0.25	0.23
cPEU	0.70	0.66	0.73	0.68	1.00	0.55	0.57	0.62	0.63	0.40	0.22	0.29	0.23
bTI	0.53	0.57	0.76	0.61	0.55	1.00	0.75	0.69	0.67	0.19	0.17	0.30	0.26
bTG	0.42	0.49	0.54	0.73	0.57	0.75	1.00	0.72	0.64	0.17	0.17	0.24	0.19
bPEU	0.38	0.48	0.50	0.60	0.62	0.69	0.72	1.00	0.67	0.27	0.20	0.27	0.24
bPU	0.52	0.53	0.60	0.56	0.63	0.67	0.64	0.67	1.00	0.37	0.27	0.41	0.38
PBC	0.35	0.37	0.34	0.28	0.40	0.19	0.17	0.27	0.37	1.00	0.62	0.73	0.64
SN	0.24	0.26	0.22	0.19	0.22	0.17	0.17	0.20	0.27	0.62	1.00	0.75	0.73
ATT	0.31	0.32	0.30	0.25	0.29	0.30	0.24	0.27	0.41	0.73	0.75	1.00	0.85
INT	0.28	0.32	0.25	0.23	0.23	0.26	0.19	0.24	0.38	0.64	0.73	0.85	1.00
AVE	0.88	0.86	0.63	0.72	0.78	0.64	0.74	0.86	0.83	0.73	0.64	0.80	0.77
$\sqrt{AVE}$	0.94	0.93	0.79	0.85	0.88	0.80	0.86	0.93	0.91	0.86	0.80	0.89	0.88

According to [33] the convergent and discriminant validity is shown when each construct's AVE is larger than it's correlation with other constructs and should be larger than 0.50. How larger AVE should be in comparison to the correlations is a matter of debate however, [43] suggests that the square root of AVE value should be much larger than the correlation values. In our data, the trust constructs and subjective norms construct proved to be problematic. The same items also proved problematic in EFA in Section 4.1 so these results were not surprising. Examining Table 4.6 which shows the standardized loadings of manifest variables (MV) on latent variables (LV) also reveals similar results. [47] posited additional constraints on both convergent validity and discriminant validity. Convergent validity is shown when each item's loading on their respective latent construct is significant. As can be seen in Table 4.6 this criteria is clearly satisfied in the

instrument developed. The same article also posits an additional rule to be met in order to ascertain the discriminant validity: The measurement items should load strongly on their own construct and have weaker loadings on other constructs. Unfortunately the items mentioned before fail to meet this criteria, as a result we cannot ascertain that the items measure just one construct.

Table 4.5 also reveals a disturbing fact about the data. There are strong correlations in the data. The correlations between intention and attitude and behavioral and control belief variants of trust constructs signal redundancy. In the existence of redundancy one of the factors might lessen the effect of the other that highly correlates with it.

The issues related to trust constructs were also evident in the high correlations among trust items of the same trust type. For example since both bTG and cTG are measuring the party based trust construct on behavioral and control beliefs, it is only natural that these two constructs correlate. Another reason specific to institutional trust constructs is related to situational normality sub-component of this construct having correlations with items from other constructs (Please refer to Table 4.6). Inspection of the instrument reveals that the wording of situational normality items were similar to PEU items. As for situational normality items, serious cross-loading issues were also evidenced in EFA. Despite being explainable, these results were not acceptable and were dealt with in Section 4.3.

4.2.2 Model Validity

The problems with instrument validity discussed in section 4.2.1 put all results discussed in this section in question but the results will be provided briefly for reference. The model fit indices are used to asses how well the model explains the data. While more common in covariance based variation, a goodness of fit (GOF) indice is also available in pls-pm if the MVs are reflective. The relative goodness of fit for the overall model was 0.77 which is below the acceptable threshold of 0.80. Low GFI values indicate that the model fails to explain strong relations in

Table 4.6: Standardized Loadings of Manifest Variables on Latent Variables in the Initial Model

	cACC	cSK	cTI	cTG	cPEU	bTI	bTG	bPEU	bPU	PBC	SN	ATT	INT
cACC1	**0.92**	0.65	0.68	0.52	0.63	0.51	0.39	0.37	0.49	0.28	0.13	0.23	0.20
cACC2	**0.96**	0.73	0.67	0.56	0.69	0.49	0.41	0.35	0.51	0.38	0.31	0.34	0.32
cSK1	0.71	**0.95**	0.66	0.55	0.63	0.51	0.42	0.42	0.46	0.39	0.29	0.34	0.33
cSK2	0.67	**0.91**	0.65	0.58	0.6	0.56	0.53	0.5	0.53	0.3	0.2	0.25	0.26
cTI1	0.50	0.47	**0.82**	0.58	0.62	0.6	0.42	0.42	0.44	0.31	0.22	0.29	0.22
cTI2	0.48	0.54	**0.82**	0.61	0.50	0.72	0.47	0.42	0.46	0.27	0.15	0.29	0.25
cTI3	0.47	0.51	**0.79**	0.54	0.43	0.71	0.45	0.37	0.39	0.16	0.08	0.18	0.15
cTI4	0.66	0.61	**0.76**	0.41	0.57	0.51	0.35	0.35	0.52	0.29	0.19	0.19	0.2
cTI5	0.70	0.66	**0.79**	0.61	0.74	0.56	0.51	0.44	0.57	0.29	0.21	0.22	0.17
cTG1	0.50	0.53	0.54	**0.84**	0.63	0.52	0.68	0.55	0.53	0.23	0.13	0.15	0.15
cTG2	0.54	0.52	0.56	**0.83**	0.53	0.51	0.62	0.44	0.47	0.23	0.18	0.24	0.23
cTG3	0.45	0.49	0.59	**0.86**	0.54	0.52	0.62	0.51	0.45	0.26	0.18	0.27	0.27
cTG4	0.49	0.49	0.63	**0.84**	0.61	0.51	0.59	0.48	0.49	0.24	0.15	0.22	0.18
cTG5	0.47	0.52	0.60	**0.86**	0.57	0.54	0.61	0.56	0.46	0.25	0.17	0.19	0.17
cPEU1	0.64	0.62	0.61	0.63	**0.85**	0.45	0.50	0.48	0.48	0.33	0.21	0.26	0.2
cPEU2	0.61	0.52	0.66	0.58	**0.89**	0.50	0.52	0.61	0.58	0.36	0.19	0.25	0.19
cPEU3	0.61	0.61	0.68	0.60	**0.90**	0.52	0.50	0.55	0.61	0.37	0.19	0.27	0.23
bTI1	0.38	0.39	0.63	0.56	0.47	**0.84**	0.68	0.65	0.56	0.15	0.13	0.27	0.21
bTI2	0.33	0.37	0.60	0.50	0.43	**0.87**	0.68	0.60	0.58	0.14	0.1	0.27	0.24
bTI3	0.40	0.44	0.62	0.48	0.45	**0.81**	0.56	0.40	0.44	0.13	0.13	0.26	0.2
bTI4	0.60	0.60	0.66	0.44	0.45	**0.75**	0.52	0.51	0.60	0.21	0.16	0.22	0.2
bTI5	0.50	0.57	0.57	0.50	0.42	**0.73**	0.61	0.65	0.55	0.17	0.19	0.16	0.21
bTG1	0.35	0.44	0.46	0.59	0.45	0.65	**0.85**	0.59	0.60	0.11	0.07	0.14	0.12
bTG2	0.35	0.38	0.45	0.61	0.48	0.58	**0.85**	0.59	0.58	0.23	0.19	0.22	0.13
bTG3	0.44	0.47	0.52	0.68	0.50	0.70	**0.89**	0.65	0.53	0.13	0.18	0.26	0.23
bTG4	0.31	0.43	0.44	0.63	0.53	0.69	**0.85**	0.69	0.53	0.12	0.14	0.18	0.16
bPEU1	0.31	0.48	0.47	0.54	0.55	0.63	0.66	**0.91**	0.59	0.24	0.18	0.21	0.21
bPEU2	0.39	0.44	0.47	0.57	0.60	0.66	0.69	**0.95**	0.66	0.27	0.20	0.29	0.24
bPU1	0.53	0.51	0.56	0.52	0.52	0.66	0.60	0.68	**0.90**	0.32	0.22	0.36	0.37
bPU2	0.44	0.46	0.54	0.51	0.63	0.57	0.57	0.56	**0.92**	0.36	0.28	0.39	0.33
PBC1	0.31	0.36	0.29	0.21	0.33	0.16	0.11	0.23	0.29	**0.88**	0.54	0.65	0.53
PBC2	0.25	0.25	0.25	0.20	0.30	0.14	0.13	0.21	0.30	**0.82**	0.52	0.61	0.54
PBC3	0.31	0.34	0.29	0.23	0.33	0.14	0.10	0.18	0.34	**0.86**	0.58	0.71	0.61
PBC4	0.35	0.33	0.34	0.33	0.40	0.22	0.25	0.33	0.35	**0.86**	0.51	0.57	0.53
SN1	0.18	0.22	0.21	0.19	0.17	0.18	0.19	0.24	0.21	0.51	**0.80**	0.64	0.61
SN2	0.19	0.19	0.20	0.11	0.16	0.16	0.17	0.14	0.20	0.49	**0.79**	0.67	0.58
SN3	0.27	0.26	0.16	0.22	0.23	0.11	0.14	0.14	0.24	0.46	**0.77**	0.53	0.58
SN4	0.16	0.18	0.14	0.09	0.16	0.09	0.07	0.12	0.23	0.55	**0.83**	0.59	0.58
ATT1	0.25	0.25	0.24	0.22	0.20	0.22	0.18	0.19	0.34	0.70	0.68	**0.91**	0.74
ATT2	0.33	0.32	0.27	0.24	0.30	0.27	0.21	0.26	0.40	0.71	0.70	**0.94**	0.78
ATT3	0.22	0.21	0.26	0.17	0.21	0.26	0.19	0.22	0.34	0.62	0.65	**0.88**	0.70
ATT4	0.32	0.34	0.30	0.27	0.32	0.32	0.27	0.30	0.39	0.62	0.68	**0.85**	0.80
INT1	0.22	0.26	0.14	0.19	0.18	0.16	0.14	0.14	0.32	0.52	0.66	0.73	**0.90**
INT2	0.27	0.28	0.19	0.16	0.13	0.22	0.14	0.23	0.29	0.52	0.61	0.67	**0.83**
INT3	0.28	0.31	0.25	0.22	0.25	0.24	0.17	0.22	0.33	0.60	0.65	0.78	**0.92**
INT4	0.24	0.29	0.29	0.26	0.25	0.29	0.23	0.25	0.41	0.62	0.66	0.80	**0.86**

the data. The model must be modified in order to increase the model fit.

[43] posited that the GOF indices alone were not representative of the model's validity alone and that the model's predictive power (R^2) and explanatory power (path coefficients) should also be discussed to evaluate a models validity.

The R^2 value for this initial model was 0.74 but this finding suffered from instrumental validity issues and could not be deemed conclusive.

Figure 4.3 shows the path coefficients among latent variables and standardized loadings of MVs on LVs. As can be seen, the measurement model fits perfectly whereas path coefficients for some LVs in the structural model are too low to be deemed meaningful. Especially the trust constructs have low effects contrary to the expectations. It has been inferred that the problems with the path coefficients might be due to the effect of various constructs overloading each other out due to multicollinearity and redundancy. These problems have been dealt with in Section 4.3.

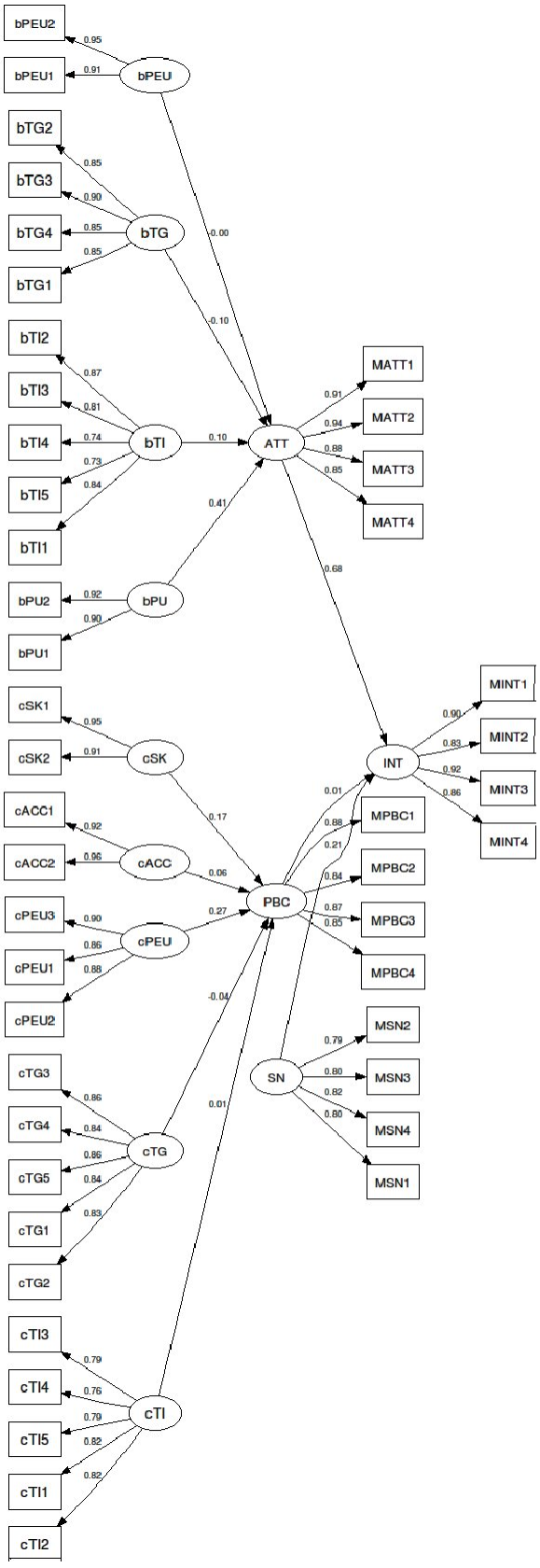

Figure 4.3: Path Diagram of the Initial Model, using non-imputed data

4.3 Model Modification

The initial model tested in Section 4.2 suffered from instrument and model validity issues and was unfit for use in a scientific study. The standard procedure in SEM studies involve formulating a model based on theory and modifying this model based on modification indices and other indicators of relations in data [32]. The key to model modification is not to loose the theoretical support of the model by following the fit indices blindly, disregarding the previous theory. The initial model was modified iteratively, making one change at a time and observing the effect of changes in the model fit, R^2, bootstrap t-test results and path loadings. Each iteration was backed with proper reasoning based on theory or logical reasoning. This approach was similar to the ones suggested in [38, 30]. After 16 iterations the following changes were applied to the final model. Figure 4.4 shows the path diagram of this final modified model.

4.3.1 Measurement Model

The first step of modification in this study was the modification of the measurement model to minimize unwanted correlations among LVs. This was achieved by removing or combining problematic items in the measurement model.

The EFA results in Table 4.1 and EVA values in Table 4.5 indicated that the measures for subjective norms construct were problematic. The removal of the problematic items left subjective norms construct with a single manifest variable and even then the goodness of fit index was sub-par, thus the complete removal of subjective norms construct was decided. The same results also pointed that the fourth item of attitude construct did not load as expected on the attitude construct, thus this item was removed from the measurement model.

The EFA results in Table 4.2, Table 4.3 and EVA values in Table 4.5 indicated that situational normality sub-component of institutional trust construct loaded stronger with other items. The removal of the fourth and the fifth manifest variables improved the AVE value of institutional trust considerably.

Another modification to the measurement model was the integration of skills and access constructs into the higher order local factors construct. As is evident in the EFA in Table 4.3 these two items loaded strongly together. Both skills and access constructs measure the perceptions of people towards the use of computers. Since computer skills and access to computers is a factor of the socio-cultural strata and the position in digital divide, this common factor was named local factors.

4.3.2 Structural Model

After the modifications to the measurement model, there were modifications to be made to the structural model.

The first modification was linking perceived usefulness and perceived ease of use constructs of behavioral beliefs. This modification was made in accordance with suggestions on the previous literature on TAM which stated that perceived ease of use was often mediated through perceived usefulness [33, 1].

The second modification was to gather all trust constructs under a single trust construct and linking this trust construct to other endogenous latent variables in order to test the theoretical connections listed in the Section 3.1. Table 4.5 shows that the trust constructs had high correlations among themselves. Some amount of correlation can be due to the shared latent variable (Trust) which was not included in the initial model. Also there were two variants (one for behavioral and one for control beliefs) for both party based and institutional trust in line with the suggestions of Ajzen [24]. Not mediating the effects of different trust types by a common latent variable (Trust) caused the trust types to overload each others' effects. By including two variants in separate latent variables this was taken even further by mediating the effects in higher order LVs. The new relation between intention and trust had been used in a variety of e-government adoption studies (See Section 2.1.2). The other relations did not require any changes to the theoretical justifications provided in Section 3.1.

4.4 Testing the Modified Model with SEM

After implementing the above mentioned changes, the modified model was put to the validation procedure laid out in Section 4.2.

4.4.1 Instrument Validity

As seen in Table 4.7, the α values for all constructs were within safe limits and the the eigenvalues of the second vectors were much lower for all items this time. After removal of the situational normality items, the institutional trust construct had improved unidimensionality.

Table 4.7: Unidimensionality and Reliability Measures for the Modified Model

Constructs	MVs	eig.1st	eig.2nd	α
LOC	4	3.03	0.45	0.90
cPEU	3	2.31	0.39	0.85
cTI	3	2.33	0.41	0.86
bTG	4	2.93	0.47	0.88
bPEU	2	1.73	0.26	0.85
bPU	2	1.61	0.38	0.77
TRT	3	2.01	0.63	0.75
PBC	4	2.85	0.45	0.87
ATT	3	2.50	0.33	0.90
INT	4	3.09	0.39	0.90

The modifications to the measurement model paid off in terms of increased AVE values for the problematic constructs as shown in Table 4.8. The AVE value of composite Trust construct (TRT) was relatively low due to the re-use of discarded trust items. This also caused correlations with other trust constructs

but none of the values were alarming. Square roots of AVE values were much higher than the correlations to other items for all items indicating convergent and discriminant validity.

Table 4.8: Correlations Among Latent Variables and AVE Values for the Modified Model

LVs	LOC	cPEU	cTI	bTG	bPEU	bPU	TRT	PBC	ATT	INT
LOC	1.00	0.73	0.62	0.53	0.49	0.64	0.58	0.45	0.39	0.38
cPEU	0.74	1.00	0.62	0.58	0.67	0.68	0.62	0.50	0.35	0.31
cTI	0.62	0.61	1.00	0.53	0.48	0.51	0.78	0.35	0.35	0.30
bTG	0.53	0.58	0.53	1.00	0.67	0.64	0.76	0.22	0.28	0.29
bPEU	0.49	0.67	0.49	0.67	1.00	0.67	0.63	0.35	0.30	0.28
bPU	0.64	0.68	0.51	0.64	0.67	1.00	0.63	0.44	0.45	0.42
TRT	0.58	0.62	0.77	0.76	0.63	0.62	1.00	0.28	0.37	0.36
PBC	0.44	0.50	0.35	0.22	0.34	0.44	0.28	1.00	0.71	0.61
ATT	0.39	0.35	0.35	0.28	0.30	0.45	0.37	0.70	1.00	0.77
INT	0.38	0.32	0.30	0.29	0.27	0.42	0.36	0.60	0.77	1.00
AVE	0.76	0.77	0.78	0.74	0.87	0.81	0.67	0.71	0.84	0.78
$\sqrt{AVE}$	0.87	0.88	0.88	0.86	0.93	0.91	0.82	0.84	0.92	0.88

Table 4.9 shows the item loadings on latent variables. As previously discussed in Section 4.2 high loadings on corresponding construct are indicators of convergent validity whereas low loadings on other constructs are indicators of discriminant validity. As seen in Table 4.9 all items met this criteria.

Table 4.10 shows the bootstrap t-test results for loadings of MV on their respective LV. The bootstraping procedure re-samples the data 200 times with a sample size of 100 and runs the analysis on each sample. This allows to observe various possible subsamples that could have come up in the population from the data at hand. Then the mean values of boot samples are compared to the original sample to see if there is a statistically significant difference. P value indicates how

Table 4.9: Standardized Loadings of Manifest Variables on Latent Variables in the Modified Model

	LOC	cPEU	TI	TG	bPEU	bPU	TRT	PBC	ATT	INT
cSK1	0.89	0.64	0.55	0.44	0.45	0.55	0.52	0.44	0.38	0.39
cSK2	0.84	0.62	0.55	0.57	0.54	0.60	0.55	0.33	0.29	0.30
cACC1	0.87	0.62	0.55	0.43	0.39	0.56	0.48	0.34	0.31	0.28
cACC2	0.90	0.69	0.54	0.44	0.37	0.56	0.49	0.44	0.37	0.36
cPEU1	0.64	0.85	0.53	0.45	0.53	0.50	0.50	0.43	0.30	0.25
cPEU2	0.63	0.89	0.54	0.54	0.65	0.63	0.59	0.44	0.30	0.27
cPEU3	0.67	0.89	0.56	0.52	0.59	0.65	0.54	0.45	0.34	0.32
cTI1	0.54	0.62	0.84	0.45	0.43	0.46	0.64	0.36	0.34	0.29
cTI2	0.57	0.56	0.90	0.48	0.47	0.48	0.73	0.34	0.34	0.28
cTI3	0.54	0.46	0.91	0.47	0.39	0.41	0.69	0.23	0.25	0.22
bTG1	0.46	0.49	0.46	0.87	0.58	0.61	0.64	0.18	0.21	0.20
bTG2	0.45	0.51	0.42	0.85	0.54	0.61	0.58	0.27	0.29	0.23
bTG3	0.46	0.47	0.47	0.85	0.55	0.47	0.70	0.14	0.23	0.29
bTG4	0.45	0.50	0.44	0.86	0.62	0.52	0.67	0.17	0.24	0.26
bPEU1	0.46	0.61	0.44	0.61	0.93	0.61	0.56	0.30	0.24	0.25
bPEU2	0.46	0.65	0.47	0.64	0.94	0.64	0.61	0.34	0.31	0.27
bPU1	0.60	0.54	0.47	0.61	0.60	0.90	0.55	0.36	0.41	0.44
bPU2	0.56	0.68	0.45	0.55	0.61	0.90	0.58	0.42	0.41	0.32
bTI2	0.42	0.46	0.65	0.66	0.59	0.56	0.83	0.19	0.32	0.27
bTI3	0.51	0.49	0.67	0.62	0.44	0.51	0.86	0.18	0.29	0.27
cTG3	0.50	0.58	0.59	0.59	0.52	0.46	0.76	0.31	0.28	0.34
PBC1	0.43	0.41	0.30	0.19	0.27	0.36	0.23	0.88	0.63	0.52
PBC2	0.33	0.40	0.25	0.18	0.29	0.36	0.24	0.82	0.55	0.48
PBC3	0.40	0.43	0.33	0.15	0.28	0.40	0.22	0.86	0.69	0.57
PBC4	0.35	0.44	0.29	0.23	0.33	0.37	0.24	0.83	0.50	0.47
ATT1	0.26	0.26	0.26	0.20	0.21	0.33	0.27	0.65	0.87	0.69
ATT2	0.43	0.38	0.34	0.29	0.32	0.47	0.37	0.68	0.95	0.75
ATT3	0.36	0.31	0.35	0.27	0.28	0.43	0.35	0.61	0.92	0.68
INT1	0.31	0.25	0.19	0.21	0.19	0.35	0.29	0.48	0.66	0.90
INT2	0.35	0.21	0.22	0.21	0.26	0.33	0.25	0.50	0.62	0.84
INT3	0.35	0.33	0.30	0.27	0.26	0.37	0.34	0.56	0.70	0.92
INT4	0.35	0.32	0.32	0.30	0.26	0.42	0.36	0.58	0.73	0.86

likely it is to observe the original data in comparison to the bootstrapped samples. A p value lower than 5% would have indicated that the observation in the original sample was due to change. The results reveal that the loading values were not statistically different between bootstrapped and original data at a 0.95 confidence interval except for the attitude item 2 and the intention item 3. Even those values are reasonably close to the limit.

Table 4.10: Bootstrap validation of Loadings in the Modified Model

MVs	Original	Mean.Boot	Std.Err	T	p
cSK1	0.8861	0.8877	0.0160	1.4115	0.1597
cSK2	0.8391	0.8381	0.0297	-0.4898	0.6248
cACC1	0.8656	0.8642	0.0284	-0.7194	0.4728
cACC2	0.8977	0.8978	0.0180	0.0462	0.9632
cPEU1	0.8544	0.8520	0.0357	-0.9539	0.3413
cPEU2	0.8894	0.8894	0.0192	-0.0312	0.9752
cPEU3	0.8932	0.8917	0.0187	-1.1339	0.2582
cTI1	0.8417	0.8409	0.0363	-0.3252	0.7454
cTI2	0.9002	0.9012	0.0153	0.8887	0.3752
cTI3	0.9086	0.9067	0.0166	-1.6374	0.1031
bTG1	0.8664	0.8660	0.0210	-0.2905	0.7717
bTG2	0.8546	0.8520	0.0302	-1.2033	0.2303
bTG3	0.8492	0.8510	0.0288	0.8858	0.3768
bTG4	0.8590	0.8609	0.0211	1.2991	0.1954
bPEU1	0.9250	0.9248	0.0192	-0.1299	0.8968
bPEU2	0.9390	0.9385	0.0141	-0.5063	0.6132
bPU1	0.8977	0.8982	0.0279	0.2634	0.7925
bPU2	0.9023	0.9015	0.0307	-0.3891	0.6976
bTI2	0.8348	0.8346	0.0315	-0.0811	0.9355
bTI3	0.8640	0.8663	0.0279	1.1601	0.2474
cTG3	0.7565	0.7527	0.0488	-1.0897	0.2772
PBC1	0.8773	0.8766	0.0248	-0.4244	0.6717
PBC2	0.8159	0.8146	0.0328	-0.5517	0.5818
PBC3	0.8576	0.8585	0.0312	0.4172	0.6770
PBC4	0.8297	0.8286	0.0365	-0.4191	0.6756
ATT1	0.8735	0.8731	0.0320	-0.1660	0.8683
ATT2	0.9484	0.9496	0.0082	2.0105	0.0457
ATT3	0.9187	0.9177	0.0201	-0.7379	0.4614
INT1	0.8971	0.8988	0.0178	1.3851	0.1676
INT2	0.8436	0.8419	0.0348	-0.7086	0.4794
INT3	0.9216	0.9235	0.0122	2.1797	0.0305
INT4	0.8583	0.8587	0.0280	0.1845	0.8538

4.4.2 Model Validity

The modifications to the initial model paid off in terms of goodness of fit indice (GFI) values. Please refer to Table 4.11 to see comparative results of various measures of GFI. The relative GFI for this modified model is 0.85, above the acceptable threshold of 0.80. This indicates that the proposed model explains a considerable amount of relations in data. The GFI for the structural model has also improved significantly in this modified model.

Table 4.11: Comparative Goodness of Fit Results

GFI	Initial Model	Modified Model
Absolute	0.53	0.59
Relative	0.77	0.85
Measurement	0.997	0.999
Structural	0.60	0.72

The R^2 value represents the predictive power of the model and the model was successful in predicting the intentions. Table 4.12 lists R^2 values for all endogenous latent variables. The R^2 value of intention for this new model was 0.61. Though seemingly lower than the initial model this result was free of the problems regarding instrumental validity and was conclusive. The final model explains 61% of the variation in the data.

The path coefficients can be seen in both Table 4.13 and Figure 4.4. Path coefficients are similar to regression coefficients in regression analysis; they represent the effect of a latent variable on the target latent variable. In our model for example, a one point change in attitudes would cause 0.67 points change in intentions. Table 4.13 shows the bootstrap validation of path coefficients. According to the results of bootstrap validation, all paths were valid and fit for interpretation.

Table 4.12: R^2 Values for Endogenous Latent Variables.

LV	R^2
INTENTION	0.61
ATTITUDE	0.22
PBC	0.26
TRUST	0.78
PU	0.45

Table 4.13: Bootstrap validation of Path Coefficients in The Structural Model

PATH	Original	Mean.Boot	Std.Err	t.statis	p.value
ATT → INT	0.6655	0.6638	0.0951	-0.2521	0.8012
PBC → INT	0.1122	0.1115	0.0781	-0.1314	0.8956
TRT → INT	0.0813	0.0883	0.0566	1.7409	0.0832
TRT → ATT	0.1612	0.1608	0.0887	-0.0576	0.9542
bPU → ATT	0.4018	0.3993	0.1055	-0.3344	0.7384
bPEU → ATT	-0.0733	-0.0681	0.0855	0.8612	0.3902
bPEU → bPU	0.6721	0.6723	0.0528	0.0549	0.9563
TG → TRT	0.4875	0.4930	0.0431	1.8212	0.0701
TI → TRT	0.5207	0.5164	0.0419	-1.4535	0.1477
cPEU → PBC	0.3650	0.3671	0.0780	0.3833	0.7019
cLOC → PBC	0.1806	0.1880	0.0733	1.4220	0.1566

4.4.3 Model Interpretation

Figure 4.4 shows the path diagram of the modified model. The factor loadings of all manifest variables were strong, indicating a strong measurement model. When interpreting either factor loadings or path coefficients two factors should be considered: (1) Is the loading/path statistically valid? (2) Is the loading/path strong? Bootstrap tests revealed that the factor loadings were statistically significant. The loadings of all manifest variables were strong (>0.80), indicating a strong measurement model.

The bootstrap tests for path coefficients show that the path coefficients were also reliable. It is argued that the path coefficients should be at least 0.10 to account for a considerable amount of variance in the latent variable they relate to. Table 4.14 shows the effect of mediated relations through the indirect effects, direct effects and total effects. The indirect effect size is a factor of all path coefficients between two LVs which are at least two edges apart. The total effects in the table are composed of both direct and mediated relationships among LVs. It can be seen in this table that the paths with small direct effect sizes (<.10) had considerable total effect sizes in the end.

The attitudes had the strongest effect on the intentions as expected. The attitudes was followed by PBC with the second largest direct effect on intentions. As expected, the salient beliefs had the proposed relations with predictor variables. PU was very influential in predicting attitudes. Trust was the second most influential figure in predicting attitudes. TI and TG together explained almost equal amount of variance in trust and explained 70% of it. PEU and LOC played significant roles in predicting PBC.

Interpretation of path coefficients revealed two findings that deviated slightly from the expectations.

Trust seemingly had a minuscule direct effect with a path coefficient of 0.08 on intentions. The effect of trust on attitudes was 0.16. When the effect of trust on intention mediated by attitudes were considered, the total effect size for trust

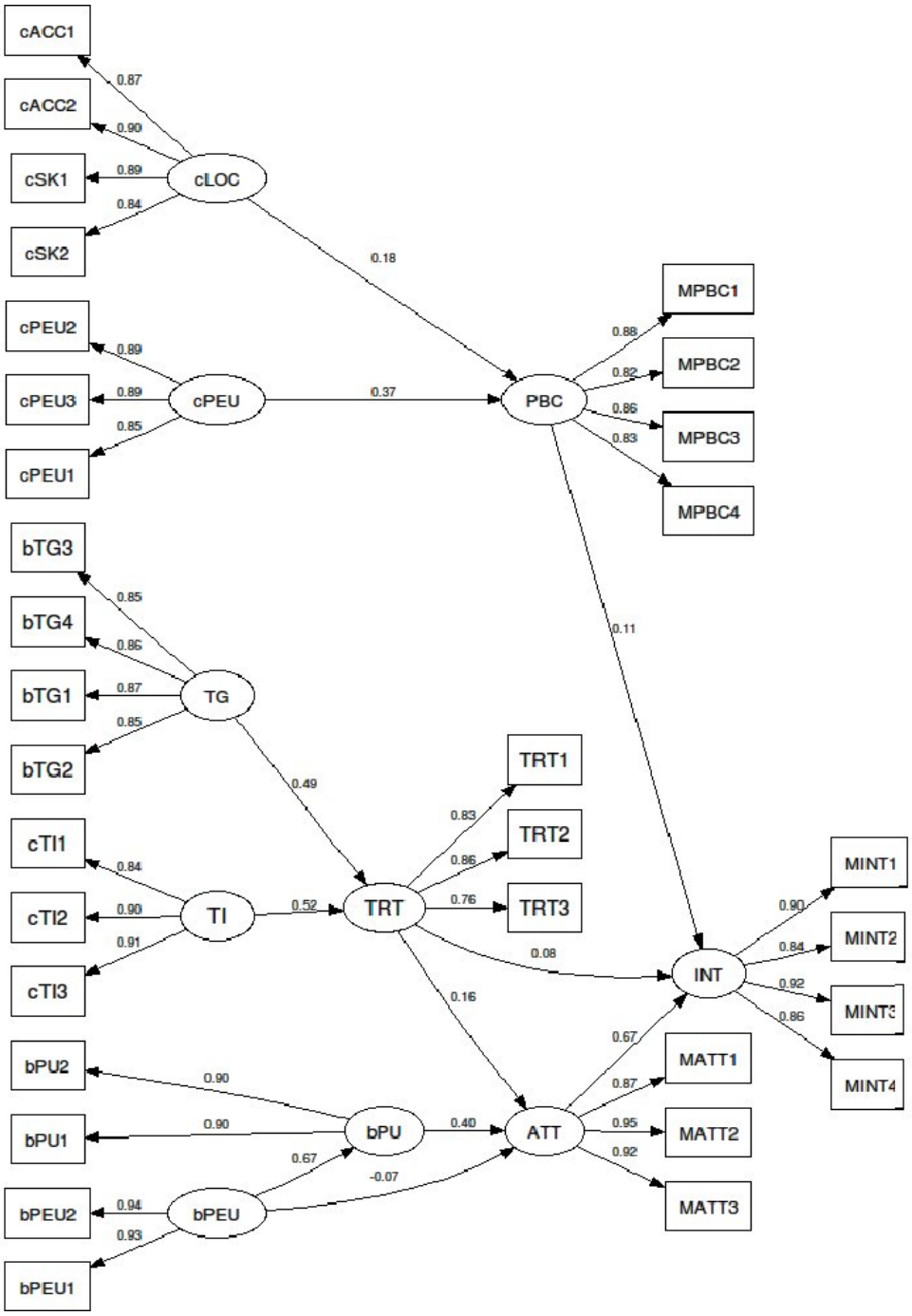

Figure 4.4: Path Diagram of the Modified Model, using non imputed data

Table 4.14: Effect Sizes in the Modified Model

Relationship	Dir. Effects	Ind. Effects	Tot. Effects
ATT → INT	0.67	0.00	0.67
PBC → INT	0.11	0.00	0.11
TRT → INT	0.08	0.11	0.19
TRT → ATT	0.16	0.00	0.16
bPU → ATT	0.40	0.00	0.40
bPU → INT	0.00	0.27	0.27
bPEU → bPU	0.67	0.00	0.67
bPEU → ATT	-0.07	0.27	0.20
bPEU → INT	0.00	0.13	0.13
TI → TRT	0.52	0.00	0.52
TI → ATT	0.00	0.08	0.08
TI → INT	0.00	0.10	0.10
TG → TRT	0.49	0.00	0.49
TG → ATT	0.00	0.08	0.08
TG → INT	0.00	0.09	0.09
cPEU → PBC	0.37	0.00	0.37
cPEU → INT	0.00	0.04	0.04
cLOC → PBC	0.18	0.00	0.18
cLOC → INT	0.00	0.02	0.02

on intention was 0.19. When included in the model, the relationship between Trust and PBC hypothesized in the initial model reduced the model fit without increasing the amount of variance explained. The bootstrap validation of the path between PBC and TRUST also failed, indicating an insignificant path. Thus the proposed path was removed from the final model.

The relation between perceived ease of use and attitude did not show up as expected in the model. Yet, the previous research has shown that perceived usefulness can be mediated over perceived usefulness [1, 33]. That was also the case in our model and was evident in strong path coefficients between PEU and PU in the model.

The rest of the relations were proved to be as assumed in the model.

4.4.4 Comparison to Alternate Models

Apart from the 16 alternate models tested in the model modification section (Please refer to Section 4.3), the final model was compared to the legendary Technology Acceptance Model [1]. Figure 4.5 shows the structural model for TAM. Manifest variables were not included to simplify the figure. All loadings of MVs were higher than 0.80.

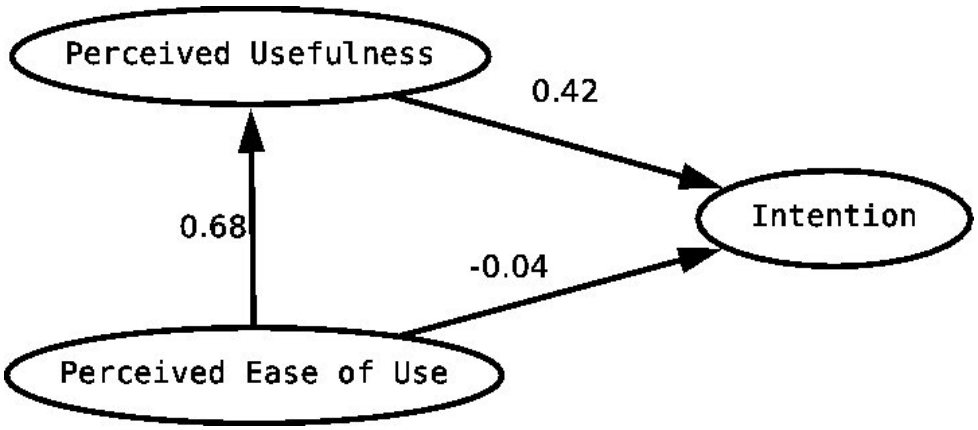

Figure 4.5: Alternate Model: TAM

The TAM model had a relative GFI value of 0.86, a seemingly 0.01 point increase over the final model. It should be kept in mind however, that the data set used for TAM model was much smaller. The TAM model consists of only three latent variables with eight manifest variables in comparison to the ten latent variables and thirty-two manifest variables of the final model. Meaning it has less variance to account for.

All paths in both models were valid but TAM model also suffered from negative loadings of PEU due to mediation through PU. The total effect of PU on intentions was 0.41 and PEU on intentions was 0.24.

The Achilles' heel for the TAM model was predictive power as was pointed in [13]. The R^2 value of intention for TAM was 0.15 a significant reduction in comparison to 0.61 provided by the final model. This result proves that the final model was far superior in comparison to TAM.

4.5 Reconsidering The Proposed Hypothesis

After the changes to the model in Section 4.3, the fit of both the measurement model and the structural model improved. Both the instrument and the model had been validated in Section 4.4. The final model required the changes to the proposed relations discussed in Section 3.1, those changes are discussed below. The modified model and the new hypotheses can be seen in Figure 4.6.

By removing SN construct, the chance to prove or disprove the H4 was lost, and this relation was removed.

H6a was proven but the effect of PEU on attitudes was completely mediated by PU. The relation between PU and PEU had to be formulated as H6c.

H6c PEU will have a positive effect on the PU of the e-government service.

With the inclusion of a higher order trust latent variable the hypothesized relations H7a, H7b and H8a, H8b were changed. These relations had to be

re-formulated to reflect the relations mediated over the trust construct. Unfortunately the path between trust and PBC could not be validated in bootstraps so the relationship between trust and PBC could not be validated and H7b and H8b were removed. The role of trust on attitudes formulated in H7a and H8a were combined under H7. Other than the partially mediated effect of trust over attitudes, the analysis brought forth the existence of a direct relation between trust and intention which was not initially theorized. This relation had previously been proven in many e-government adoption models (See Section 2.1.2), and was now formulated as H11. The relations between TG and TI and trust had been formulated as H12 and H13.

H7 Trust will have a positive effect on the attitude toward the use of e-government service.

H11 Trust will have a positive effect on the intention to use the e-government service.

H12 TI will have a positive effect on trust.

H13 TG will have a positive effect on the trust.

The skills and access were combined under the local factors construct. Thus the H9 and H10 had to be combined under H14. The IT penetration will have a positive effect on perceived behavioral control [11].

H14 Local factors will have a positive effect on the PBC to use the e-government service.

The rest of the hypothesized relations were proven. Table 4.15 shows the hypothesis number in the initial model, the number in the final model and the final status of the hypothesis after PLS-PM validation. The final model, although different from the initially proposed model, was more like a refined and rephrased version of the initial model since it did not require a major overhaul of the underlying theoretical basis.

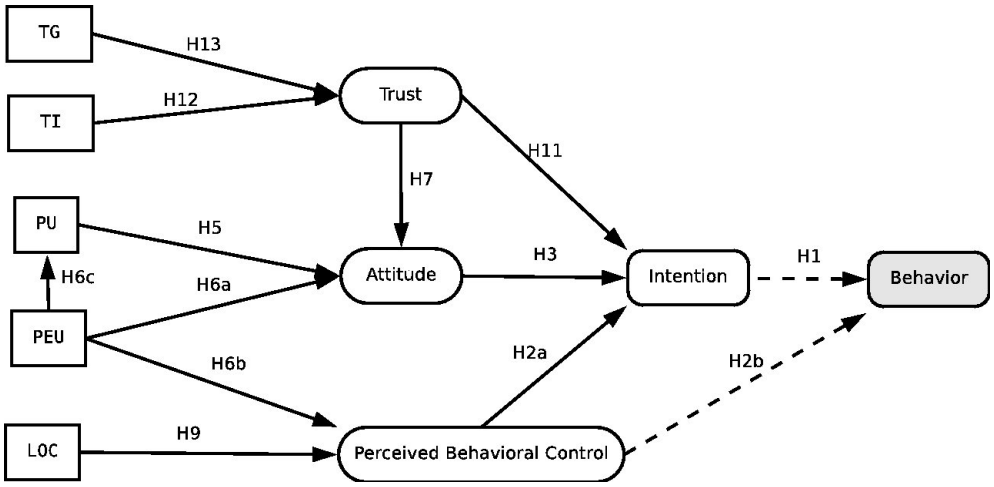

Figure 4.6: The Relations in the Final Model

Table 4.15: The Stata of Hypothesis in the Final Model

Old Hypothesis	New Hypothesis	Status
H1	H1	Could not be tested
H2a	H2a	Proven
H2b	H2b	Could not be tested
H4	-	Could not be tested due to instrumental validity
H3	H3	Proven
H5	H5	Proven
H6a	H6a	Proven, fully mediated by PU
H6b	H6b	Proven
-	H6c	Proven
-	H7	Proven
H7a	H7	Proven, was mediated by TRUST
H7b	-	Falsified due to non significant path
H8a	H7	Proven, was mediated by TRUST
H8b	-	Falsified due to non significant path
H9	H14	Proven, mediated by LOC
H10	H14	Proven, mediated by LOC
-	H11	Proven
-	H12	Proven
-	H13	Proven
-	H14	Proven

CHAPTER 5

CONCLUSION

This chapter discusses the findings of , lists the limitations to and proposes venues for further research for this study.

5.1 Summary of the Study

As the e-government initiatives gain traction, the need to better understand this phenomena is gaining importance. The models for adoption of G2C e-government services have the potential to provide the much needed insight into the adoption behavior. To this end, this study has developed and validated an e-government adoption model based on the theory of planned behavior (TPB). TPB has served for years in diverse domains to predict and explain human behavior. With this study, TPB was employed in e-government context and validated by contemporary statistical techniques.

The Partial Least Squares Path Modelling (PLS-PM), a variation of Structural Equation Modelling (SEM), was employed in this study to validate both the measurement instrument and the proposed model. The initial model had to be modified to increase the model fit, explanatory power and the instrument validity, but these modifications are also a part of standard SEM conduct. Although the final model at hand was not the initially proposed model, the final model was

more like a refined, rephrased version of the initial model. Most of the proposed relationships in the model was preserved and the others were altered without any change to the underlying theoretical foundations.

The study investigated and uncovered the factors effecting the intention to use the KYK electronic services. The results of the PLS-PM analysis proved, as is evidenced by high R^2 value (Please refer to Table 4.12) of intentions in the final model, that the predictor variables of the theory of planned behavior actually do predict the e-government adoption behavior well.

Path coefficients in the model reveal that attitudes got the lion's share in explaining the intentions. This is in-line with the expectations and the previous literature [4]. The Perceived Behavioral Control (PBC) had the second largest direct effect on intentions in our model, based on the data at hand. This shows that the PBC actually plays a role in the forming the intentions to use the KYK services. While PBC had the second largest direct effect, it was shadowed by the total effect of combined trust.

The role of trust was partially mediated over attitudes. This means that trust both precedes the attitudes and the intentions. The effect of trust on the intentions is composed of both a direct effect and an indirect effect over the attitudes. In our model Trust was the second most influential construct due to the large total effect size (See Table 4.14), proving the importance of trust in e-government setting. This importance was also emphasized in a number of previous studies [16, 11, 20, 21, 23]. The role of Trust on PBC however could not be proven due to non-significant path loading. It should be kept in mind however, it is not recommended to generalize the PLS results to the general population and this might be due to a sample specific issue. The role of Trust on PBC should be investigated with a multivariate normal data set in covariance based SEM if conclusive results are desired.

The Perceived Usefulness (PU) proved to be a strong determinant of attitudes as expected. The Perceived Ease of Use (PEU) on the other hand was totally mediated by PU, and had no direct effect of its own in the presence of PU. This

was expected as the previous studies have confirmed such a structure [1].

Trust in internet and trust in government seemingly explain almost all of the variance in combined trust construct. How ever, this finding should be taken with a pinch of salt. Since the initial model did not poses a combined trust construct and PLS method we employed required Manifest Variables (MV) for every Latent Variables (LV) to be estimated. Hence we integrated three of the surplus items that originated from the discarding of extra trust belief types in forming the combined trust LV. For a more accurate estimation of the variance explained by TI and TG in combined trust construct the use of items from a unitary trust scale –which we lacked– would have been better.

The findings of the model also proved the relations between PBC and PEU and PBC and local factors for our sample.

5.2 Limitations

Implementing TPB, a theory more than two decades old, strictly as suggested by Ajzen [14, 4, 12, 24] created some complications uncovered with the modern analytical techniques as was evidenced in the Chapter 4. First of all, employing separate belief constructs for behavioral and control belief types of the same salient belief (such as trust in internet in our study) created a shared correlation among the constructs which caused multicollinearity. This would cause the constructs to reduce each others' effects, messing the path coefficients. Furthermore if left out of the model this relation would reduce the overall model fit. For future reference; in SEM techniques using multi method approach is clearly the superior method, if not, a single construct for a single salient belief is clearly a better choice than integrating two versions of the same method.

Another complication was caused by formating the items in the measurement model in line with Ajzen's guidelines [12]. Ajzen suggested defining each item in the questionnaire in terms of TACT and the wording of items were further defined according to salient belief types. This similarity of the items in the questionnaire

caused a method halo –a disturbance in the data caused by the instrument. This created correlations due to the sentence structure among similarly worded items and further multicollinearity. It is now clear that defining all items in such similar manner blurs the findings in SEM analysis. It would be wise to mention TACT in the instructions section of each set of questions and reduce the length of questions in future work.

Investigating the role of Subjective Norms (SN) would have made the final model a complete TPB study. Unfortunately however, the items derived from [24] for the SN construct failed the factorial validity tests, thus the effect of subjective norms could not be observed. The items for SN should have been defined in narrower terms for better instrument validity. This should be taken into account in any follow-up studies.

This study was conducted on a particular e-government service from KYK with a very special sample – young people with high computer access – and in order for the results to be generalizable the findings should be proven in other studies.

5.3 Implication for Future Research

One venue for future research would be to test the model in an inter-cultural setting. According to 2005 OECD figures the number of Internet users is one fifth of the European average in Turkey [5]. Comparing a developed country with Turkey might better uncover the role of IT penetration in e-government adoption.

Another possible route for future research would be to improve the explanatory power of the model further. Since the TPB implemented in this study stayed firmly true to Ajzen's guidelines except for the elicitation of salient beliefs. Instead of eliciting salient beliefs affecting the adoption behavior from the population, this study used the salient beliefs derived from the literature. The derived constructs of perceived usefulness, perceived ease of use, local factors, trust in government and trust in Internet contributed to the explanatory power

of the model. Although the R^2 value for intentions and trust were beyond satisfactory, the R^2 values for attitudes and PBC were sub-par (see. Table 4.12. This indicates that there is room for improvement in explaining and predicting attitudes and PBC. To enhance the explanatory power of the model the factors influencing these constructs should be investigated, either by elicitation of salient beliefs or by more constructs derived from the literature. Further research into uncovering these factors would be a worthwhile effort, increasing the explanatory power and the usefulness of the model.

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APPENDICES

Appendix A: List of Publications

Findings of this study has been presented in the following conferences:

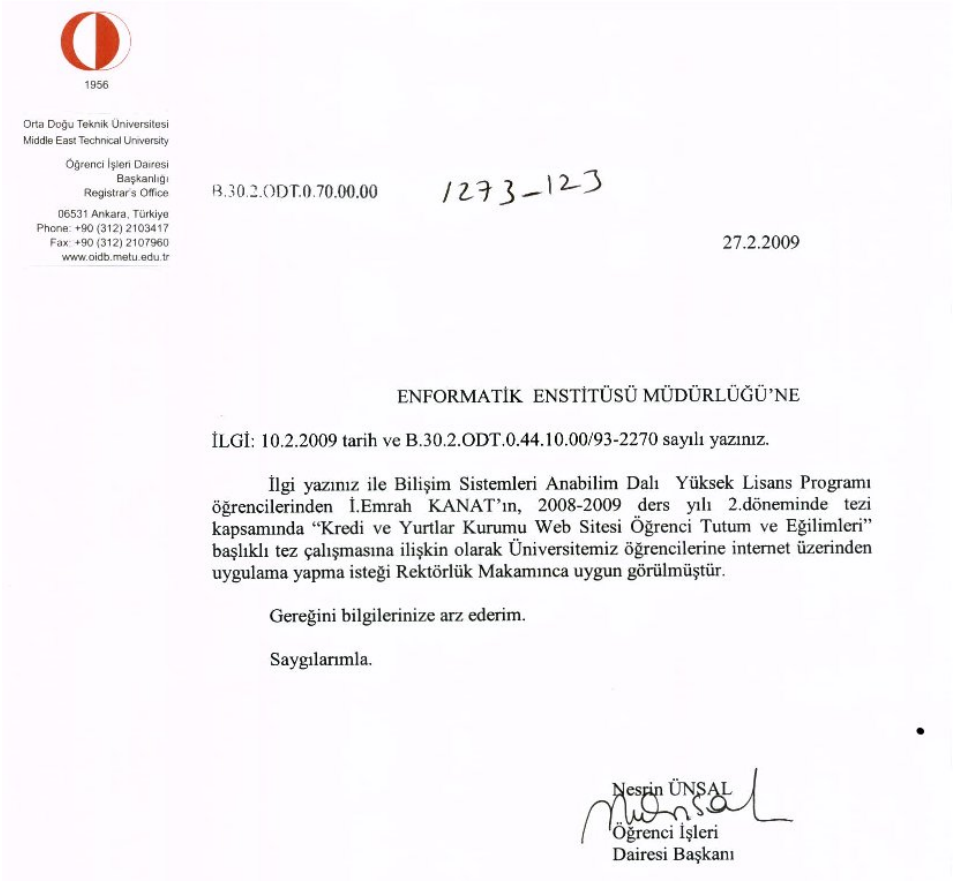
Euro 2009 : European Conference on Operations Research 2009

EMCIS 2009 : European and Mediterranean Conference on Information Systems 2009

E-Challenges 2009 : E-Challenges Conference 2009

The preparation of a journal article based on this study is ongoing.

Appendix B: Ethics Clearance



1956

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27.2.2009

ENFORMATİK ENSTİTÜSÜ MÜDÜRLÜĞÜ'NE

İLGİ: 10.2.2009 tarih ve B.30.2.ODT.0.44.10.00/93-2270 sayılı yazınız.

İlgi yazınız ile Bilişim Sistemleri Anabilim Dalı Yüksek Lisans Programı öğrencilerinden İ.Emrah KANAT'ın, 2008-2009 ders yılı 2.döneminde tezi kapsamında "Kredi ve Yurtlar Kurumu Web Sitesi Öğrenci Tutum ve Eğilimleri" başlıklı tez çalışmasına ilişkin olarak Üniversitemiz öğrencilerine internet üzerinden uygulama yapma isteği Rektörlük Makamınca uygun görülmüştür.

Gereğini bilgilerinize arz ederim.

Saygılarımla.

Nesrin ÜNSAL
Öğrenci İşleri
Dairesi Başkanı

Figure 5.1: The ethics clearance

Appendix C: The Measurement Instrument (Turkish)

Predictor Variable Items:

The subjects reported their level of agreement with the statement on a five point likert scale from "Kesinlikle Katılmıyorum" to "Tamamen Katılıyorum".

Intention Items:

INT1 Dönem içerisinde kredi ödemelerime dair bilgi almak için kredi yurtlar kurumu web sitesini kullanmayı planlıyorum.

INT2 Dönem içerisinde kredi ödemelerime dair bilgi almak için kredi yurtlar kurumu web sitesini kullanmaya çalışacağım.

INT3 Kredi ödemelerime dair bilgi almak için dönem içerisinde kredi yurtlar kurumu web sitesini kullanmayı düşünüyorum.

INT4 Kredi ödemelerime dair bilgi almak için dönem içerisinde kredi yurtlar kurumu web sitesini kullanmayı isterim.

Attitude Items:

ATT1 Dönem içerisinde kredi ödemelerime dair bilgi almak için kredi yurtlar kurumu web sitesini kullanmanın iyi bir fikir olduğunu düşünüyorum.

ATT2 Dönem içerisinde kredi ödemelerime dair bilgi almak için kredi yurtlar kurumu web sitesini kullanmanın faydalı olacağını düşünüyorum.

ATT3 Kredi ödemelerime dair bilgi almak dönem içerisinde için kredi yurtlar kurumu web sitesini kullanmanın akıllıca olacağını düşünüyorum.

ATT4 Kredi ödemelerime dair bilgi almak dönem içerisinde için kredi yurtlar kurumu web sitesini kullanmanın gerekli olacağını düşünüyorum.

Subjective Norms Items:

SN1 Kredi yurtlar kurumu web sitesini kullanarak dönem içerisinde kredi ödemelerim hakkında bilgi almam çevremde onaylanan bir davranıştır.

SN2 Bu konuda fikirlerine değer verdiğim insanlar kredi ödemelerime dair bilgi almak için dönem içinde kredi yurtlar kurumu web sitesini kullanmam gerektiğini düşünür.

SN3 Kredi ödemelerime dair bilgi almak için dönem içinde kredi yurtlar kurumu web sitesini kullanmam benden beklenen bir davranıştır.

SN4 Etrafımdaki insanlar kredi ödemelerine dair bilgi almak için dönem içinde kredi yurtlar kurumu web sitesini kullanır.

Perceived Behavioral Control Items:

PBC1 Dönem içerisinde kredi yurtlar kurumu websitesini kullanarak kredi ödemelerime dair bilgi almam için gereken imkanlara sahibim.

PBC2 Dönem içerisinde kredi yurtlar kurumu web sitesini kullanarak kredi ödemelerime dair bilgi almak tamamen bana bağlıdır.

PBC3 Eğer istersem dönem içinde kredi yurtlar kurumu web sitesini kullanarak kredi ödemelerime dair bilgi alabileceğime inanıyorum.

PBC4 Kredi yurtlar kurumu web sitesine dönem içerisinde kolayca erişebilirim.

Belief Composites

Probability Component of Belief Composites

Subjects reported the probability of the statement being true for them on a five point likert scale from "Çok düşük ihtimal" to "Çok yüksek ihtimal".

Perceived Usefulness Items

pPU1 Kredi yurtlar kurumu web sitesi sayesinde kredi ödemelerime dair bilgiye daha hızlı ulaşabilmem.

pPU2 Kredi yurtlar kurumu web sitesi sayesinde kredi ödemelerime dair bilgiye daha rahat ulaşabilmem.

Perceived Ease of Use Items

pPEU1 Kredi Yurtlar Kurumu web sitesini kullanmayı öğrenmenin kolay olması.

pPEU2 Kredi Yurtlar Kurumu web sitesini kullanmanın kolay olması.

pPEU3 Kredi Yurlar Kurumu web sitesinin kolay anlaşılabilir bir yapıda olması.

Trust in Government Items

pTG1 Kredi yurtlar kurumunun alanında bilgili olması.

pTG2 Kredi yurtlar kurumunun, krediler konusunda yetkin olması.

pTG3 Kredi yurtlar kurumunun vaatlerini yerine getirmesi.

pTG4 Kredi yurtlar kurumunun sadece kendi çıkarlarını değil, kullanıcılarının çıkarlarını da gözetmesi.

pTG5 Kredi yurtlar kurumunun çıkarlarımı göz önünde tutması.

Trust in Internet Items

pTI1 Yasal ve teknik yapıların internetten kaynaklanabilecek sorunlara karşı yeterli koruma sunması.

pTI2 Şifreleme ve diğer teknolojik ilerlemeler sonucu internetin daha güvenli olması.

pTI3 İnternetin yeterli güvence mekanizmalarına sahip olması.

pTI4 İnterneti kullanmak konusunda rahat olmam.

pTI5 İnternetin işleyiş şeklinden memnun olmam.

Skills Items

pSK1 İhtiyaçlarımı karşılayacak düzeyde bilgisayar bilgisine sahip olmam.

pSK2 Bilgisayar kullanırken karşılaştığım sorunları çözebilmem.

Access Items

pAC1 İhtiyacım olduğunda bir bilgisayara rahatca erişebilmem.

pAC2 İhtiyacım olduğunda internete rahatca erişebilmem.

Impact Component of Behavioral Belief Composites

Subjects reported the importance of the statement on a five point likert scale from "Çok Önemsiz" to "Çok Önemli"

Perceived Usefulness Items

sPU1 Kredi ödemelerime dair bilgiye daha hızlı ulaşmak.

sPU2 Kredi ödemelerime dair bilgiye daha kolay ulaşmak.

Perceived Ease of Use Items

sPE1 Kredi yurtlar kurumu web sitesini kullanmayı kolayca öğrenmek.

sPE2 Kredi yurtlar kurumu web sitesinin kolay kullanılabilir olması.

Trust in Government Items

sTG1 Kredi yurtlar kurumunun alanında bilgili olması.

sTG2 Kredi yurtlar kurumunun konusunda yetkin olması.

sTG3 Kredi yurtlar kurumunun vaatlerini yerine getirmesi.

sTG4 Kredi yurtlar kurumunun çıkarlarımı gözetmesi.

Trust in Internet Items

sTI1 Yasal ve teknik yapıların internetten kaynaklanabilecek sorunlara karşı yeterli koruma sunması.

sTI2 Şifreleme ve diğer teknolojik ilerlemeler sayesinde internetin güvenli olması.

sTI3 Internetin yeterli güvence mekanizmalarına sahip olması.

sTI4 İnterneti kullanırken rahat olabilmem.

sTI5 İnternetin memnuniyet verici bir şekilde işlemesi.

Impact Component of Control Belief Composites

Subjects reported the reduction in effort of the statement on a five point likert scale from "Çok Zorlaştırır" to "Çok Kolaylaştırır"

Perceived Ease of Use Items

iPE1 Kredi yurtlar kurumu sitesini kullanmayı öğrenmek.

iPE2 Kredi yurtlar kurumu web sitesini kolayca kullanabilmek.

iPE3 Kredi yurtlar kurumu sitesinin anlaşılır olması.

Trust in Government Items

iTG1 Kredi yurtlar kurumunun alanında bilgili olması.

iTG2 Kredi yurtlar kurumunun yaptığı işte yetkin olması.

iTG3 Kredi yurtlar kurumunun vaatlerini yerine getirmesi.

iTG4 Kredi yurlar kurumu sadece kendi çıkarlarını değil, kullanıcılarının çıkarlarını da gözetmesi.

iTG5 Kredi yurtlar kurumunun çıkarlarımı göz önünde tuttuğunu bilmek.

Trust in Internet Items

iTI1 Yasal ve teknik yapıların internetten kaynaklanabilecek sorunlara karşı yeterli koruma sunması.

iTI2 Şifreleme ve diğer teknolojik ilerlemeler sayesinde internetin güvenli olması.

iTI3 Internetin yeterli güvence mekanizmalarına sahip olması.

iTI4 İnterneti kullanırken rahat olabilmem.

iTI5 İnternetin memnuniyet verici bir şekilde işlemesi.

Skills Items

iSK1 Yeterli düzeyde bilgisayar bilgisine sahip olmam.

iSK2 Bilgisayar kullanırken karşılaştığım sorunları çözebilmem.

Access Items

iAC1 Bilgisayara erişimimin kolay olması.

iAC2 Kolaylıkla internete erişebilmem.

Appendix D: The Measurement Instrument (English)

The items listed below were translated from Turkish originals.

Predictor Variable Items:

The subjects reported their level of agreement with the statement on a five point likert scale from "Strongly Disagree" to "Strongly Agree".

Intention Items:

INT1 I am planning to use the KYK web site during the semestre.

INT2 I will try to use the KYK web site during the semestre.

INT3 I am considering to use the KYK web site during the semestre.

INT4 I would like to use the KYK web site during the semestre.

Attitude Items:

ATT1 I think using the KYK web site during the semestre to obtain information on credit payments is a good idea.

ATT2 Using the KYK web site during the semestre to obtain information on credit payments would be beneficial.

ATT3 I think using the KYK web site during the semestre to obtain information on credit payments is a smart move.

ATT4 Using the KYK web site during the semestre to obtain information on credit payments is necessary.

Subjective Norms Items:

SN1 Using KYK web site to obtain credit payment details is a generally accepted behavior.

SN2 The people whose ideas I value think I should use KYK web site to obtain information on credit payments.

SN3 It is expected of me to use the KYK web site to obtain information on credit payments.

SN4 The people around me use KYK web site to obtain information on credit payments.

Perceived Behavioral Control Items:

PBC1 I have the means to obtain credit payment information from KYK web site during the semestre.

PBC2 It is up to me to obtain credit payment information from KYK web site during the semestre.

PBC3 I believe, if I wish, I can obtain credit payment information from KYK web site during the semestre.

PBC4 I can easily access the KYK website during the semestre.

Belief Composites

Probability Component of Belief Composites

Subjects reported the probability of the statement being true for them on a five point likert scale from "Very Improbable" to "Very Probable".

Perceived Usefulness Items

pPU1 Reaching credit payment information faster with the KYK web site.

pPU2 Reaching credit payment information easier with the KYK web site.

Perceived Ease of Use Items

pPEU1 Learning to use the KYK web page being easy.

pPEU2 Using the KYK web page being easy.

pPEU3 KYK web page being clear and understandable.

Trust in Government Items

pTG1 KYK being knowledgeable in its field.

pTG2 KYK being competent about credits.

pTG3 KYK keeping its commitments.

pTG4 KYK being interested in the users' well-being, not just its own.

pTG5 KYK considering my interests.

Trust in Internet Items

pTI1 Legal and technichal structures providing adequate protection against the problems stemming from internet.

pTI2 Internet being a safer place due to encryption and other technological advances.

pTI3 Internet having adequate safety mechanisms.

pTI4 Me, being at ease in using internet.

pTI5 Me, being satisfied with the working of internet.

Skills Items

pSK1 Me, having enough computer skills to match my needs.

pSK2 Me, tackling the problems I face using a computer.

Access Items

pAC1 Me, having access to a computer easily when I need one.

pAC2 Me, having access to internet easily when I need it.

Impact Component of Behavioral Belief Composites

Subjects reported the importance of the statement on a five point likert scale from "Very Unimportant" to "Very Important"

Perceived Usefulness Items

sPU1 Reaching credit payment information faster.

sPU2 Reaching credit payment information easier.

Perceived Ease of Use Items

sPE1 Learning to use KYK web site easily.

sPE2 KYK website being easy to use.

Trust in Government Items

sTG1 KYK being knowledgeable in its field.

sTG2 KYK being competent about credits.

sTG3 KYK keeping its commitments.

sTG4 KYK considering my interests.

Trust in Internet Items

sTI1 Legal and technichal structures providing adequate protection against the problems stemming from internet.

sTI2 Internet being a safer place due to encryption and other technological advances.

sTI3 Internet having adequate safety mechanisms.

sTI4 Me, being at ease in using internet.

sTI5 Me, being satisfied with the working of internet.

Impact Component of Control Belief Composites

Subjects reported the reduction in effort of the statement on a five point likert scale from "Çok Zorlaştırır" to "Çok Kolaylaştırır"

Perceived Ease of Use Items

iPE1 Learning to use the KYK web page.

iPE2 Using the KYK web page easily.

iPE3 KYK web page being clear and understandable.

Trust in Government Items

iTG1 KYK being knowledgeable in its field.

iTG2 KYK being competent about credits.

iTG3 KYK keeping its commitments.

iTG4 KYK being interested in the users' well-being, not just its own.

iTG5 KYK considering my interests.

Trust in Internet Items

iTI1 Legal and technichal structures providing adequate protection against the problems stemming from internet.

iTI2 Internet being a safer place due to encryption and other technological advances.

iTI3 Internet having adequate safety mechanisms.

iTI4 Being at ease in using internet.

iTI5 Internet working in a satisfactory fashion.

Skills Items

iSK1 Having enough computer skills to match my needs.

iSK2 Being able to solve the problems I face using a computer.

Access Items

iAC1 Having access to a computer easily when I need one.

iAC2 Having access to internet easily when I need it.

Appendix E: The Descriptive Statistics

Table 5.1: Descriptive Statistics for Questionnaire Items

Item	n	mean	sd	median	min	max	range	skew	kurtosis
MINT1	210	0.64	1.04	1	-2	2	4	-0.6	-0.34
MINT2	210	0.64	1.03	1	-2	2	4	-0.89	0.41
MINT3	209	0.71	1.04	1	-2	2	4	-0.82	0.12
MINT4	210	0.87	0.95	1	-2	2	4	-0.94	0.58
MATT1	212	0.82	1.04	1	-2	2	4	-0.97	0.5
MATT2	212	0.82	0.98	1	-2	2	4	-1.11	0.91
MATT3	209	0.96	0.96	1	-2	2	4	-1.01	0.83
MATT4	208	0.84	0.99	1	-2	2	4	-1.1	1.01
MSN1	211	0.59	0.99	1	-2	2	4	-0.57	0.07
MSN2	209	0.53	0.94	1	-2	2	4	-0.45	0.02
MSN3	209	0.46	0.99	1	-2	2	4	-0.37	-0.24
MSN4	209	0.2	1.07	0	-2	2	4	-0.23	-0.49
MPBC1	212	0.97	1	1	-2	2	4	-1.2	1.41
MPBC2	211	0.87	1.1	1	-2	2	4	-1.01	0.38
MPBC3	210	0.77	0.96	1	-2	2	4	-1.04	0.92
MPBC4	211	0.91	0.99	1	-2	2	4	-1.1	1.21
bPU1	210	4.46	3.52	4	-10	10	20	-0.85	2.5
bPU2	210	4.72	3.34	4	-4	10	14	-0.03	-0.43
bPEU1	212	3.29	3.62	4	-10	10	20	-0.26	0.84
bPEU2	211	3.96	3.45	4	-10	10	20	-0.3	0.92
bTG1	211	4.09	3.45	4	-8	10	18	-0.21	-0.26
bTG2	210	4.08	3.59	4	-10	10	20	-0.37	0.55
bTG3	208	3.68	3.29	4	-8	10	18	-0.46	0.41
bTG4	212	3.1	3.44	3	-8	10	18	-0.3	0.29
bTI1	209	3.87	3.19	4	-10	10	20	-0.41	1.5
bTI2	210	4.4	3.43	4	-10	10	20	-0.39	0.69
bTI3	211	3.97	3.24	4	-10	10	20	-0.44	1.44
bTI4	212	4.42	3.47	4	-4	10	14	0.08	-0.71
bTI5	210	3.85	3.4	4	-10	10	20	-0.57	1.73
cPEU1	211	4.13	3.2	4	-6	10	16	0.12	-0.12
cPEU2	208	4.46	3.11	4	-6	10	16	-0.02	0.31
cPEU3	210	4.51	2.93	4	-4	10	14	0.07	-0.19
cTG1	211	3.89	3	4	-6	10	16	0.03	0.3
cTG2	212	4.39	3.06	4	-4	10	14	0.02	-0.37
cTG3	207	3.68	3.06	3	-4	10	14	0.26	-0.45
cTG4	212	3.66	2.83	3	-4	10	14	0.33	-0.2
cTG5	212	3.33	2.88	3	-4	10	14	0.2	0.21
cTI1	208	4.01	2.79	4	-2	10	12	0.36	-0.28
cTI2	208	4.25	3.28	4	-8	10	18	-0.11	0.14
cTI3	210	4.09	2.97	4	-4	10	14	0.15	-0.31
cTI4	211	4.8	3.32	4	-6	10	16	-0.22	-0.08
cTI5	211	4.43	2.94	4	-6	10	16	-0.11	0.5
cSK1	211	4.74	3.41	4	-8	10	18	-0.39	0.71
cSK2	211	4.51	3.13	4	-6	10	16	0.19	-0.29
cACC1	208	5.08	3.59	4	-8	10	18	-0.28	-0.19
cACC2	208	5.22	3.36	4	-8	10	18	-0.25	-0.05

Appendix F: The Raw Data

Table 5.2: Correlations Among Questionnaire Items

	Predictor Variables																Behavioral Belief Composites													Control Belief Composites																
	Intention				Attitute				Subjective Norm				Perc. Beh. Con.				P.U.		P.E.U.		Trust in Gov.				Trust in Internet					P.E.U.			Trust in Government					Trust in Internet					Skill		Access	
	IN1	IN2	IN3	IN4	AT1	AT2	AT3	ATT4	SN1	SN2	SN3	SN4	PC1	PC2	PC3	PC4	PU1	PU2	PE1	PE2	TG1	TG2	TG3	TG4	TI1	TI2	TI3	TI4	TI5	PE1	PE2	PE3	TG1	TG2	TG3	TG4	TG5	TI1	TI2	TI3	TI4	TI5	SK1	SK2	AC1	AC2
IN1	1	0.67	0.82	0.68	0.64	0.66	0.59	0.71	0.52	0.49	0.57	0.53	0.45	0.40	0.52	0.41	0.28	0.30	0.14	0.12	0.06	0.07	0.19	0.11	0.11	0.13	0.17	0.11	0.14	0.13	0.15	0.19	0.14	0.16	0.24	0.13	0.11	0.12	0.15	0.06	0.10	0.13	0.28	0.20	0.12	0.26
IN2	0.67	1	0.69	0.60	0.60	0.60	0.54	0.64	0.50	0.45	0.47	0.53	0.46	0.41	0.56	0.38	0.37	0.16	0.21	0.22	0.07	0.07	0.20	0.10	0.23	0.17	0.08	0.17	0.27	0.13	0.11	0.11	0.08	0.20	0.16	0.09	0.13	0.14	0.15	0.13	0.21	0.11	0.27	0.24	0.21	0.29
IN3	0.82	0.69	1	0.72	0.66	0.70	0.63	0.78	0.55	0.50	0.53	0.51	0.47	0.55	0.52	0.52	0.31	0.30	0.18	0.23	0.12	0.12	0.19	0.15	0.15	0.22	0.22	0.18	0.18	0.21	0.22	0.24	0.17	0.22	0.25	0.15	0.14	0.21	0.26	0.13	0.20	0.18	0.31	0.27	0.19	0.32
IN4	0.68	0.60	0.72	1	0.70	0.76	0.68	0.70	0.56	0.58	0.48	0.49	0.50	0.54	0.56	0.54	0.36	0.38	0.21	0.26	0.17	0.18	0.23	0.19	0.24	0.30	0.22	0.23	0.15	0.21	0.17	0.27	0.14	0.22	0.29	0.25	0.20	0.30	0.29	0.19	0.20	0.16	0.31	0.21	0.19	0.25
AT1	0.64	0.60	0.66	0.70	1	0.85	0.75	0.68	0.58	0.62	0.40	0.57	0.60	0.55	0.70	0.53	0.30	0.32	0.12	0.22	0.08	0.20	0.20	0.10	0.22	0.20	0.17	0.17	0.07	0.17	0.19	0.17	0.12	0.21	0.23	0.19	0.16	0.28	0.25	0.13	0.15	0.13	0.26	0.20	0.20	0.26
AT2	0.66	0.60	0.70	0.76	0.85	1	0.82	0.70	0.59	0.64	0.50	0.51	0.63	0.56	0.69	0.54	0.35	0.37	0.19	0.28	0.13	0.20	0.20	0.17	0.24	0.25	0.21	0.20	0.14	0.27	0.23	0.29	0.15	0.23	0.23	0.24	0.15	0.28	0.24	0.14	0.17	0.21	0.34	0.24	0.24	0.36
AT3	0.59	0.54	0.63	0.68	0.75	0.82	1	0.59	0.52	0.63	0.41	0.51	0.56	0.55	0.56	0.45	0.30	0.31	0.16	0.24	0.10	0.16	0.22	0.13	0.26	0.24	0.21	0.18	0.11	0.17	0.16	0.20	0.04	0.18	0.18	0.18	0.13	0.26	0.25	0.18	0.15	0.19	0.24	0.15	0.15	0.25
AT4	0.71	0.64	0.78	0.70	0.68	0.70	0.59	1	0.57	0.53	0.55	0.53	0.51	0.51	0.60	0.51	0.34	0.38	0.27	0.29	0.18	0.21	0.30	0.22	0.25	0.28	0.30	0.22	0.25	0.28	0.29	0.27	0.20	0.24	0.29	0.19	0.21	0.24	0.30	0.19	0.20	0.26	0.34	0.28	0.23	0.35
SN1	0.52	0.50	0.55	0.56	0.58	0.59	0.52	0.57	1	0.48	0.49	0.57	0.47	0.39	0.42	0.46	0.21	0.17	0.25	0.21	0.08	0.18	0.21	0.14	0.14	0.11	0.19	0.13	0.19	0.18	0.18	0.09	0.13	0.22	0.17	0.11	0.18	0.19	0.16	0.11	0.18	0.15	0.24	0.17	0.14	0.2
SN2	0.49	0.45	0.50	0.58	0.62	0.64	0.63	0.53	0.48	1	0.48	0.59	0.40	0.38	0.50	0.40	0.16	0.20	0.09	0.16	0.08	0.20	0.14	0.12	0.14	0.09	0.11	0.21	0.11	0.15	0.11	0.16	0.07	0.12	0.11	0.09	0.09	0.23	0.14	0.09	0.15	0.15	0.24	0.09	0.07	0.26
SN3	0.57	0.47	0.53	0.48	0.40	0.50	0.41	0.55	0.49	0.48	1	0.51	0.41	0.41	0.38	0.37	0.18	0.26	0.13	0.14	0.08	0.16	0.13	0.10	0.06	0.12	0.05	0.09	0.14	0.21	0.18	0.22	0.17	0.19	0.21	0.21	0.14	0.12	0.07	0.01	0.19	0.21	0.27	0.20	0.14	0.33
SN4	0.53	0.53	0.51	0.49	0.57	0.51	0.51	0.53	0.57	0.59	0.51	1	0.44	0.48	0.53	0.42	0.16	0.25	0.09	0.13	-0.02	0.08	0.09	0.07	0.08	0.01	0.08	0.10	0.15	0.13	0.15	0.14	0.04	0.04	0.08	0.08	0.14	0.15	0.10	0.04	0.08	0.15	0.17	0.17	0.07	0.2
PC1	0.45	0.46	0.47	0.50	0.60	0.63	0.56	0.51	0.47	0.40	0.41	0.44	1	0.63	0.69	0.70	0.26	0.26	0.23	0.21	0.07	0.15	0.08	0.08	0.13	0.13	0.11	0.14	0.14	0.25	0.28	0.33	0.17	0.19	0.19	0.16	0.18	0.24	0.23	0.14	0.24	0.27	0.37	0.29	0.25	0.32
PC2	0.40	0.41	0.55	0.54	0.55	0.56	0.55	0.51	0.39	0.38	0.41	0.48	0.63	1	0.63	0.61	0.23	0.31	0.17	0.21	0.07	0.17	0.10	0.09	0.09	0.14	0.09	0.14	0.08	0.28	0.27	0.26	0.15	0.15	0.23	0.18	0.14	0.17	0.26	0.11	0.24	0.18	0.25	0.21	0.18	0.28
PC3	0.52	0.56	0.52	0.56	0.70	0.69	0.56	0.60	0.42	0.50	0.38	0.53	0.69	0.63	1	0.62	0.28	0.33	0.16	0.16	0.05	0.13	0.08	0.06	0.12	0.06	0.08	0.17	0.14	0.28	0.29	0.31	0.17	0.18	0.21	0.19	0.20	0.28	0.21	0.15	0.24	0.23	0.35	0.27	0.21	0.36
PC4	0.41	0.38	0.52	0.54	0.53	0.54	0.45	0.51	0.46	0.40	0.37	0.42	0.70	0.61	0.62	1	0.33	0.32	0.25	0.34	0.19	0.32	0.17	0.18	0.16	0.16	0.15	0.24	0.19	0.31	0.38	0.37	0.28	0.26	0.27	0.26	0.31	0.35	0.22	0.15	0.27	0.30	0.35	0.25	0.31	0.34
PU1	0.28	0.37	0.31	0.36	0.30	0.35	0.30	0.34	0.21	0.16	0.18	0.16	0.26	0.23	0.28	0.33	1	0.66	0.59	0.67	0.57	0.52	0.52	0.47	0.58	0.56	0.35	0.59	0.61	0.37	0.49	0.51	0.48	0.46	0.41	0.43	0.42	0.37	0.47	0.40	0.50	0.50	0.42	0.53	0.50	0.49
PU2	0.30	0.16	0.30	0.38	0.32	0.37	0.31	0.38	0.17	0.20	0.26	0.25	0.26	0.31	0.33	0.32	0.66	1	0.50	0.54	0.51	0.54	0.44	0.49	0.45	0.50	0.45	0.50	0.40	0.50	0.56	0.59	0.48	0.39	0.41	0.45	0.42	0.42	0.37	0.31	0.45	0.54	0.42	0.44	0.39	0.43
PE1	0.14	0.21	0.18	0.21	0.12	0.19	0.16	0.27	0.25	0.09	0.13	0.09	0.23	0.17	0.16	0.25	0.59	0.50	1	0.73	0.53	0.54	0.60	0.61	0.58	0.52	0.38	0.48	0.59	0.45	0.53	0.49	0.51	0.40	0.44	0.40	0.53	0.34	0.40	0.37	0.36	0.40	0.41	0.48	0.31	0.28
PE2	0.12	0.22	0.23	0.26	0.22	0.28	0.24	0.29	0.21	0.16	0.14	0.13	0.21	0.21	0.16	0.34	0.67	0.54	0.73	1	0.56	0.55	0.61	0.67	0.63	0.59	0.37	0.47	0.61	0.45	0.59	0.54	0.50	0.42	0.49	0.48	0.52	0.43	0.39	0.33	0.30	0.42	0.37	0.46	0.38	0.36
TG1	0.06	0.07	0.12	0.17	0.08	0.13	0.10	0.18	0.08	0.08	0.08	-0.02	0.07	0.07	0.05	0.19	0.57	0.51	0.53	0.56	1	0.72	0.68	0.63	0.55	0.59	0.47	0.48	0.53	0.35	0.42	0.41	0.66	0.55	0.47	0.42	0.43	0.34	0.39	0.35	0.32	0.44	0.37	0.46	0.33	0.34
TG2	0.07	0.07	0.12	0.18	0.20	0.20	0.16	0.21	0.18	0.20	0.16	0.08	0.15	0.17	0.13	0.32	0.52	0.54	0.54	0.55	0.72	1	0.61	0.61	0.50	0.54	0.39	0.45	0.43	0.42	0.44	0.42	0.60	0.62	0.42	0.48	0.48	0.31	0.36	0.35	0.33	0.45	0.31	0.41	0.34	0.32
TG3	0.19	0.20	0.19	0.23	0.20	0.20	0.22	0.30	0.21	0.14	0.13	0.09	0.08	0.10	0.08	0.17	0.52	0.44	0.60	0.61	0.68	0.61	1	0.70	0.66	0.60	0.54	0.43	0.57	0.46	0.46	0.41	0.57	0.53	0.67	0.54	0.56	0.43	0.46	0.45	0.29	0.46	0.41	0.48	0.39	0.43
TG4	0.11	0.10	0.15	0.19	0.10	0.17	0.13	0.22	0.14	0.12	0.10	0.07	0.08	0.09	0.06	0.18	0.47	0.49	0.61	0.67	0.63	0.61	0.70	1	0.62	0.60	0.52	0.46	0.57	0.45	0.45	0.50	0.54	0.44	0.52	0.56	0.60	0.33	0.40	0.38	0.26	0.41	0.34	0.47	0.27	0.31
TI1	0.11	0.23	0.15	0.24	0.22	0.24	0.26	0.25	0.14	0.14	0.06	0.08	0.13	0.09	0.12	0.16	0.58	0.45	0.58	0.63	0.55	0.50	0.66	0.62	1	0.74	0.57	0.47	0.49	0.39	0.41	0.45	0.39	0.40	0.53	0.55	0.47	0.65	0.60	0.61	0.32	0.39	0.33	0.41	0.39	0.33
TI2	0.13	0.17	0.22	0.30	0.20	0.25	0.24	0.28	0.11	0.09	0.12	0.01	0.13	0.14	0.06	0.16	0.56	0.50	0.52	0.59	0.59	0.54	0.60	0.60	0.74	1	0.64	0.52	0.52	0.32	0.39	0.42	0.44	0.44	0.39	0.44	0.40	0.47	0.68	0.61	0.36	0.35	0.31	0.40	0.35	0.28
TI3	0.17	0.08	0.22	0.22	0.17	0.21	0.21	0.30	0.19	0.11	0.05	0.08	0.11	0.09	0.08	0.15	0.35	0.45	0.38	0.37	0.47	0.39	0.54	0.52	0.57	0.64	1	0.48	0.49	0.37	0.41	0.41	0.40	0.40	0.44	0.38	0.42	0.50	0.63	0.65	0.32	0.44	0.43	0.38	0.36	0.39
TI4	0.11	0.17	0.18	0.23	0.17	0.20	0.18	0.22	0.13	0.21	0.09	0.10	0.14	0.14	0.17	0.24	0.59	0.50	0.48	0.47	0.48	0.45	0.43	0.46	0.47	0.52	0.48	1	0.63	0.39	0.41	0.40	0.42	0.40	0.32	0.33	0.40	0.42	0.50	0.51	0.67	0.53	0.55	0.57	0.59	0.55
TI5	0.14	0.27	0.18	0.15	0.07	0.14	0.11	0.25	0.19	0.11	0.14	0.15	0.14	0.08	0.14	0.19	0.61	0.40	0.59	0.61	0.53	0.43	0.57	0.57	0.49	0.52	0.49	0.63	1	0.32	0.38	0.40	0.48	0.42	0.39	0.30	0.52	0.29	0.45	0.45	0.46	0.62	0.49	0.58	0.43	0.49
PE1	0.13	0.13	0.21	0.21	0.17	0.27	0.17	0.28	0.18	0.15	0.21	0.13	0.25	0.28	0.28	0.31	0.37	0.50	0.45	0.45	0.35	0.42	0.46	0.45	0.39	0.32	0.37	0.39	0.32	1	0.63	0.64	0.55	0.48	0.53	0.57	0.51	0.55	0.39	0.37	0.46	0.59	0.60	0.55	0.56	0.63
PE2	0.15	0.11	0.22	0.17	0.19	0.23	0.16	0.29	0.18	0.11	0.18	0.15	0.28	0.27	0.29	0.38	0.49	0.56	0.53	0.59	0.42	0.44	0.46	0.45	0.41	0.39	0.41	0.41	0.38	0.63	1	0.72	0.55	0.47	0.48	0.47	0.49	0.55	0.43	0.35	0.52	0.69	0.49	0.47	0.53	0.6
PE3	0.19	0.11	0.24	0.27	0.17	0.29	0.20	0.27	0.09	0.16	0.22	0.14	0.33	0.26	0.31	0.37	0.51	0.59	0.49	0.54	0.41	0.42	0.41	0.50	0.45	0.42	0.41	0.40	0.40	0.64	0.72	1	0.56	0.47	0.43	0.58	0.51	0.55	0.50	0.42	0.51	0.66	0.57	0.57	0.57	0.58
TG1	0.14	0.08	0.17	0.14	0.12	0.15	0.04	0.20	0.13	0.07	0.17	0.04	0.17	0.15	0.17	0.28	0.48	0.48	0.51	0.50	0.66	0.60	0.57	0.54	0.39	0.44	0.40	0.42	0.48	0.55	0.55	0.56	1	0.71	0.63	0.57	0.66	0.42	0.46	0.41	0.34	0.50	0.46	0.54	0.47	0.47
TG2	0.16	0.20	0.22	0.22	0.21	0.23	0.18	0.24	0.22	0.12	0.19	0.04	0.19	0.15	0.18	0.26	0.46	0.39	0.40	0.42	0.55	0.62	0.53	0.44	0.40	0.44	0.40	0.40	0.42	0.48	0.47	0.47	0.71	1	0.62	0.60	0.61	0.38	0.50	0.43	0.38	0.54	0.49	0.48	0.49	0.52
TG3	0.24	0.16	0.25	0.29	0.23	0.23	0.18	0.29	0.17	0.11	0.21	0.08	0.19	0.23	0.21	0.27	0.41	0.41	0.44	0.49	0.47	0.42	0.67	0.52	0.53	0.39	0.44	0.32	0.39	0.53	0.48	0.43	0.63	0.62	1	0.68	0.68	0.55	0.53	0.43	0.33	0.48	0.45	0.47	0.38	0.45
TG4	0.13	0.09	0.15	0.25	0.19	0.24	0.18	0.19	0.11	0.09	0.21	0.08	0.16	0.18	0.19	0.26	0.43	0.45	0.40	0.48	0.42	0.48	0.54	0.56	0.55	0.44	0.38	0.33	0.30	0.57	0.47	0.58	0.57	0.60	0.68	1	0.69	0.59	0.56	0.52	0.36	0.49	0.44	0.47	0.44	0.48
TG5	0.11	0.13	0.14	0.20	0.16	0.15	0.13	0.21	0.18	0.09	0.14	0.14	0.18	0.14	0.20	0.31	0.42	0.42	0.53	0.52	0.43	0.48	0.56	0.60	0.47	0.40	0.42	0.40	0.52	0.51	0.49	0.51	0.66	0.61	0.68	0.69	1	0.49	0.51	0.51	0.34	0.55	0.48	0.50	0.44	0.44
TI1	0.12	0.14	0.21	0.30	0.28	0.28	0.26	0.24	0.19	0.23	0.12	0.15	0.24	0.17	0.28	0.35	0.37	0.42	0.34	0.43	0.34	0.31	0.43	0.33	0.65	0.47	0.50	0.42	0.29	0.55	0.55	0.55	0.42	0.38	0.55	0.59	0.49	1	0.64	0.63	0.44	0.53	0.47	0.40	0.49	0.46
TI2	0.15	0.15	0.26	0.29	0.25	0.24	0.25	0.30	0.16	0.14	0.07	0.10	0.23	0.26	0.21	0.22	0.47	0.37	0.40	0.39	0.39	0.36	0.46	0.40	0.60	0.68	0.63	0.50	0.45	0.39	0.43	0.50	0.46	0.50	0.53	0.56	0.51	0.64	1	0.80	0.46	0.47	0.49	0.51	0.46	0.45
TI3	0.06	0.13	0.13	0.19	0.13	0.14	0.18	0.19	0.11	0.09	0.01	0.04	0.14	0.11	0.15	0.15	0.40	0.31	0.37	0.33	0.35	0.35	0.45	0.38	0.61	0.61	0.65	0.51	0.45	0.37	0.35	0.42	0.41	0.43	0.43	0.52	0.51	0.63	0.80	1	0.46	0.44	0.48	0.48	0.49	0.41
TI4	0.10	0.21	0.20	0.20	0.15	0.17	0.15	0.20	0.18	0.15	0.19	0.08	0.24	0.24	0.24	0.27	0.50	0.45	0.36	0.30	0.32	0.33	0.29	0.26	0.32	0.36	0.32	0.67	0.46	0.46	0.52	0.51	0.34	0.38	0.33	0.36	0.34	0.44	0.46	0.46	1	0.60	0.56	0.58	0.65	0.59
TI5	0.13	0.11	0.18	0.16	0.13	0.21	0.19	0.26	0.15	0.15	0.21	0.15	0.27	0.18	0.23	0.30	0.50	0.54	0.40	0.42	0.44	0.45	0.46	0.41	0.39	0.35	0.44	0.53	0.62	0.59	0.69	0.66	0.50	0.54	0.48	0.49	0.55	0.53	0.47	0.44	0.60	1	0.61	0.62	0.60	0.7
SK1	0.28	0.27	0.31	0.31	0.26	0.34	0.24	0.34	0.24	0.24	0.27	0.17	0.37	0.25	0.35	0.35	0.42	0.42	0.41	0.37	0.37	0.31	0.41	0.34	0.33	0.31	0.43	0.55	0.49	0.60	0.49	0.57	0.46	0.49	0.45	0.44	0.48	0.47	0.49	0.48	0.56	0.61	1	0.73	0.61	0.71
SK2	0.20	0.24	0.27	0.21	0.20	0.24	0.15	0.28	0.17	0.09	0.20	0.17	0.29	0.21	0.27	0.25	0.53	0.44	0.48	0.46	0.46	0.41	0.48	0.47	0.41	0.40	0.38	0.57	0.58	0.55	0.47	0.57	0.54	0.48	0.47	0.47	0.50	0.40	0.51	0.48	0.58	0.62	0.73	1	0.61	0.64
AC1	0.12	0.21	0.19	0.19	0.20	0.24	0.15	0.23	0.14	0.07	0.14	0.07	0.25	0.18	0.21	0.31	0.50	0.39	0.31	0.38	0.33	0.34	0.39	0.27	0.39	0.35	0.36	0.59	0.43	0.56	0.53	0.57	0.47	0.49	0.38	0.44	0.44	0.49	0.46	0.49	0.65	0.60	0.61	0.61	1	0.77
AC2	0.26	0.29	0.32	0.25	0.26	0.36	0.25	0.35	0.20	0.26	0.33	0.20	0.32	0.28	0.36	0.34	0.49	0.43	0.28	0.36	0.34	0.32	0.43	0.31	0.33	0.28	0.39	0.55	0.49	0.63	0.60	0.58	0.47	0.52	0.45	0.48	0.44	0.46	0.45	0.41	0.59	0.70	0.71	0.64	0.77	1