Aalto University
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DETERMINING FACTORS CONTRIBUTING TO SOFTWARE ADOPTION ON A PERSONAL LEVEL

Testing TAM and UTAUT and a new combined model based on the two models

Master's Thesis
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Abstract

This study uses UTAUT and TAM and a combined model based on them to test, which factors contribute to the adoption of a new software on an employee's personal level. The data is gathered in a company-wide survey that uses a 7-point Likert scale. Structural equation modeling using partial least squares is applied to the data to find out the causalities between the constructs and to test how well UTAUT and TAM perform. The combined model is created to test how well the two models perform together and whether there are new causalities between the variables.

Based on the results, the models partially succeeded to find significant relations between constructs. All the relations in TAM were found significant, whereas half of the relations in UTAUT were not found to be significant. The majority of the relations presented in the combined model we found significant.

This study suggests that UTAUT and TAM can be used to assess the adoption process of a new technology, but using new variables and different frameworks would be in the benefit of the field of technology adoption research.

Keywords technology adoption, innovation adoption, software adoption, TAM, UTAUT

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Tiivistelmä

Tämä tutkimus käyttää UTAUT- ja TAM-teorioita ja niistä muodostettua yhdistettyä mallia testaamaan mitkä tekijät vaikuttavat uuden ohjelmiston adoptioon henkilökohtaisella tasolla. Aineisto kerätään yrityksestä kyselytutkimuksella, jossa käytetään 7-pisteistä Likert-asteikkoa. Rakenneyhtälömallinnusta (strucural equation modeling) ja osittaisia neliösummien estimointia (partial least squares) käytetään syy-seurausyhteyksien löytämiseksi ja UTAUT- ja TAM- teorioiden testaamiseksi. Yhdistetty malli luodaan testaamaan kuinka hyvin UTAUT ja TAM toimivat yhdessä ja onko sitä kautta löydettävissä uusia syy-seuraussuhteita muuttujien välillä.

Tulosten perusteella mallit onnistuivat osittain löytämään tilastollsesti merkittäviä suhteita konstruktien välillä. Kaikki suhteet TAM-mallissa olivat merkittäviä, kun taas puolet UTAUT-mallin suhteista eivät olleet merkittäviä. Suurin osa yhdistetyn mallin suhteita todettiin merkittäviksi.

Tämä tutkimus esittää, että UTAUT- ja TAM- malleja voidaan käyttää merkittävien suhteiden löytämiseen konstruktien välillä, mutta uusien muuttujien ja viitekehysten käyttäminen voisi hyödyttää teknologia-adoption tutkimusta.

Avainsanat teknologian adoptio, innovaation adoptio, ohjelmiston adoptio, TAM, UTAUT

Table of Contents

List of Tables

List of Figures

1 Introduction

The purpose of this study is to find out which factors make employees want to start using a new software. The Technology Acceptance Model by Davis (1985) and the Unified Theory of Acceptance and Use of Technology by Venkatesh et al. (2003) are used to test, which constructs contribute the most to employee's intention to use the new software in the future. These models are then combined into one to see how the constructs used in them behave together with new hypothesized causalities. The constructs used entail performance and effort expectancy, social influence, facilitating conditions, use behavior, self-efficacy, anxiety, attitude and behavioral intention to use the software. In addition, age, company division, sex, awareness of the software and employee's managerial position are used as moderating variables to explore the potential changes in the relations between constructs.

Innovation and technology adoption research is not a new branch of studies. The modern way of studying technology adoption dates to the 80's when the use of PCs started to increase. The adoption of new technology is still accelerating and there are sectors, where there is a lot of unused potential for especially information technology. As new technology is being adopted, it is important to study how the potential future users are affected by this process.

This paper proceeds by describing the case in question, going through earlier research done in this field, presenting the framework used and applying parametric tests to test the validity of the constructs. The approach of this study is to use structural equation modeling using partial least squares. Also, the limitations of this study, some of which concern the field of technology adoption research in general are addressed at the end of this paper.

2 Case Description

In June 2017, a new software called the Situational Awareness Tool (SAT) was launched in VR Track. The software was developed to give employees a new tool where they can share and view videos and images filmed by themselves or by their coworkers of the railway working environment. Even though a new software is officially adopted into the organization by management, it has little effect on actual work processes if the target group does not accept the software or for some other reason will not start using it in their work.

The case company, VR Track, is a state-owned company that operates in the infrastructure sector with an emphasis on railroad systems. What is relevant in this study are the five divisions that especially are the target group for SAT: planning, construction, maintenance, materials and machinery. VR Track had 1350 employees in 2016.

2.1 Description of the Situational Awareness Tool

SAT is a cloud operating SaaS product, that can also be described as a map based platform where every employee of VR Track has the possibility to produce videos and still pictures using a specially developed application on their smartphones. The innovation entails two parts: a smartphone application for Android phones for producing footage and SAT for viewing, sharing and commenting the produced material. Both software are provided by the same subcontractor for VR Track. SAT can be seen bearing resemblance to a two-sided platform, because there can be a user group that only produces footage to the service and another group that only views the footage on the service. However, every user can both produce and view footage.

After filming the footage is automatically sent to SAT and positioned on a map based on the material's GPS coordinates. Filmed videos will show as a trail on the map. The filmed footage can also include audio and while filming users can record audio comments to the video, which will show as red dots on the video's timeline, as well as on the map layer. Users can also add comments to the uploaded videos and pictures later when viewing the material on SAT. SAT can include multiple groups with open or restricted access to footage. At the time of the study SAT included one open default group for all the employees in the company and a few small closed or open groups.

The footage on SAT includes the following data:

- Date and time of filming
- GPS coordinates
- Rail kilometrage points, which is a marking system for locating rail sections (e.g. in Finland the kilometrage starts from Helsinki, so the main railway station in Helsinki has a value of 0 kilometers)
- A specific tag describing the nature of the subject, which the user writes on the smartphone application before filming
- Email address of the user who produced the footage

2.2 Complementary sources of data

Existing complementary IT or sources of data can prevent or delay the adoption of a new software. The employees at VR Track have multiple sources for different kinds of data. Before the launch of SAT two different solutions had been used to provide footage from the tracks: separate 360-degree filming for a few specific projects and still picture mappings throughout the public railroad network in Finland. The still picture mappings were enveloped into SAT and produced into a "video". The 360-degree filming took place in specific projects, where the railroad track and its immediate surroundings were filmed from a railroad car. The footage from 360-degree filming was handed over on a USB mass drive and an offline software was required to be installed on the user's computer to view the footage.

For visual communication and sharing pictures workgroups and teams have used for example WhatsApp, company's network drives, email and Google Drive. Especially the possibility to have conversations on WhatsApp while sharing pictures has been seen useful. There has not been a consistent protocol about storing footage, which is why the material has been stored e.g. on several network drives.

There can be some level of subsidization considering the user groups of a platform. This is done to lure more users to use the platform and to balance the perceived worth between different user groups. Some subsidization takes place in attracting employees to adopt SAT. Gear is provided for the teams interested in using SAT for taking pictures and

videos, which include e.g. handheld electric stabilizers, mobile phones and harnesses for attaching the mobile phone. This subsidization is thought to lower the threshold for adoption, because the costs of these gear are covered by the Strategy and Development unit.

One of the ideas behind SAT is that it would be a common-good platform where employees can film videos also for the good of the organization or the employee community. The regular users are expected to upkeep the data on the platform so that management would not have to dictate or lead the use of SAT. In that sense, the expectations of management mix the line between an individual's work and the greater good of the organization. Is it possible to get employees filming videos that are of no importance to themselves personally? The company will not be giving any monetary or material rewards for active footage producers.

2.3 Communication and The Launch

The way the launch is communicated in the company can have a major effect on the adoption of the software. The message needs to have good coverage, it needs to be informative and spark interest among employees towards the innovation. All the communication related to SAT can be divided into five categories: a user guide on the company intranet, the launch, presentations to employees, active promotion of SAT on Yammer and the final survey

SAT was officially launched on 19.6.2017 on the company's intranet. The launch consisted of a piece of news covering SAT's qualities, a link to the actual software and a link to the instructions site, pinned on the intranet's front page and two posts to two of company's own Yammer groups with approximately 120 and 630 members in them. The members of the smaller group also belonged to the larger group. On 20.6.2017 text messages about the launch of SAT were sent to every employee. The two Yammer posts were updated throughout the summer, thus trying to increase the number of employees being aware of SAT.

SAT was developed by the Strategy and Development unit of VR Track. There was no large-scale communication about SAT before the launch. 13 employees from different divisions had been assigned to the project team responsible for implementing SAT. Training sessions showing the features of SAT and collecting feedback were given in June, July and August for approximately 20 groups consisting of around 160 employees in total.

3 Literature Review

This study rests on the existing theoretical background of studies on innovation adoption, IT adoption, organizational culture, social networks and human behavior. Terms “innovation adoption” and “technology adoption” are sometimes used interchangeably in the literature, because adopting new technology seems to be juxtaposed with innovative behavior.

The literature review is dedicated to researching commonly used theories in technology adoption research and differentiate variables used in those studies. In this paper, the word “item” means an individual survey question, which belongs to a certain construct. Independent and dependent variables are all constructs entailing one or more items and therefore the words variable and construct are used interchangeably. The word “factor” is used ambiguously for referring to constructs/ variables and larger concepts such as network effects and organizational culture.

3.1 Innovation Adoption Theories and Frameworks

The scope of technology adoption theories is broad varying from micro to macro level research. Two popular theories explaining the bigger picture of technology adoption are Diffusion of Innovations (DOI) by Rogers (1962) and the Technology-Organization-Environment (TOE) framework by Tornaztky et al. (1990). DOI focuses on the societal or macro level of innovation spreading. Rogers (1962) describes diffusion as a “*process by which an innovation is communicated through certain channels over time among the members of a social system*”. The variables of DOI used to explain the rate of adoption include perceived attributes of an innovation, the way the decision is made (optional, collective or authority), communication channels, nature of the social system and change agents’ promotion efforts (Rogers, 2010). TOE describes the adoption process in companies using three categories. It is a tool for studying the internal and external technologies available for a company, the situation on the organizational level and the commercial environment (Baker, 2012).

DeLone & McLean’s (1992) D&M IS Success Model (ISM), like the rest of the theories presented in this paper, focus on the processes and the cultural side inside the

company. ISM was developed to evaluate which factor would describe the success of information system (IS) adoption in a company the best (*Figure 1).*

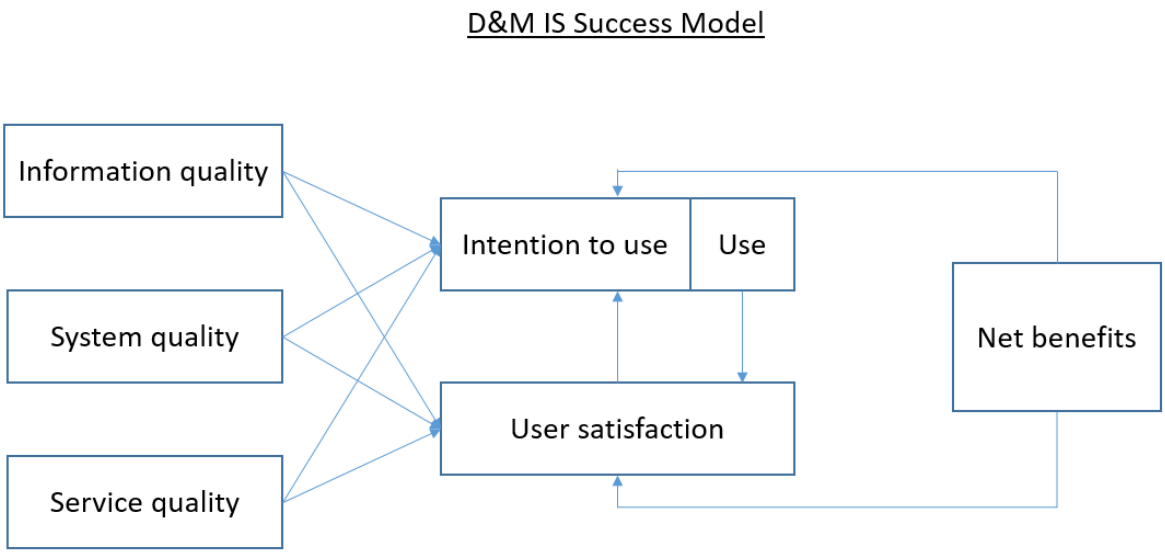

Figure 1. D&M IS success model (DeLone & McLean, 1992)

Compared to TOE DeLone & McLean (1992) focus more on the software level of the adoption process instead of also evaluating external factors outside the company. Information, system and service quality are all linked to user satisfaction and intention to use. ISM suggests that IS adoption success should be evaluated based on the net benefits the system produces. Those benefits also contribute to intention to use the system as well as to user satisfaction.

Goodhue & Thompson (1995) present the Technology-to-Performance Chain (TPC), which includes same type of variables as ISM, but also includes as a construct the fit between the technology and the tasks that it is used for (*Figure 2*).

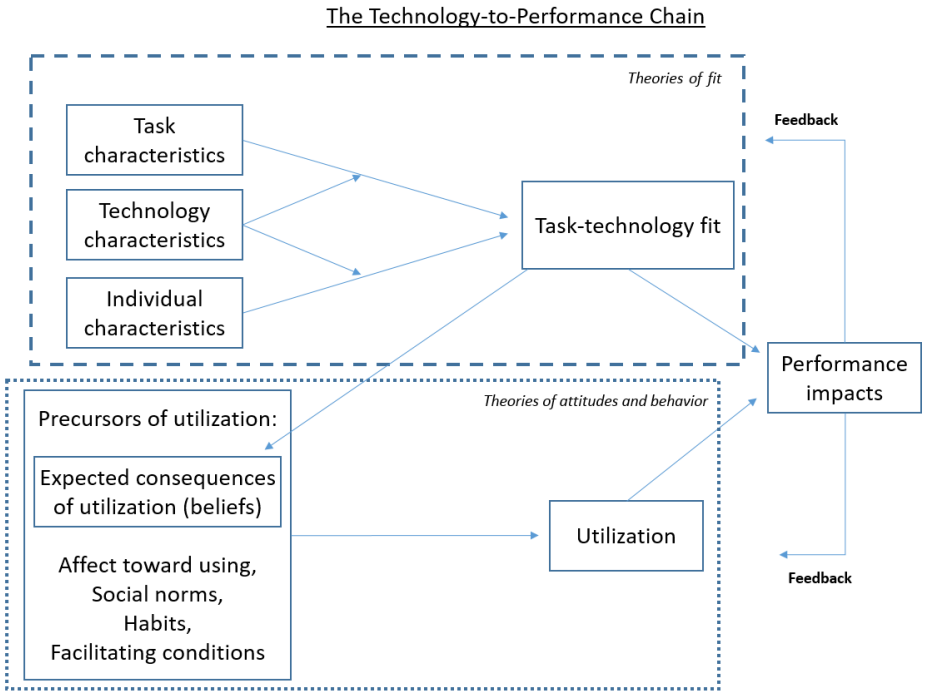

Figure 2. The technology-to-performance chain (Goodhue & Thompson, 1995)

In addition to task-technology fit, TPC adds behavioral factors to the model describing social aspects and the facilitation process. In TPC, the behavioral and fit sides are almost separated to two different processes, with some interaction from task-technology fit to user beliefs.

One of the most cited theories in innovation and IT adoption research is the Technology Acceptance Model (TAM) by Davis (1985). The model is partly based on the Theory of Reasoned Action (TRA) by Fishbein & Ajzen (1977). TAM aims to explain which determinants contribute to the intention to use a technology (computers in the original article). The two most significant factors contributing to IT adoption presented by Davis (1985) are perceived usefulness and perceived ease of use (*Figure 3*).

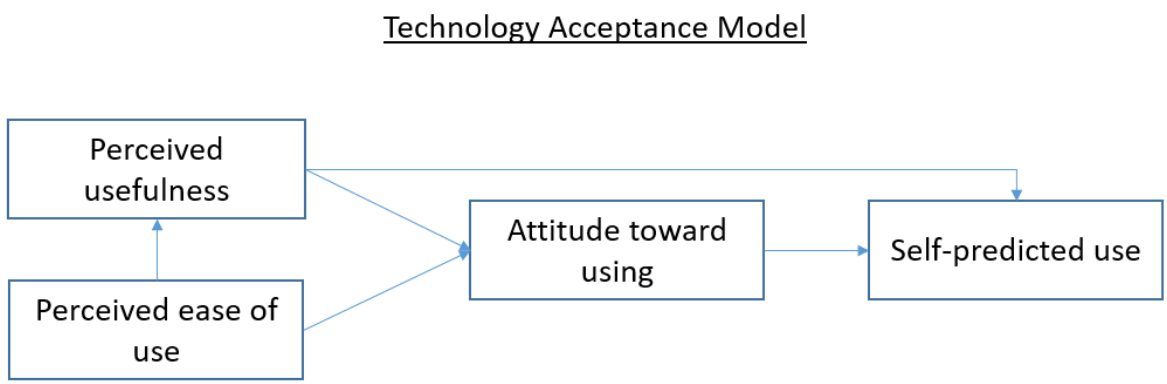

Figure 3. Technology acceptance model (TAM) (Davis, 1985)

According to the study, perceived usefulness affects directly to self-predicted use. Attitude toward using a technology acts as a mediator for self-predicted use and is affected by perceived usefulness and perceived ease of use. Ease of use also affects perceived usefulness. Davis et al. (1989) write that perceived usefulness is "*a major determinant*" and perceived ease of use is "*a significant secondary determinant*".

Venkatesh & Davis (2000) updated TAM to TAM 2 and later Venkatesh & Bala (2008) presented TAM 3 (*Figure 4*).

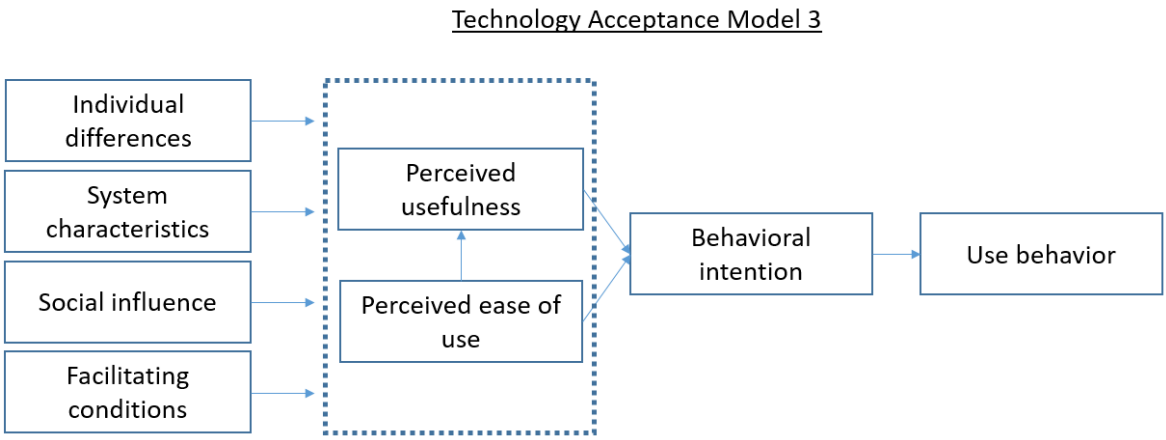

Figure 4. Technology acceptance model 3 (TAM 3) (Venkatesh & Bala, 2008)

Compared to the original version of TAM, the third version includes now use behavior (UB) as a dependent variable and behavioral intention (BI) (earlier: self-predicted use) acts now as a mediator. Perceived usefulness and ease of use are affected by system characteristics, individual differences, social influence (SI) and facilitating conditions (FC). Table 1 and Table 2 show the results of meta-analysis from multiple TAM studies.

Table 1: Meta-study on significant relations in TAM studies (Schepers & Wetzels, 2007)

Variables	**Significant relations/ number of studies**
Perceived usefulness & Effort expectancy	51/53 = 96 %
Perceived usefulness & Attitude	15/15 = 100 %
Perceived usefulness & Behavioral intention	38/38 = 100 %
Effort expectancy & Attitude	15/16 = 94 %
Effort expectancy & Behavioral intention	40/40 = 100 %
Effort expectancy & Usage	19/21 = 90 %
Attitude & Behavioral intention	14/14 = 100 %
Attitude & Usage	7/7 = 100 %
Behavioral intention & Usage	9/9 = 100 %

Table 2: Meta-study on significant relations in TAM studies (Ma & Liu, 2004)

Variables	**Significant relations/ number of studies**
Perceived usefulness & Technology acceptance	23/37 = 62 %
Effort expectancy & Technology acceptance	17/32 = 53 %
Effort expectancy & Perceived usefulness	21/33 = 64 %

Comparing the results of Schepers & Wetzels's (2007) Ma & Liu's (2004) meta-studies we find that the results are not consistent, but there is a pattern toward TAM having explanatory

power in explaining technology adoption. Ma & Liu (2004) do not specify if technology acceptance refers to BI or UB, but their study still gives shows the ratio between significant relations and number of studies conducted.

Venkatesh et al. (2003) compile the Unified Theory of Acceptance and Use of Technology (UTAUT) different models including e.g. TRA, TAM, the theory of planned behavior (TPB), a theory combining TBP and TAM, DOI and social cognitive theory (*Figure 5*).

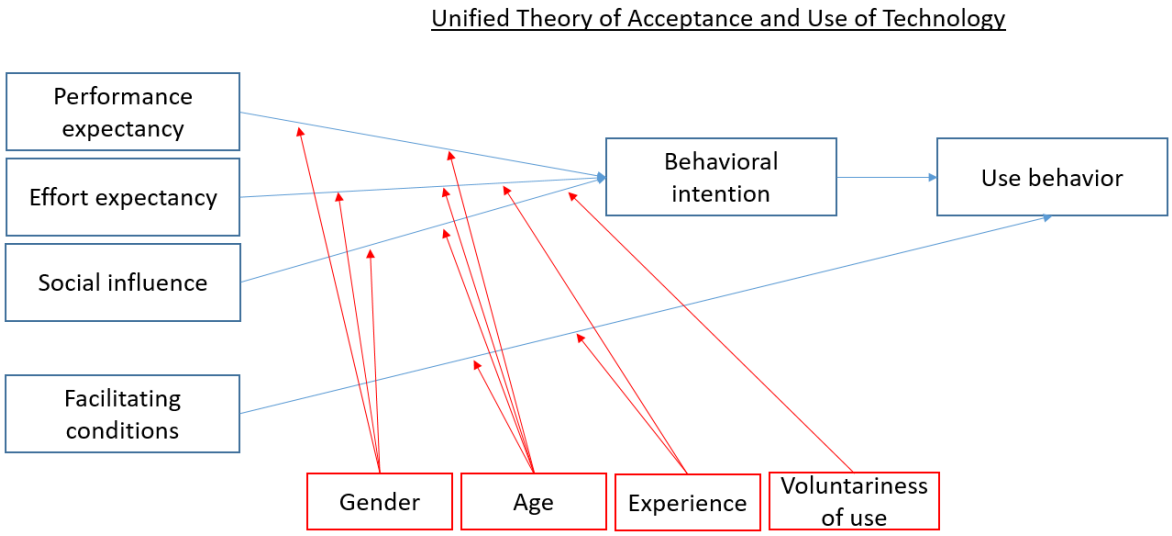

Figure 5. Unified theory of acceptance and use of technology (UTAUT) model (Venkatesh et al. 2003)

The variables observed in UTAUT are performance expectancy (PE) (perceived usefulness in TAM), effort expectancy (EE) (ease of use in TAM), attitude toward using technology (AT), SI, FC, self-efficacy (SE), anxiety (ANX), BI and UB. Venkatesh et al. (2003) also used gender, age, experience with IT systems and voluntariness of use as moderating variables in their original study.

According to the meta study of Williams et al. (2015) the main variables of UTAUT studied are PE, EE, SI, BI and UB. Variables and their share of significant relations found in studies by Williams et al. (2015) are found in Table 3.

Table 3: Meta-study on significant relations in UTAUT studies (Williams et al. 2015)

Variables	Significant relations/ number of relations studied		
BI & UB	50/61	=	82 %
PE & BI	93/116	=	80 %
SI & BI	86/115	=	75 %
FC & BI	33/48	=	69 %
FC & UB	36/54	=	67 %
EE & BI	64/110	=	58 %

Williams et al. (2015) write that all the significant relations are positive except for FC & BI and BI & U where both had one case of negative relation. The authors write that it is not common to fully use the original UTAUT model with all its variables and that in increasing number of studies, the use UTAUT is mixed with external variables and theories. There is a significant resemblance between TAM 3 and UTAUT. The constructs are almost identical with some differences in their interrelations. UTAUT also uses moderating variables such as gender, age, experience and voluntariness of technology use.

There have been various modifications based on the theories presented earlier in this paper, of which two are the Technology Readiness and Acceptance Model (TRAM) by Lin et al. (2007) and an Integrated TAM/ TTF Model by Usoro et al. (2010) (Figure 1*Figure 6 &Figure* 7).

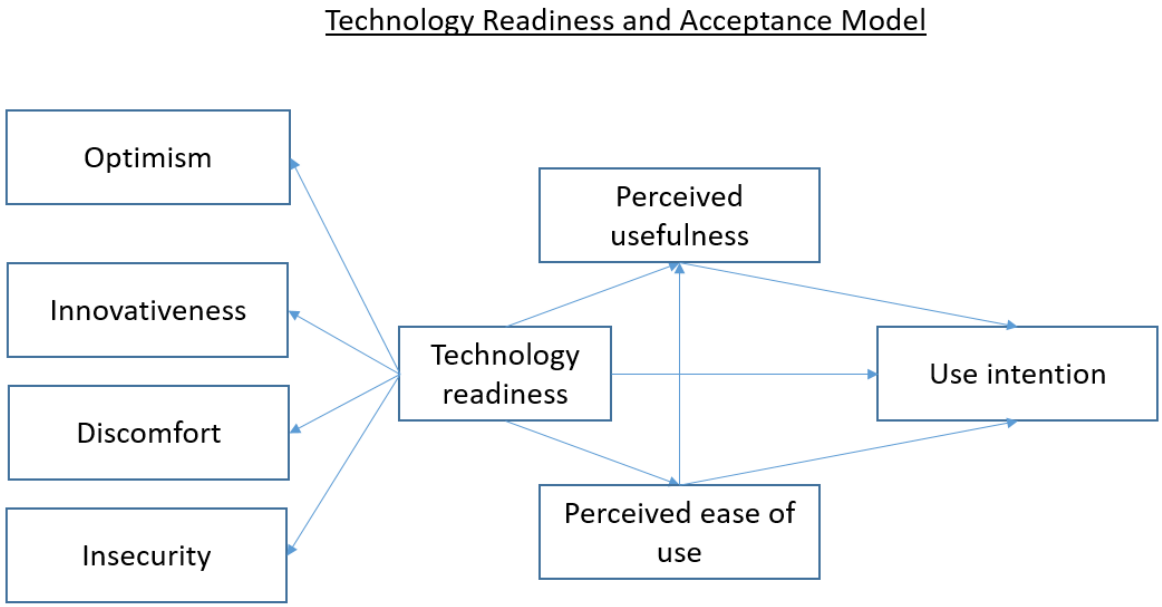

Figure 6. Technology readiness and acceptance (TRAM) model (Lin et al. 2007)

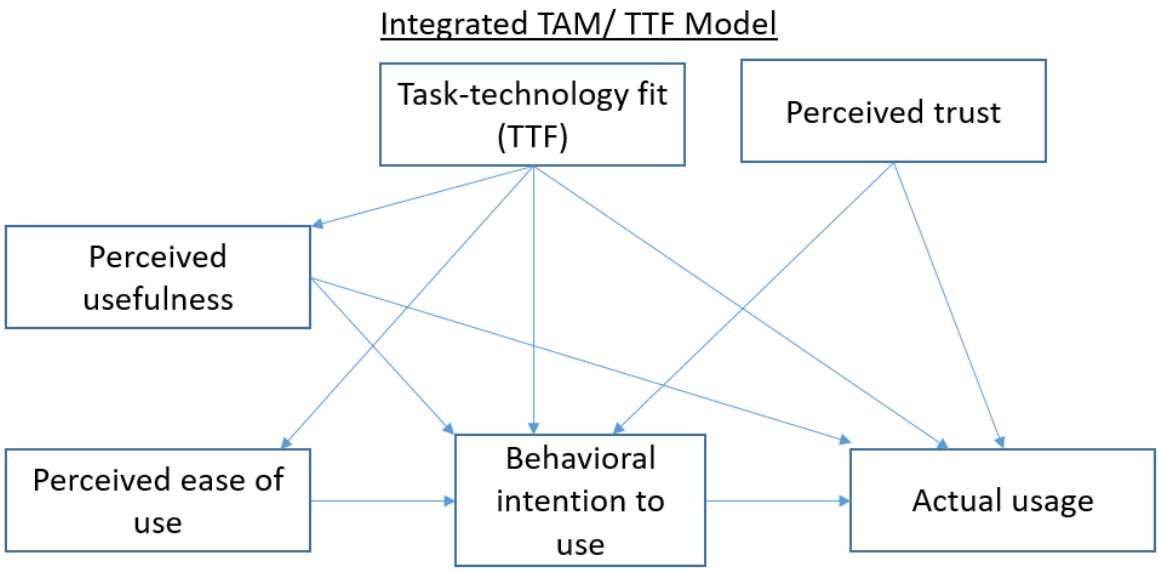

Figure 7. Integrated TAM/ TTF model (Usoro et al. 2010)

Like in other models, the differences in the models by Lin et al. (2007) and Usoro et al. (2010) are related to whether actual usage or behavioral intention is measured and what is the role of quantitative benefits of adopting a technology. Theories of technology adoption can therefore be divided into two categories: 1) Theories that aim to measure (intended) technology usage and 2) theories that try to estimate the net benefits and the suitability of a technology to tasks. In this paper, the framework is chosen so that we can estimate behavioral intention to use SAT without studying tangible benefits of using the software.

3.2 Factors Used to Build Variables in This Study

There are many variables used in technology adoption studies, but in the literature some variables are repeated more often than others. Peansupap & Walker (2005) separate individual, environment, management and technology factors as determinants contributing to information and communications technology (ICT) adoption. Individual factors include e.g. feelings and perceived usefulness, environment factors include help being available and a supportive and communicative work environment, management factors include support from managers and technology factors include frustration with ICT use.

Jeyaraj et al. (2006) study 48 empirical studies on individual IT adoption and presents that top management support, computer experience, perceived usefulness, behavioral intention and user support were the best predictors of IT adoption. The authors also write about promising predictors that had not been at the time studied as much yet. Those predictors include e.g. system quality, user training, computer self-efficacy, outcome expectations performance-wise and on personal level problem importance.

Based on her meta-study, Korpelainen (2011) states that four major contributors to ICT adoption are 1) organizational support 2) informal peer support 3) being able to find the information wanted in the ICT system and 4) the support of management and it is reassuring that the ICT system is going to be used in the company, making it worthwhile learning to use the system.

3.2.1 Social Influence

Two significant problems in the launching phase of a platform are the penguin problem and the chicken-or-egg problem (Tiwana, 2013). The penguin problem means that potential users are waiting for other users of the same side to join the network before they do. The chicken-or-egg problem is similar, but now the potential users of one group are waiting the users of another group to join the platform first. The rate of adoption can depend on many factors. Sometimes a bandwagon effect can occur, which means that people are more likely to join a platform if there is a significant number of existing users on the platform. Bayerl et al. (2016) present three different cases of groups having a different “path” towards the adoption decision: 1) Uneasy early adoption, team-wide withdrawal and recovery 2) promising start and late failure 3) from collective rejection to collective embrace. The authors write that in their study subgroups with different attitudes towards the adoption of the new technology

were in key roles in swaying the general opinion in a group to either towards pro-adoption or anti-adoption.

Employees are affected by and contribute to the organizational culture they are working in. Some ambivalence may take place when facing a new change (Piderit, 2000), which is why the willingness to adopt a new platform is not always clear when a person hears about the new platform for the first time. Bayerl et al. (2016) state that adoption process is a long-lasting event that is affected by different triggers throughout its cycle.

If a platform is perceived as useful, a motivated manager could encourage his or her employees to try it. Managers are not necessarily always the impact factors of new technology adoption, but can have significant roles as catalysts by listening, assisting and empowering their subordinates. Bhattacherjee (1998) writes that managers have a significant role in enabling IT adoption within the company by designing proper control structures for IT usage. Whenever there are new information systems available, management has an important role in the adoption process (Bhattacherjee, 1998; Lam et al. 2007). Makkonen et al. (2016) write that to enhance technology adoption management should constantly improve performance, support innovation, help in problem solving and choose the best practices.

Bayerl et al. (2016) found external and internal triggers affecting technology adoption. External triggers originated e.g. from management. The authors suggest that the more stable and uniform the attitudes in a team are the stronger the team resists external and internal triggers. The authors continue that trigger events can affect significantly a team that doesn't have a uniform view about e.g. the perceived usefulness of the innovation, but the same trigger event might not affect another team. These results show that employees can be prone to various signals affecting (purposely or not) their behavior.

The social network around the employee can impact significantly his or her perception of the innovation and the process of adopting it. The work at VR Track is interconnected to other work done by professionals of a different segment in the company. For example, design engineers make the plans for a new track section for which they need information from e.g. workers from the worksite and vice versa. Besides individuals having their own opinions on using certain information systems the group valence towards those information systems affects the opinions of individuals and the actual possibilities of using the software, because e.g. SAT is meant for sharing information between individuals and groups. In their study Talukder & Quazi (2011) found out that social networks affect employees' perception toward an innovation and the probability of using the innovation. However, the authors continue that peer influence, which in their study refers to personal

encouragement to use an innovation, did not seem to affect perception or actual adoption of an innovation.

Sykes et al. (2009) studied social networks in a workplace and based on their results state that social networks provide a useful channel for peer support. The authors write that employees that are outside of those social networks are in risk of not getting the support needed to adopt an innovation, which is why identifying those employees and providing suitable support for them is crucial. In a company of 1350 employees it is possible that some individuals or even groups will be neglected when it comes to implementing SAT. To achieve a high adoption and acceptance rate of SAT finding those individuals and groups is important. On the other hand, if the use of SAT starts to spread among employees, those individuals and groups could be reached by other employees who have just adopted SAT. The situation resembles a twisted version of "early adopters" and "late bloomers" where the reasons for not adopting early are different.

Sarker et al. (2005) write that the process of technology adoption in a group includes comparing perceived attitudes towards the technology, discussing the actual features, social influence on members and forming group valence, which sets the direction of a group's technology adoption process. Sarker & Valacich (2010) state that instead of the formally highest-ranking employee, the person possessing the deepest expertise on the technology has a significant impact on group valence. Rogers (1962) states that a group where its members think and act similarly is more prone to accept an innovation, because of more fruitful communication.

In their study of a new cutting technology for football manufacturers Atkin et al. (2015) found out that so-called gatekeeper employees have a major impact on the adoption process. In this case the gatekeepers were the employees cutting the material for footballs, thus being able to affect the management with their expert opinions. Atkin et al. (2015) suggest that if an employee in an important position does not have incentives to adopt a new technology it may significantly hinge the adoption process in the whole organization.

3.2.2 Attitude toward technology

Resistance to change can occur on an organizational or individual level. Launching a new platform can face big challenges if employees already think that there is no need for a new software or for some other reason oppose adopting the software. On the other hand, Dent & Goldberg (1999) state that people do not tend to resist change, but the things that come along

with that change. They claim that sheer resistance to change is not the reason why a development project would not be able to take off. In this study, the reasons for not wanting to adopt SAT could vary e.g. from having to study a new software to losing an important part of the job, which in this case could be the decreased need for employees driving to the worksite to check the current situation.

The way previous projects were implemented can affect the way future development projects are accepted. If employees feel like their opinions and development ideas were not noted, they might lose interest in future projects. Also, if new projects and services are introduced in too fast a pace people may become uninterested in following new development projects. When it comes to change management, recognizing cynicism among employees and reducing it can result in increased commitment toward the organization (Grama & Todericiu, 2016).

Lewis & Seibold (1996) write that if employees like a certain innovation, they are more likely to act favorably towards that same innovation. However, the authors continue that the sheer attitude is not enough to predict the behavior of employees and that e.g. the way the features of an innovation are perceived needs to be considered. Schepers & Wetzels (2007) write that an important contributor to adoption on an individual level is both department and company level having a positive atmosphere toward adoption.

Anxiety is also used as a variable to estimate employee's tendency to adopt new technology. It relates closely to attitude in general, but in literature is used to depict the negative feelings the respondent has. For example, Igbaria & Iivari (1995) suggest that anxiety affects directly perceived ease of use.

3.2.3 Performance and Effort Expectancy

User expectations toward an innovation can be the make-or-break variable in adopting the innovation, especially if the adoption decision lies solely on the decision of the potential user. The employee might not even consider adopting or even testing the innovation. Expectation management and expectation gaps are the other side of how expectations can affect adoption. If an employee is not disappointed with the innovation, it can affect positively the level of satisfaction and the perceived usefulness of the innovation (Tan & Kim, 2015). Therefore, surpassed expectations and disappointments can guide the adoption process to better or worse.

The focus of expectations is practically infinite, which is why finding the areas of expectations that matter for a specific innovation can be challenging. Also, separating e.g. expectations toward software usefulness from noticed usefulness through software use can be challenging. A user cannot always know how a software can affect his/ her work in the future.

The first thing to assess when implementing a platform is to consider whether it is actually useful for the employees. There is no need to adopt a software that does not include the key features that the employees need in their work. Software relevancy to work and ease of use have been found to be important factors for its adoption (Venkatesh & Davis, 2000). Mun et al. (2006) state that being able to demonstrate results from using the new digital application eases the adoption process. Satisfaction in the software has also been shown to encourage to continue the use of the software Tan & Kim (2015).

Evaluating the usefulness of a platform is subjective. At VR Track people have diverse job descriptions, which is why one feature considered useful in the platform by one user group might not be as useful for other groups. When the work is technical and highly specialized, it raises the stakes for platform development, especially in the form of delivering specifically designed tools to be used on the platform.

There is no clear consensus on the relationship of perceived usefulness and ease of use in the process of adopting an innovation. When studying computer use, Davis et al. (1989) found out that perceived usefulness and ease of use are notable factors considering the adoption process and that ease of use affects also through perceived usefulness. Mun et al. (2006) studied the use of a personal digital assistant, which is a type of an electronic calendar. The authors suggest that perceived ease of use correlates positively with perceived usefulness. On the other hand, Lewis et al. (2003) write that in their study the ease of use of an innovation did not affect its perceived usefulness. Wu & Wang (2005) write that "*Perceived ease of use does not directly influence behavioral intention to use but indirectly affects behavioral intention to use through perceived usefulness*". Davis (1989) writes, on computer applications, that "*usefulness was significantly more strongly linked to usage than was ease of use*". King & He (2006) state that perceived usefulness and perceived ease of use both contribute to innovation adoption, even though the two concepts can get mixed up. The authors continue that perceived ease of use has a very important role in the adoption process of internet applications.

Schepers & Wetzels (2007) suggest that usefulness is more important than a low level of complexity when adopting new technology. The authors also suggest that the ease

of use loses its importance when the technology has been used for a longer period. Lee et al. (2005) write that when studying students' adoption of an internet-based learning medium perceived usefulness and enjoyment affected the adoption process positively. However, ease of use was not seen as a significant factor affecting the adoption of the learning medium. Based on their meta-analysis Tornatzky & Klein (1982) suggest that compatibility is positively and complexity is negatively related to innovation adoption. Even though their study was related to innovation adoption on a company level, individual employees can also perceive complexity and compatibility in different ways when potentially adopting a new platform. Complexity is directly related to employee's self-efficacy in using IT, which has been seen linking to behavior through increased technology use and receptiveness toward guidance (Igbaria & Iivari, 1995).

3.2.4 Facilitating Conditions

The way technology implementation is organized and done can have a significant impact on the result. The need for training is emphasized e.g. when an information system innovation targets a partial segment of job tasks, requires certain skills to use the system or for some reason is unknown to employees and therefore it is likely that the employees will not try the software on their own. Providing training and explicitly showing the advantages of a new software could enhance user acceptance (Venkatesh & Davis, 2000; Quazi & Talukder, 2011).

Talukder's (2012) findings suggest that by providing proper training companies can support the adoption process. The author continues that identifying organizational, individual, social and demographic factors that affect employees is also important and that reciprocal learning and support among employees enhances the adoption rate, because people tend to want to keep up with the rest of their peer group.

Jasperson et al. (2005) state that to keep employees using the new software, management needs to make sure e.g. by organizing training sessions that the use of the new software will continue and the employees will deepen their knowledge on it. The authors emphasize "*active management of the post-adoptive life cycle and the active collection of data on post-adoptive behaviors*". However, the post-adoptive life cycle is not in the scope of this study, because at the time of the study the employees were in the beginning of the adoption process.

Arranging formal training is important to be able to manage and evaluate the implementation process. However, Sykes et al. (2009) state that identifying informal networks that provide assistance in technology adoption and supporting them is important for organization-wide technology adoption. The authors write that supporting employees that master the new technology, regardless of their formal rank in the organization, could enhance the adoption process. Sykes et al. (2009) continue that aiding employees that for some reason don't have access to a help providing network is also an important part of adoption management. Antonioli & Della Torre (2016) found a positive, although weak correlation between the level of overall innovativeness in the company and the level of employee training. The significant determinants were the coverage and intensity of training.

Venkatesh & Davis (2000) write that finding out together the pros of adopting a new system and discussing about them seems more effective than dictating the steps of system implementation top-down. On the other hand, Liang et al. (2007) emphasize the role of top management when assimilating ERP systems. The authors write that even though heavy top-down implementation has its cons, it can quicken companywide adoption process.

It is likely that the best practice for innovation adoption lies somewhere between the two points of views presented earlier. For example, Gallivan (2001) writes that strong top-down innovation implementation might achieve the results wanted in the beginning, but might lose its efficiency in later phases of adoption where the innovation should be rooted to the everyday work of the employees. According to the author, the same goes with highly centralized planning of implementation. These results describe the importance of intrinsic motivation when fully adopting an innovation. Intrinsic motivation has been found to result in "*high-quality learning and creativity*" and it correlates with "*interest, enjoyment, felt competence and positive coping*" (Ryan & Deci, 2000).

3.2.5 Age, Gender, Managerial Position and Awareness

The way users perceive the innovation implementation process can vary based on demographics. For example, in the study of Lee et al. (2005) the result of ease of use not being considered as a significant factor can derive from the population observed in the study, which in this case consisted of students. Prensky (2001) depicted the differences between digital natives and digital immigrants, which simply put means that people who were not raised during the era of digital information have to put more effort into learning the use of new software i.e. using different software is natural to younger people.

However, in the meta study of Jeyaraj et al. (2006) e.g. age and gender were found to be among the least accurate predictors of IT adoption. Also, in the study of Quazi & Talukder (2011) employee's age was not related to the adoption process of a new technological innovation. In their other study Talukder & Quazi (2011) suggest that it is the employee's attitude towards the innovation that matters, unlike gender and age. However, age has found to be a significant factor when deciding on whether to start using a new technology or not (Morris & Venkatesh, 2000). Also, the study of Lerouge et al. (2005) suggest that younger users emphasize more system development and technology skills than older users when comparing groups of below 30-year-olds and above 50-year-olds.

An innovation can be seen from different perspectives depending on the job description of the employee. It is possible that not every employee will automatically think that an innovation is also meant for them. Targeting the potential user group of an innovation can be difficult, especially if the innovation is meant for everyone in the company. Gallivan (2001) writes that an organizational culture that strives to categorize rigorously employees' roles in the organization might restrain employees from adopting the innovation. SAT is the kind of an innovation that the management wants to spread across the company, which is why identifying the number of employees that do not see themselves belonging to the target group is important.

Along with informal status in the organization or work group the formal status of an employee can also affect adopting an innovation. Pressure from management, fear of not keeping up with development or wanting to belong to a certain user group are all possible reasons contributing to adoption and on the other hand, reasons for not wanting to adopt. Wang et al. (2013) studied how peers, subordinates and superiors affect an individual's knowledge management system (KMS) use. The authors found out that below middle management level KMS use was affected by peers and subordinates, but from middle management to senior management KMS use was affected only by subordinates. Also, they found out that higher ranking employees were less likely to be affected by other's KMS use.

In this paper, the employee's awareness of the technology is also taken into consideration. It is possible that employees more familiar with the technology, or with more user experience, are more prone to adopt it. For example, in TAM awareness of the technology is indirectly present through perceived usefulness and ease of use, which could also mean that the more one uses the technology, the more he/ she learns about its benefits. Awareness can also be linked to attitude, because e.g. employees who are not familiar with

the new technology could have inaccurate perceptions of it that are based on factors such as social influence.

4 Method

The data for this thesis was collected by conducting a company-wide survey. A personal link to the survey was sent via email to every employee and the survey was open for 24 days. After the initial invitation, a reminder email was sent once per week to employees who had not yet answered the survey. The data is tested using UTAUT, TAM and a combined based on them. Parametric tests in the form of structural equation modelling using partial least squares are applied. The software used for the analysis are SmartPLS 3 and SPSS.

4.1 Survey and Analysis

In the survey, normative measurement in the form of a 7-point Likert scale was chosen. Respondents were to express their attitude toward a claim by ticking if they 1) fully agreed 2) somewhat agreed 3) slightly agreed 4) were undecided 5) slightly disagreed 6) somewhat disagreed or 7) fully disagreed with the claim. There were 39 questions in the survey, of which the three last ones were open questions for getting ideas for different ways of applying the software, developing and implementing it in the company. After finishing the survey, the respondents had a possibility to participate in a lottery by giving their email address. The prizes included a headphone set (value ~50 €) and two power banks (value ~20 € each). The lottery was arranged to get a higher response rate.

There is no consensus in the literature on "the right way" of conducting a Likert scale survey, especially when it comes to the number of answer options. Matell & Jacoby (1972) write that the "uncertain" mid-point seems to get ticked more frequently when the number of options is 3 or 5, which implies that if the answer options are seen too strict, the respondent might more easily be undecided. In their study on the use Likert scales in subjective quality of life research Cummins & Gullone (2000) suggest that expanding the number of choice points in a Likert scale from 5 or 7 to 10 and numbering those points from 1 to 10 instead of naming them increases the accuracy of answers and their interpretation.

Another subtopic is whether there should be an even numbered scale or not, meaning that ticking "undecided" would not always be possible. Garland (1991) suggests that using an even numbered Likert scale can decrease the possibility of getting "socially acceptable

answers". However, the author concludes that an even numbered scale can shift the results compared to an uneven numbered scale, thus leaving the decision to researchers.

4.2 Framework

The framework used in this study combines UTAUT and TAM. The aim is to test the two theories separately with new additional variables and combine them to one model afterwards. The purpose of this is to test the data against different models and compare the results. Finally, the results are compared to the combined model so that we can see if all the variables can be studied simultaneously while maintaining their original levels of significance. This approach gives an exploratory nuance to this paper while strictly resting on well-tested theory. Table 4 shows all the variables used in this study and their explanations.

Table 4: The variables used in this study, their abbreviations and explanations

Independent Variables	**Abbreviation**	**Eplanation**
Performance expectancy	PE	Perception of the usefulness and the sufficiency of atrributes of SAT
Effort expectancy	EE	Perception of how easy SAT is to use
Self-efficacy	SE	Respondent's proficiency in using software
Anxiety	ANX	Anxiety and hesitation toward using SAT
Use behavior	UB	Current use of SAT by the respondent
Attitude toward SAT	AT	How good of an idea is using SAT
Social influence	SI	Colleagues' and managers' influence on using SAT
Facilitating conditions	FC	Sufficiency of communication, guidance and availability of help in using SAT
Moderating Variables		
Age		Age of the respondent
Sex		Sex of the respondent
Managerial position		The respondent is or is not in a managerial position
Division		The division where the respondent is working in
Awareness		The level of familiarity the respondent has with SAT
Dependent Variable		
Behavioral intention to use SAT	BI	Respondent's estimation on his/ her use of SAT in the future

Performance expectancy (PE) describes the usefulness of SAT whereas effort expectancy (EE) estimates to what extent SAT usage is free from effort. Self-efficacy (SE) tells about the respondent's ability to use SAT independently, Anxiety (ANX) depicts the level of anxiousness and hesitation that the use of SAT brings up in the respondent, use behavior (UB) tells whether the respondent is already using SAT and attitude toward SAT (AT) tells

if the respondent thinks using SAT is a good idea in general. Social influence (SI) and facilitating conditions (FC) describe how the behavior of the respondent's colleagues and managers would affect the respondent's use of SAT and if the implementation process of SAT was comprehensive and wide-spread enough.

Moderating variables are used to find differences within the independent variables. These include age, sex, division, which tells the division the respondent is working in, managerial position, which tells if the respondent is a manager or not, and awareness, which describes how well the respondent was familiar with SAT before taking the survey.

UTAUT and TAM do not study the influence of present use of a technology to the intention to use it in the future. Also, the moderating variable describing experience with IT systems in UTAUT is merged to the independent variable describing SE, because the differences between these two components can be seen semantic. Also, voluntariness of use is removed from the variables. Two new variables are managerial position awareness and division. The dependent variable, behavioral intention to use SAT (BI) tells if the respondent is going to use SAT in the future.

Every construct, except UB, entail 3,4 or 6 items (questions). Since UB measures the present use of SAT by the respondent, it only includes one item. Before publishing the survey, the items were sent to eight people to get feedback, of which three of them replied. However, to secure the validity of the items, the majority of the questions were taken or slightly modified from previous research, e.g. from the study by Venkatesh et al. (2003).

Figure 8, Figure 9 and Figure 10 show the models used to test the data.

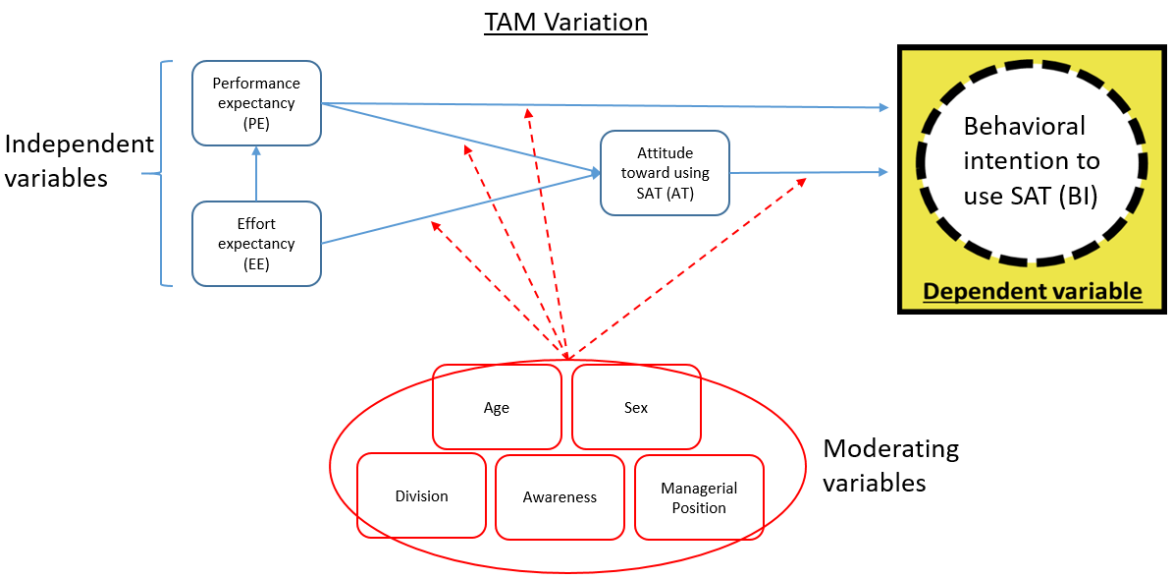

Figure 8. Variation of TAM: the relationships of variables

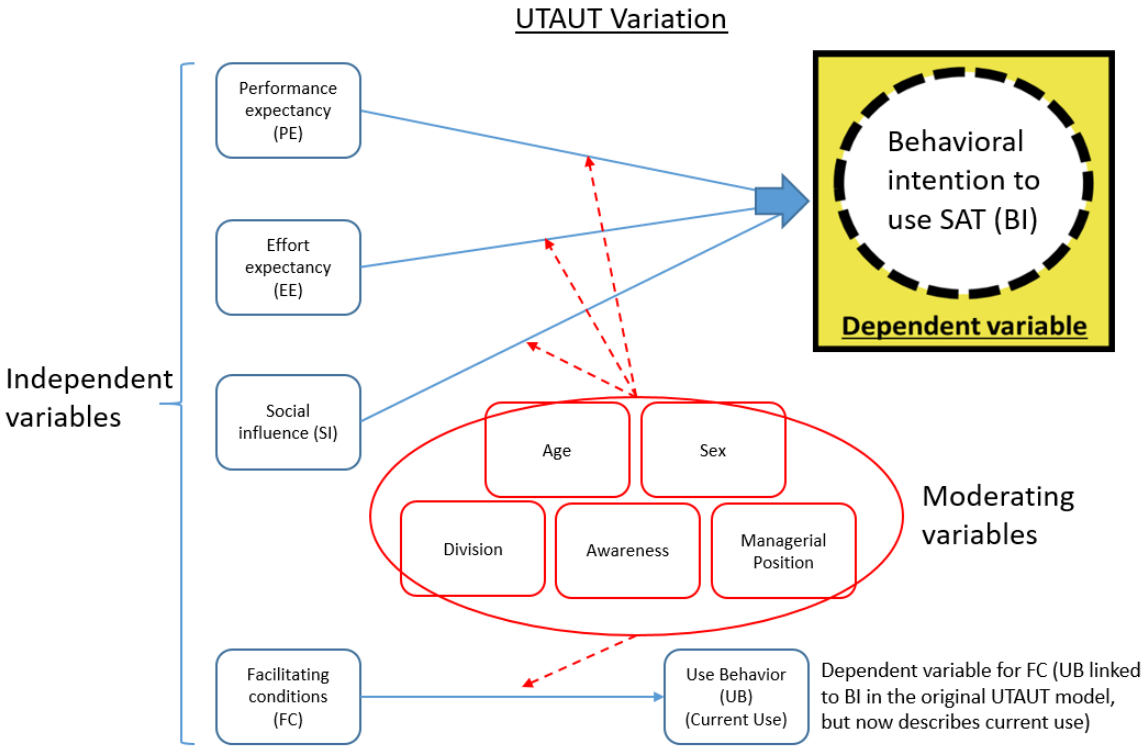

Figure 9. Variation of UTAUT: the relationships of variables

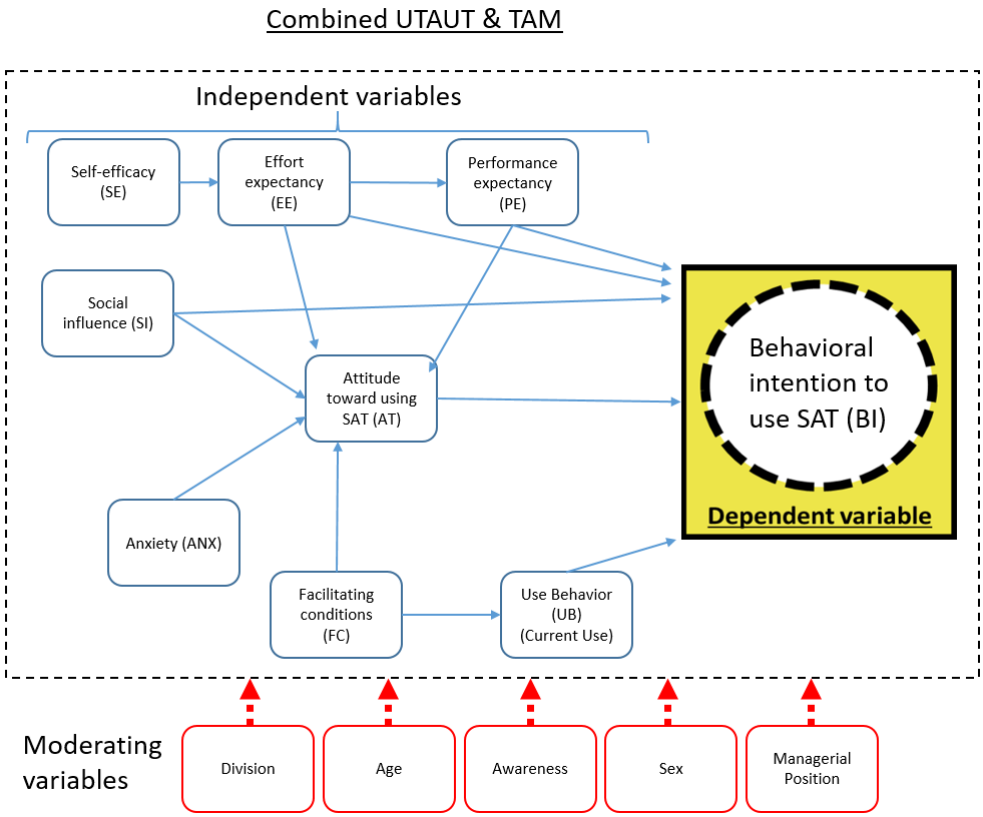

Figure 10. Combined model of UTAUT & TAM

There are slight modifications done in the two models. Both models have now new moderating variables. Every moderating variable is tested with every relation presented in the models to see if they affect the relations. Also, UTAUT has been divided into two parts, because in the original model UB measured the actualized future use, whereas in this study UB measures subjectively the current use of SAT.

Otherwise UTAUT and TAM remain in their original form. In TAM, EE is hypothesized to affect BI through PE and AT. PE and AT are proposed to affect BI directly, but AT should also act as a mediator for PE. In UTAUT, PE, EE and SE are hypothesized to affect BI directly and FC is expected to affect UB directly.

As we can see, the combined model of UTAUT & TAM includes the same hypothesized causalities. In addition, EE, SI, ANX and FC are expected to affect AT directly. SE has also been added to study the effect it could have on EE. The moderating variables are used in the same manner, but for simplicity and clarity are presented outside the box. Based on the literature review and the models presented here, following hypothesis are formed (*Table 5*).

Table 5:Hypothesis

Hypothesis	Condition
H1	PE will have a positive effect on BI
H2	EE will have a positive effect on BI
H3	EE will have a positive effect on PE
H4	SE will have a positive effect on EE
H5	SI will have a positive effect on BI
H6	AT will have a positive effect on BI
H7	UB will have a positive effect on BI
H8	PE will have a positive effect on AT
H9	EE will have a positive effect on AT
H10	SI will have a positive effect on AT
H11	ANX will have a negative effect on AT
H12	FC will have a positive effect on AT
H13	FC will have a positive effect on UB

The hypothesis presented are based on the literature review and are supported in the research in technology adoption. Due to lack of research and/or consistent results in the literature, hypothesis for moderating variables are not proposed, thus making this paper having also an exploratory feature.

5 Results

There were 29 questions using a 7-point Likert scale and those answers were checked for answer biases (*Table 6, Figure 11 and Table 7*).

Table 6: Frequency of responses per answer category per respondent

# of responses per respondent	Frequency "fully agree"	Frequency "somewhat agree"	Frequency "sligthly agree"	Frequency "undecided"	Frequency "slightly disagree"	Frequency "somewhat disagree"	Frequency "fully disagree"
25-29	1	0	0	17	0	0	0
20-24	1	0	0	8	0	0	0
15-19	10	11	1	21	0	0	1
10-14	36	64	10	33	3	1	4
5-9	69	105	95	74	23	46	44
0-4	158	95	169	122	249	228	226
Total	**275**	**275**	**275**	**275**	**275**	**275**	**275**

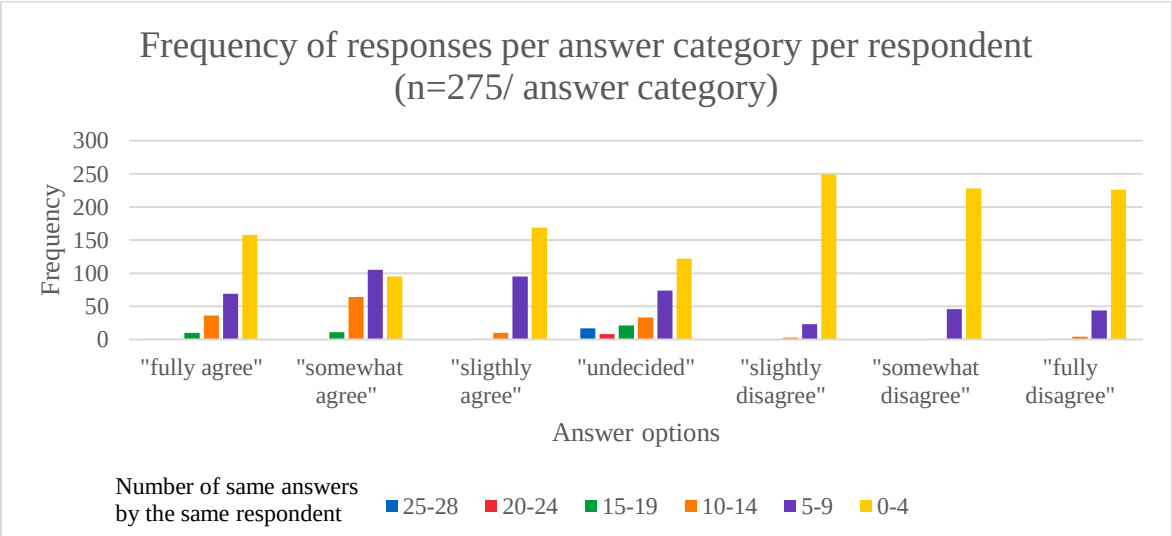

Figure 11. Frequency of responses per answer category per respondent (n=275/ answer category)

Table 7: Standard deviation ranges and their mean and median values

SD range	MEAN	MEDIAN	n
0.37-0.99	3.80	3.90	25
1.00-1.49	3.40	3.47	78
1.50-1.99	3.34	3.25	116
2.00-2.79	3.18	3.03	56
		Total	275

Scale: 1 (fully agree), 2 (somewhat agree), 3 (slightly agree), 4 (undecided), 5 (slightly disagree), 6 (somewhat disagree), 7 (fully disagree)

In Table 6 we can see the frequencies for ticking the same answer by the same respondent. Only two respondents ticked “fully agree” 20 or more times, but 25 respondents ticked “undecided” 20 or more times. “Undecided” was the most common option for people who ticked the same answer multiple times in half of the questions or more. The same results are presented in Figure 11, and we can see that the majority of answers are on the “agree” side instead of the “disagree” side. Table 7 shows that when standard deviation increases, the mean and median values shift from “undecided” toward “slightly agree”. These tests suggest that respondents, when uncertain, did not tick e.g. “fully agree” to complete the survey quickly and just to participate in the lottery. Low standard deviation combined with the mean being close to “undecided” supports this conclusion.

Table 8 shows items belonging to every construct used in this study, their meaning, scale, mean and median values and interquartile ranges.

Table 8: Explanation of individual items and their mean and median values

Independent Variables	**Mean**	**SD**	**Median**	**IQR**		**Item (question)**
Performance Expectancy (PE)	*The way the respondent perceives the usefulness of SAT*					
PE1	3.0	1.5	3	2	N = 274	SAT would likely be useful in my own work
PE2	2.4	1.4	2	3	N = 274	In general, SAT seems like a useful application
PE3	3.3	1.1	4	2	N = 274	The features of SAT are sufficient for my work
PE4[1]	1.4	0.5	1	1	N = 270	I feel that I belong to the target group of SAT (SAT is meant for employees like myself)
Effort Expectancy (EE)	*How easily the respondent believes he/ she could learn to use SAT*					
EE1	2.2	1.2	2	2	N = 275	I believe I would learn to use SAT easily
EE2	3.0	1.7	3	2	N = 272	Learning to use SAT would require a lot of learning (scale reversed)
EE3	2.7	1.4	3	2	N = 271	I believe using SAT will be difficult (scale reversed)
Self-Efficacy (SE)	*How proficient the respondent is in using software*					
SE1	2.7	1.5	2	2	N = 273	I believe I can use SAT without outside help
SE2	3.2	1.6	3	2	N = 273	I have the knowhow required for using SAT
SE3	2.3	1.3	2	2	N = 274	I learn to use new software quickly
Anxiety (ANX)	*The anxiety and hesitation of the respondent toward using SAT*					
ANX1	3.4	1.8	4	3	N = 273	I hesitate using SAT, because I do not know what one can do with it (scale reversed)
ANX2	3.2	1.7	3	2	N = 273	I hesitate using SAT, because I am afraid of adding useless material into the software (scale reversed)
ANX3	2.5	1.6	2	3	N = 272	I feel anxious about using SAT (scale reversed)
Attitude (AT)	*Whether the respondent finds using SAT a good idea in general*					
AT1	2.4	1.4	2	2	N = 273	Using SAT is a good idea
AT2	2.7	1.4	2	2	N = 273	I like using new software and applications
AT3	2.2	1.3	2	2	N = 272	Developing new software for the employees of VR Track is a good idea
AT4	4.1	1.6	4	2	N = 269	New software are proposed to be implemented too much (scale reversed)
Social Influence (SI)	*Whether encouragement from colleagues or managers would increase the respondents use of SAT*					
SI1	3.1	1.5	3	2	N = 273	Encouragement and showing example by my manager would likely increase my use of SAT
SI2	2.9	1.4	3	2	N = 272	Encouragement and showing example by my peers would likely increase my use of SAT
SI3	2.8	1.4	3	2	N = 273	The usefulness of SAT depends on its number of users: The more employees use it, the more useful it is for myself
Facilitating Conditions (FC)	*Whether communication and guidance on SAT was sufficient and whether the respondent feels that help is available*					
FC1	3.7	1.5	4	1	N = 271	My colleagues are able to help me using SAT
FC2	3.2	1.7	3	2	N = 272	I know where I can get gelp for using SAT
FC3	3.6	1.5	4	2	N = 272	Guidance for using SAT is sufficient
FC4	3.6	1.8	4	3	N = 271	There has been enough communication about SAT
FC5	2.8	1.6	2	2	N = 273	Threshold for using help from my colleagues to use SAT is low
FC6[1]	1.8	.4	2	0	N = 275	I have attended an organized presentation about SAT (yes/ no)
Use Behavior (UB)	*The respondent's present use of SAT*					
UB1	5.3	1.2	6	1	N = 272	I use SAT 1) daily 2) once a week 3) biweekly 4) once a month 5) less frequently than once a month or 6) I do not use SAT
Dependent Variable						
Behavioral intention (BI)	*Whether the respondent thinks he/ she will use SAT in the future*					
BI1	3.2	1.7	3	2	N = 275	I intend to use SAT during the year 2017
BI2	3.2	1.6	3	2	N = 275	My use of SAT is likey to increase
BI3	3.5	1.6	4	2	N = 275	I will likely use SAT regularly in the future
Moderator variables						
Age	41 (Mean)	12 (SD)	38 (Median)	22 (IQR)	N = 265	Age of the respondent
Gender	Female (%)	16 %			N = 274	Gender of the respondent
	Male (%)	84 %				
Job Title	Non-manager (%)	78 %			N = 268	Managerial status of the respondent
	Manager (%)	22 %				
Awareness	Have used SAT (%)			30 %		
	Have not tried SAT, but are familiar with it (%)			43 %	N = 274	The respondent's awareness of SAT
	Have not heard of SAT, or do not understand it (%)			27 %		

Scale: 1 = Fully agree 2 = Somewhat agree 3 = Slightly agree 4 = Undecided 5 = Slightly disagree 6 = Somewhat disagree 7 = Fully disagree

[1] Scale 1 = Yes 2 = No

SD = Standard deviation

IQR = Interquartile range

In Table 8 we can see that the mean values are consistently on the "agree" side of the scale. Also, when comparing the mean and median values, there is no significant distortion in the values. Every construct consists of at least three items, except use behavior, which only

represents one item. Out of 279, the responses of four respondents were removed, because of poor quality of data (missing answers etc.). The response rate for individual items is close to 275, generally over 270. Age (N=265) has the lowest response rate. The notable difference between the number of female and male respondents is due to the significantly smaller number of females working in the company. The majority of the respondents were familiar with SAT prior to taking the survey.

5.1 UTAUT

The results for UTAUT show that two out of four relations were significant at the 0,001 level. Figure 12 and Figure 13 show the models analyzed and their t-values. All the items, except for FC5, were significant at the 0,001 level.

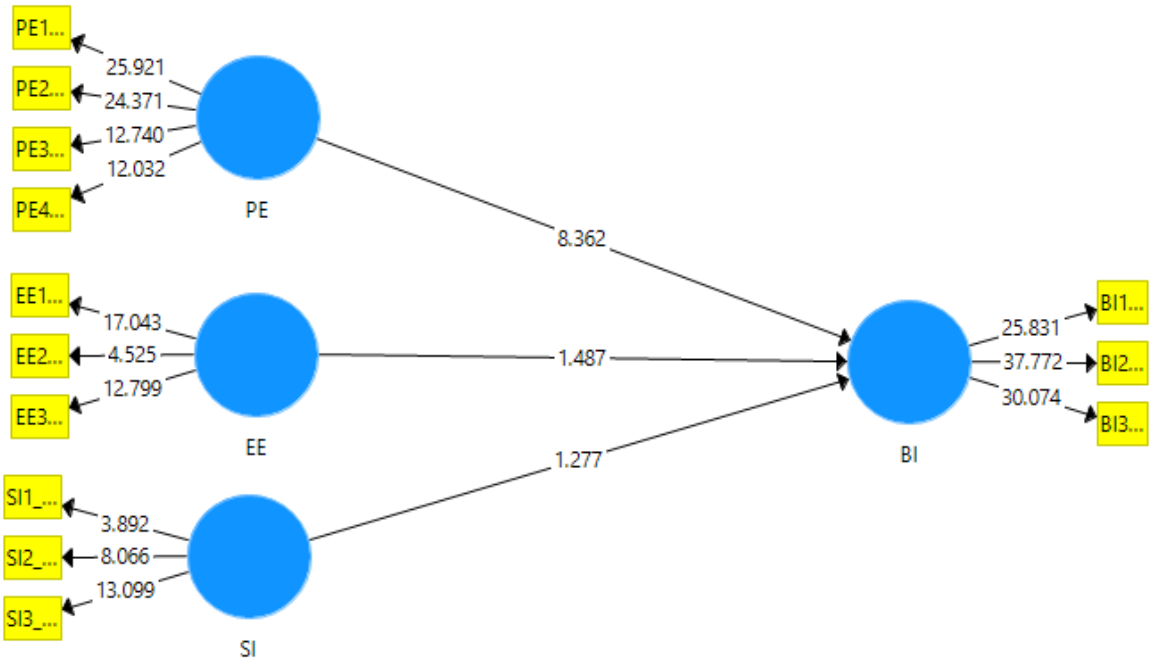

Figure 12. UTAUT T statistics, behavioral intention as the dependent variable

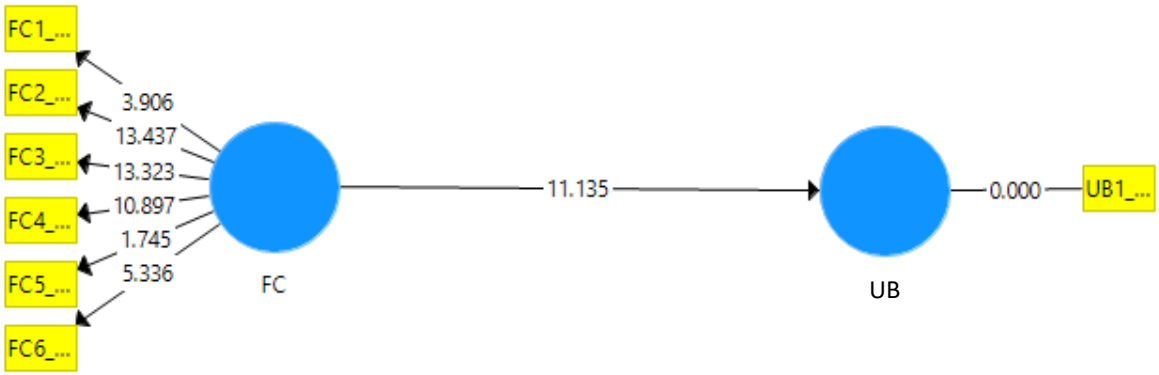

Figure 13. UTAUT T statistics, use behavior as the dependent variable

Table 9 and Table 10 show more detailed information on the path coefficient values.

Table 9: UTAUT path coefficient mean, standard deviation, t statistics and p values, behavioral intention as the dependent variable

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
EE -> BI	0.098	0.099	0.066	1.487	0.137
PE -> BI	0.689	0.682	0.082	8.362	0.000
SI -> BI	0.097	0.107	0.076	1.277	0.202

Table 10: UTAUT path coefficient mean, standard deviation, t statistics and p values, use behavior as the dependent variable

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
FC -> UB	0.525	0.534	0.047	11.135	0.000

The path coefficients, which are assumed direct effects of constructs to the dependent variable, are small for EE and SI, thus suggesting that EE and SI do not have explanatory power when estimating BI. Only relations being significant at 0,001 level seem to be PE -> BI and FC -> UB with t-values of 8,4 and 11,1. There are differences in the way items load together for different constructs (*Table 11 and Table 12*).

Table 11: UTAUT outer loadings for items, behavioral intention as the dependent variable

	BI	EE	PE	SI
BI1	0.851			
BI2	0.951			
BI3	0.866			
EE1		1.016		
EE2		0.461		
EE3		0.777		
PE1			0.809	
PE2			0.841	
PE3			0.641	
PE4			0.618	
SI1				0.361
SI2				0.612
SI3				0.925

Table 12: UTAUT outer loadings for items, use behavior as the dependent variable

	FC	UB
FC1	0.397	
FC2	0.767	
FC3	0.857	
FC4	0.668	
FC5	0.184	
FC6	-0.571	
UB1		1.000

For BI, every item loads with values over 0,8, whereas for EE, PE, SI and FC some of the items load with values less than 0,7. There is no rule of thumb for factor loading values, but the notable differences especially in EE, SI and FC may suggest that the items do not necessarily measure the same concept well enough. Table 13, Table 14, Table 15 and Table 16 tell us more about the correlations and covariances between the variables.

Table 13: UTAUT latent variable correlations, behavioral intention as the dependent variable

	BI	EE	PE	SI
BI	1.000			
EE	0.508	1.000		
PE	0.799	0.542	1.000	
SI	0.553	0.386	0.610	1.000

Table 14: UTAUT latent variable correlations, use behavior as the dependent variable

	FC	UB
FC	1.000	
UB	0.524	1.000

Table 15: UTAUT latent variable covariances, behavioral intention as the dependent variable

	BI	EE	PE	SI
BI	0.994			
EE	0.503	0.988		
PE	0.791	0.536	0.988	
SI	0.548	0.381	0.602	0.986

Table 16: UTAUT latent variable covariances, use behavior as the dependent variable

	FC	UB
FC	0.985	
UB	0.517	0.989

The correlations suggest that the variables describe the same phenomena to some extent, but are not identical. The biggest correlation (0,8) is between PE and BI. Similar effect can be seen in inter-factor covariances. Table 17, Table 18, Table 19, Table 20, Table 21 and Table 22 show the values for Cronbach's alpha, composite reliability (CR), average variance extracted (AVE) and R square.

Table 17: UTAUT construct reliability and validity, behavioral intention as the dependent variable

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
BI	**0.919**	**0.920**	**0.793**
EE	**0.819**	**0.815**	**0.616**
PE	**0.814**	**0.821**	**0.539**
SI	**0.733**	**0.687**	**0.454**

Table 18: UTAUT construct reliability and validity, use behavior as the dependent variable

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
FC	**0.564**	**0.588**	**0.381**
UB	**1.000**	**1.000**	**1.000**

Table 19: UTAUT R square, behavioral intention as the dependent variable

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
BI	0.652	0.661	0.053	12.356	0.000

Table 20: UTAUT R square, use behavior as the dependent variable

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
UB	0.274	0.281	0.049	5.625	0.000

Table 21: UTAUT R square adjusted, behavioral intention as the dependent variable

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
BI	0.648	0.657	0.053	12.149	0.000

Table 22: UTAUT R square adjusted, use behavior as the dependent variable

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
UB	0.272	0.279	0.049	5.550	0.000

Tavakol & Dennick (2011) write that, in general, recommendations for sufficient Cronbach's alpha (alpha from now on) sets between 0,75 and 0,95 and Gliem & Rosemary (2003) propose 0,8 as a "*reasonable goal*". Only FC has an alpha below 0,6. UB's alpha, CR and AVE are 1,0 because the construct includes only one item and therefore is not comparable. Hair et al. (2011) write that CR values lower than 0,60 "*indicate a lack of reliability*". SI (0,69) and FC (0,59) have the lowest CR values, thus seeming less reliable than BI, EE and PE. R square values (regular and adjusted) are 0,65 for BI and 0,27 for UB. BI's higher R square value is explained, to some extent, by the bigger number of constructs used to explain it. Both R square values are significant at the 0,001 level. Hair et al. (2011) suggest that for convergent validity AVE should be over 0,5 and to fulfill the Fornell-Larcker criterion it should be higher than the construct's squared correlations (Table 23 *and* Table 24) with other constructs.

Table 23: UTAUT squared latent variable correlations, behavioral intention as the dependent variable

	BI	EE	PE	SI
BI	1.000			
EE	0.258	1.000		
PE	0.638	0.294	1.000	
SI	0.306	0.149	0.372	1.000

Table 24: UTAUT squared latent variable correlations, use behavior as the dependent variable

	FC	UB
FC	1.000	
UB	0.275	1.000

As we can see, every construct's AVE value is higher than its squared correlations with other constructs, even though SI and FC have AVE values less than 0,5. To test discriminant and convergent validity we can also check how the items correlate with each other (*Table 25*).

Table 25: UTAUT item correlations, behavioral intention as the dependent variable

	BI1	BI2	BI3	EE1	EE2	EE3	PE1	PE2	PE3	PE4	SI1	SI2	SI3	SI2	SI3
BI1	1.	.8	.76	.42	.29	.4	.58	.5	.4	.48	.18	.33	.38	.33	.38
BI2	.8	1.	.81	.45	.24	.38	.64	.6	.46	.48	.25	.37	.48	.37	.48
BI3	.76	.81	1.	.41	.21	.35	.62	.54	.45	.48	.18	.28	.42	.28	.42
EE1	.42	.45	.41	1.	.53	.62	.43	.47	.4	.33	.22	.29	.37	.29	.37
EE2	.29	.24	.21	.53	1.	.66	.15	.23	.12	.19	-.02	.05	.17	.05	.17
EE3	.4	.38	.35	.62	.66	1.	.29	.38	.28	.28	.05	.19	.24	.19	.24
PE1	.58	.64	.62	.43	.15	.29	1.	.68	.56	.62	.11	.25	.49	.25	.49
PE2	.5	.6	.54	.47	.23	.38	.68	1.	.56	.4	.22	.3	.57	.3	.57
PE3	.4	.46	.45	.4	.12	.28	.56	.56	1.	.3	.16	.23	.38	.23	.38
PE4	.48	.48	.48	.33	.19	.28	.62	.4	.3	1.	.06	.17	.3	.17	.3
SI1	.18	.25	.18	.22	-.02	.05	.11	.22	.16	.06	1.	.74	.33	.74	.33
SI2	.33	.37	.28	.29	.05	.19	.25	.3	.23	.17	.74	1.	.37	1.	.37
SI3	.38	.48	.42	.37	.17	.24	.49	.57	.38	.3	.33	.37	1.	.37	1.

Convergent validity is supported if items belonging to the same construct have high levels of correlation. Discriminant validity is supported if correlations in the same construct are higher than correlations with items belonging to different construct, i.e. items belonging to one construct should not correlate significantly with item belonging to other constructs. In Table 24 we can see that BI's and EE's inter-construct correlations (are highlighted in green) seem to be higher than the correlations with items belonging to other constructs (area highlighted in red). However, BI's items correlate more than EE's items. With PE and SI

there is not that clear of a difference with these correlations. For the model where UB is the dependent variable comparing inter-item correlations is not meaningful since UB includes only one item.

Table *26* and Table 27 describe the general model fits of UTAUT.

Table 26: UTAUT model fit, behavioral intention as the dependent variable

	Saturated Model	Estimated Model
SRMR	0.081	0.081
Chi-Square	505.708	506.470
NFI	0.759	0.759

Table 27: UTAUT model fit, use behavior as the dependent variable

	Saturated Model	Estimated Model
SRMR	0.082	0.082
Chi-Square	81.767	81.759
NFI	0.852	0.852

Hu & Bentler (1998) suggest 0,08 as a threshold value for standardized root mean square residual (SRMR), where values lower than 0,08 would suggest adequate model fit. As we can see in

Table *26* and Table 27, both models meet, though barely, the threshold value of 0,08. To assess the chi square value, for which we need to know the degree of freedom (df). Df (N-1) in this case is 275-1 = 274. For the model with BI as the dependent valuable chi square of 505 gives us a P-value of 0,001. For the model with UB as the dependent variable, the chi square value of 82 is too low for the model to be significant. When it comes to the normed fit index (NFI), a threshold value of 0,9 has been proposed to describe a sufficient model fit (Bentler & Bonett, 1980). For the model studying BI NFI is 0,76 and for UB NFI is 0,85.

5.2 TAM

All the relations in TAM result significant (*Figure 14, Table 28 and Table 29*).

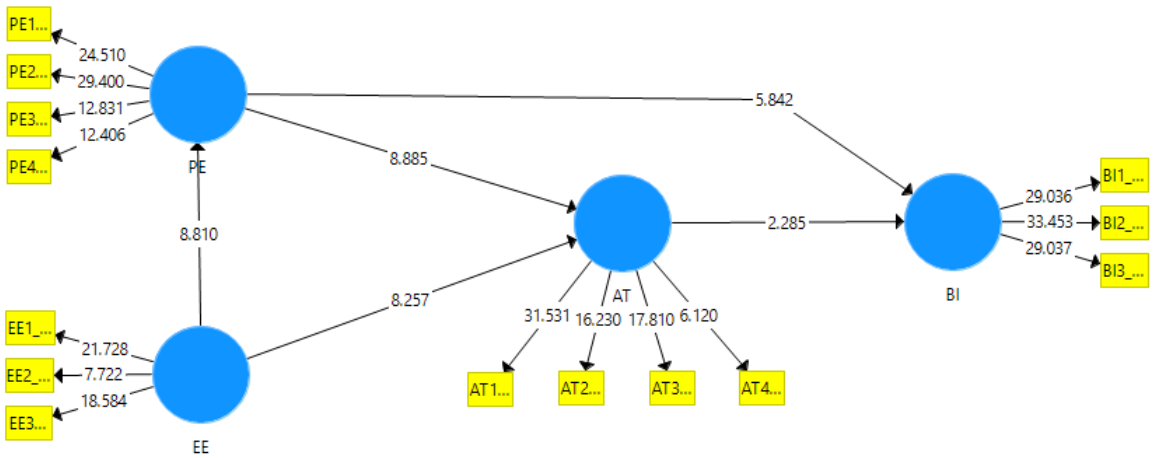

Figure 14. TAM T statistics

Table 28: TAM path coefficients: sample mean, standard deviation, t statistics and p values

	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
AT -> BI	0.235	0.108	2.285	0.022
EE -> AT	0.478	0.058	8.257	0.000
EE -> PE	0.543	0.062	8.810	0.000
PE -> AT	0.512	0.057	8.885	0.000
PE -> BI	0.623	0.105	5.842	0.000

Table 29: TAM Specific indirect effects: sample mean, standard deviation, t statistics and p values

	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
EE -> PE -> AT	0.277	0.035	7.829	0.000
EE -> AT -> BI	0.113	0.054	2.196	0.028
EE -> PE -> AT -> BI	0.065	0.031	2.188	0.029
EE -> PE -> BI	0.339	0.069	4.821	0.000

The relation between AT and BI is significant at the 0,05 level and the other relations are significant at the 0,001 level. When observing indirect effects, we can see that all the mediating effects are also significant. The chain of effects for EE, PE & AT and EE, PE &

BI are significant at the 0,001 level, whereas EE, AT & BI and EE, PE, AT & BI are significant at the 0,05 level. Table 30 shows the item loadings.

Table 30: TAM outer loadings for items

	AT	BI	EE	PE
AT1	0.888			
AT2	0.718			
AT3	0.728			
AT4	0.394			
BI1		0.865		
BI2		0.930		
BI3		0.873		
EE1			0.929	
EE2			0.545	
EE3			0.816	
PE1				0.788
PE2				0.869
PE3				0.617
PE4				0.629

BI is the only construct that has all the items loading close to 0,9. PE's loadings are not consistently good, because PE3 and PE4 load close to 0,6. AT4 loads poorly (0,4), but on the other hand the construct has four items, unlike EE, which has EE2 loading at 0,55. Table 31 and

Table 32 show the correlations and covariances between the variables.

Table 31: TAM latent variable correlations

	AT	BI	EE	PE
AT	1.000			
BI	0.715	1.000		
EE	0.754	0.514	1.000	
PE	0.769	0.799	0.543	1.000

Table 32: TAM latent variable covariances

	AT	BI	EE	PE
AT	0.986			
BI	0.708	0.994		
EE	0.743	0.508	0.986	
PE	0.759	0.791	0.536	0.988

Both the correlations and covariances seem to be higher in TAM than in UTAUT. Especially AT seems to correlate consistently higher with other variables. Table 33, Table 34 and Table 35 describe construct reliability and show us the R square values.

Table 33: TAM construct reliability and validity

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
AT	**0.792**	**0.787**	**0.497**
BI	**0.919**	**0.919**	**0.792**
EE	**0.819**	**0.817**	**0.609**
PE	**0.814**	**0.820**	**0.538**

Table 34: TAM R square

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
AT	0.752	0.759	0.046	16.188	0.000
BI	0.663	0.668	0.048	13.757	0.000
PE	0.295	0.302	0.064	4.608	0.000

Table 35: TAM R square adjusted

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
AT	0.750	0.757	0.047	16.030	0.000
BI	0.660	0.666	0.049	13.606	0.000
PE	0.293	0.300	0.064	4.551	0.000

When comparing construct reliability, TAM's AT seems to score better than UTAUT's SI. Both alpha and CR are close to 0,8. However, AVE remains below 0,5. The R square values for BI (0,66) do not differ a lot from BI's R square values in UTAUT. AT's R square value (0,75) is notably higher, whereas PE (0,29) scores significantly lower.

Table 36: TAM squared latent variable correlations

	AT	BI	EE	PE
AT	1.000			
BI	0.511	1.000		
EE	0.569	0.264	1.000	
PE	0.591	0.638	0.295	1.000

As mentioned earlier, to reach the Fornell-Larcker criterion, AVE should be higher than the squared correlations of latent variables. In this case the criterion is not met, because AT's squared correlations are consistently higher than its AVE and only one out of three of PE's squared correlations is lower than its AVE. In Table 37 we compare again the item correlations.

Table 37: TAM item correlations

	AT1	AT2	AT3	AT4	BI1	BI2	BI3	EE1	EE2	EE3	PE1	PE2	PE3	PE4
AT1	1.	.48	.57	.26	.56	.62	.57	.46	.31	.43	.62	.84	.48	.39
AT2	.48	1.	.67	.48	.44	.44	.41	.59	.41	.53	.34	.4	.29	.37
AT3	.57	.67	1.	.48	.44	.49	.44	.52	.33	.48	.39	.54	.33	.3
AT4	.26	.48	.48	1.	.28	.27	.3	.28	.26	.37	.11	.2	.08	.1
BI1	.56	.44	.44	.28	1.	.8	.76	.42	.29	.4	.58	.5	.4	.48
BI2	.62	.44	.49	.27	.8	1.	.81	.45	.24	.38	.64	.6	.46	.48
BI3	.57	.41	.44	.3	.76	.81	1.	.41	.21	.35	.62	.54	.45	.48
EE1	.46	.59	.52	.28	.42	.45	.41	1.	.53	.62	.43	.47	.4	.33
EE2	.31	.41	.33	.26	.29	.24	.21	.53	1.	.66	.15	.23	.12	.19
EE3	.43	.53	.48	.37	.4	.38	.35	.62	.66	1.	.29	.38	.28	.28
PE1	.62	.34	.39	.11	.58	.64	.62	.43	.15	.29	1.	.68	.56	.62
PE2	.84	.4	.54	.2	.5	.6	.54	.47	.23	.38	.68	1.	.56	.4
PE3	.48	.29	.33	.08	.4	.46	.45	.4	.12	.28	.56	.56	1.	.3
PE4	.39	.37	.3	.1	.48	.48	.48	.33	.19	.28	.62	.4	.3	1.

Based on the inter-item correlations, only BI seems to show signs of convergent and discriminant validity. EE's internal correlations are also higher than the inter-construct

correlations, but the differences are not as notable as with BI. Table 38 describes the model fit.

Table 38: TAM model fit

	Saturated Model	Estimated Model
SRMR	0.073	0.073
Chi-Square	525.935	525.968
NFI	0.793	0.793

The SRMR values are below 0,08 and the chi-square returns us a P-value of 0,001. However, NFI does not reach the proposed threshold value of 0,9.

5.3 Combined UTAUT & TAM

Finally, we go through the results of the combined model of UTAUT & TAM. Figure 15 shows us the model and the T-values of the relations and Table 39 and Table 40 describe the significance of the relations and the indirect effects.

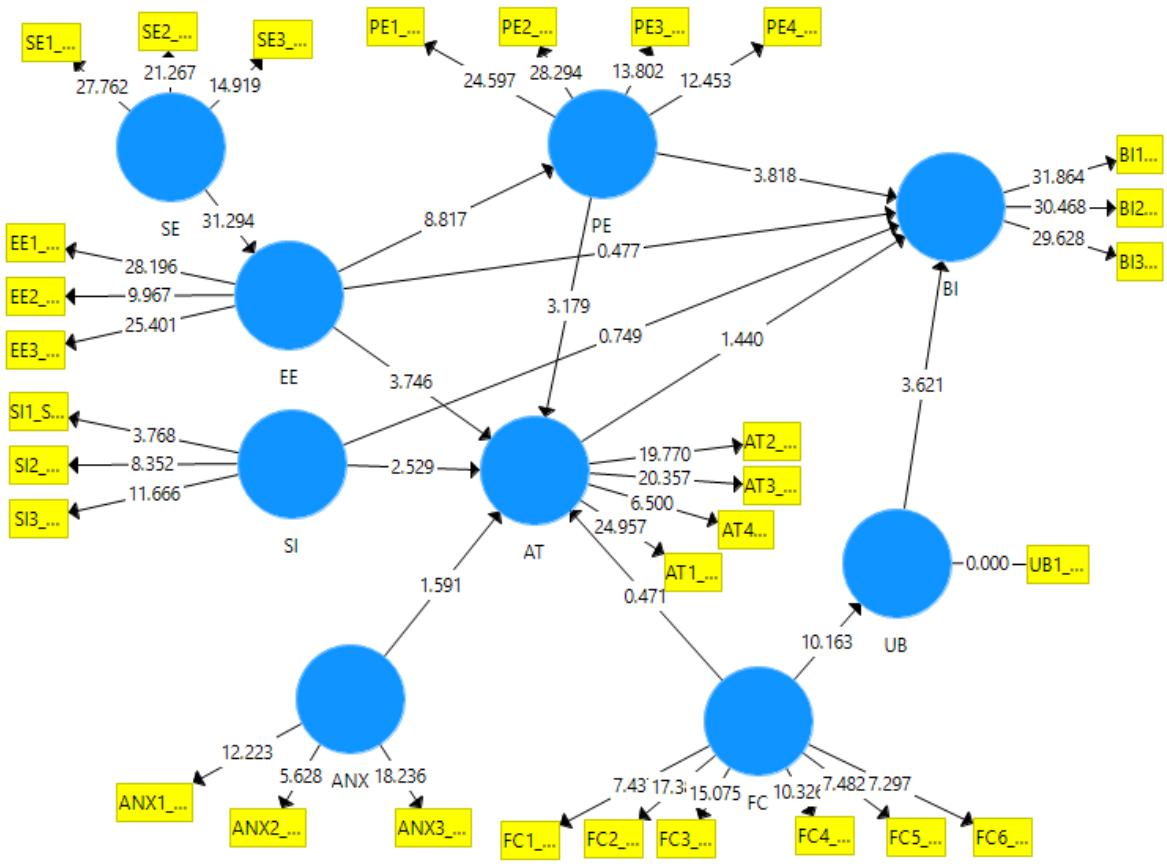

Figure 15. Combined UTAUT & TAM T statistics

Table 39: Combined UTAUT & TAM path coefficients: sample mean, standard deviation, t statistics and p values

	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
ANX -> AT	0.151	0.097	1.542	0.123
AT -> BI	0.274	0.182	1.493	0.136
EE -> AT	0.361	0.099	3.684	0.000
EE -> BI	-0.062	0.118	0.496	0.620
EE -> PE	0.543	0.060	9.010	0.000
FC -> AT	0.044	0.098	0.473	0.636
FC -> UB	0.518	0.050	10.253	0.000
PE -> AT	0.310	0.109	2.924	0.004
PE -> BI	0.481	0.128	3.763	0.000
SE -> EE	0.937	0.028	33.127	0.000
SI -> AT	0.249	0.101	2.350	0.019
SI -> BI	0.066	0.091	0.706	0.480
UB -> BI	0.194	0.053	3.660	0.000

Table 40: Combined UTAUT & TAM specific indirect effects

	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
SE -> EE -> AT	0.339	0.095	3.579	0.000
SE -> EE -> PE -> AT	0.157	0.057	2.823	0.005
ANX -> AT -> BI	0.042	0.040	1.010	0.313
SE -> EE -> AT -> BI	0.093	0.075	1.241	0.215
FC -> AT -> BI	0.015	0.034	0.377	0.706
SE -> EE -> PE -> AT -> BI	0.041	0.032	1.376	0.169
SI -> AT -> BI	0.070	0.060	1.087	0.277
SE -> EE -> BI	-0.058	0.111	0.494	0.621
SE -> EE -> PE -> BI	0.245	0.072	3.379	0.001
FC -> UB -> BI	0.100	0.029	3.502	0.000
SE -> EE -> PE	0.509	0.061	8.254	0.000

The relations between EE & AT, EE & PE, FC & UB, PE & BI, SE & EE and UB & BI are significant at the 0,001 level, whereas PE & AT and SI & AT are significant at the 0,05 level. No other relation seems to be significant. When it comes to the indirect effects, SE,

EE & AT, FC, UB & BI and SE, EE & PE are significant at the 0,001 level and SE, EE, PE & AT and SE, EE, PE & BI are significant at the 0,01 level.

Table 41: Combined UTAUT & TAM item loadings

	ANX	AT	BI	EE	FC	PE	SE	SI	UB
ANX1	0.727								
ANX2	0.448								
ANX3	0.951								
AT1		0.836							
AT2		0.759							
AT3		0.744							
AT4		0.409							
BI1			0.882						
BI2			0.907						
BI3			0.878						
EE1				0.861					
EE2				0.612					
EE3				0.839					
FC1					0.494				
FC2					0.731				
FC3					0.762				
FC4					0.609				
FC5					0.521				
FC6					-0.474				
PE1						0.774			
PE2						0.844			
PE3						0.669			
PE4						0.620			
SE1							0.837		
SE2							0.774		
SE3							0.719		
SI1								0.377	
SI2								0.626	
SI3								0.907	
UB1									1.000

FC, PE and SI have the most inconsistent item loadings of all the variables. Only two out of six FC's items load over 0,7 and the negative value of FC6 combined with the fact that the item measures on a scale of yes and no suggests that the item is not suitable for the model. Half of PE's items load less than 0,7 and SI's item loadings have significant distances. As seen earlier, only BI's items load consistently and have relatively high values. What is notable is that SE is the only model, in addition to BI, that has loading values consistently over 0,7.

Table 42 and Table 43 show the correlations and covariances between the variables.

Table 42: Combined UTAUT & TAM latent variable correlations

	ANX	AT	BI	EE	FC	PE	SE	SI	UB
ANX	1.000								
AT	0.633	1.000							
BI	0.432	0.712	1.000						
EE	0.715	0.762	0.513	1.000					
FC	0.541	0.681	0.603	0.666	1.000				
PE	0.475	0.761	0.800	0.540	0.658	1.000			
SE	0.604	0.735	0.546	0.939	0.767	0.536	1.000		
SI	0.204	0.619	0.554	0.375	0.435	0.611	0.306	1.000	
UB	0.336	0.409	0.557	0.418	0.514	0.541	0.440	0.259	1.000

Table 43: Combined UTAUT & TAM latent variable covariances

	ANX	AT	BI	EE	FC	PE	SE	SI	UB
ANX	0.986								
AT	0.624	0.986							
BI	0.428	0.705	0.994						
EE	0.704	0.750	0.508	0.985					
FC	0.533	0.671	0.597	0.655	0.984				
PE	0.469	0.751	0.793	0.533	0.648	0.988			
SE	0.597	0.727	0.541	0.927	0.757	0.530	0.990		
SI	0.201	0.610	0.549	0.370	0.428	0.603	0.302	0.985	
UB	0.331	0.404	0.552	0.413	0.507	0.534	0.436	0.255	0.989

When we study the correlations and covariances, we can see that especially EE and SE have relatively high correlation and covariance, as do BI and PE as well. Next we look at the construct reliability and the R square values (*Table 44*, *Table 45* and *Table* 46).

Table 44: Combined UTAUT & TAM construct reliability and validity

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
ANX	0.779	0.768	0.544
AT	0.792	0.790	0.499
BI	0.919	0.919	0.791
EE	0.819	0.819	0.607
FC	0.564	0.649	0.371
PE	0.814	0.820	0.536
SE	0.817	0.821	0.606
SI	0.733	0.690	0.452
UB	1.000	1.000	1.000

Table 45: Combined UTAUT & TAM R square

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
AT	0.792	0.808	0.044	17.819	0.000
BI	0.692	0.706	0.042	16.636	0.000
EE	0.882	0.883	0.053	16.791	0.000
PE	0.292	0.298	0.065	4.520	0.000
UB	0.264	0.269	0.051	5.137	0.000

Table 46: Combined UTAUT & TAM R square adjusted

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
AT	0.788	0.804	0.045	17.408	0.000
BI	0.686	0.700	0.042	16.197	0.000
EE	0.881	0.883	0.053	16.721	0.000
PE	0.289	0.295	0.065	4.463	0.000
UB	0.262	0.267	0.052	5.066	0.000

FC has the lowest alpha (0,56), but all the other variables score over 0,7. EE, PE and SE have alpha values over 0,8 and BI over 0,9. Even though all the CR values are over the suggested threshold value of 0,6, there is a notable gap between FC and SI and the other

variables. AT, FC and SI have AVE values less than 0,5. Only BI has AVE notably larger than others (0,79). All the R square values are significant at the 0,001 level, AT, BI and EE having the highest values. PE and UB's R square values are close to each other, but significantly smaller then AT, BI and EE's.

Table 47: Combined UTAUT & TAM squared latent variable correlations

	ANX	AT	BI	EE	FC	PE	SE	SI	UB
ANX	1.000								
AT	0.401	1.000							
BI	0.187	0.507	1.000						
EE	0.511	0.580	0.264	1.000					
FC	0.292	0.464	0.364	0.443	1.000				
PE	0.226	0.579	0.640	0.292	0.432	1.000			
SE	0.365	0.541	0.298	0.882	0.588	0.287	1.000		
SI	0.041	0.383	0.307	0.141	0.189	0.374	0.094	1.000	
UB	0.113	0.168	0.310	0.175	0.264	0.292	0.194	0.067	1.000

When assessing the Fornell-Larcker criterion with the squared correlations (*Table 47*), we see that only ANX, BI and SI have an AVE value larger than their correlations with other variables, i.e. the criterion is not met.

Table 48: Combined UTAUT & TAM item correlations

	ANX1	ANX2	ANX3	AT1	AT2	AT3	AT4	BI1	BI2	BI3	EE1	EE2	EE3	FC1	FC2	FC3	FC4	FC5	FC6	PE1	PE2	PE3	PE4	SE1	SE2	SE3	SI1	SI2	SI3	UB1
ANX1	1.	.59	.51	.34	.3	.24	.17	.3	.27	.28	.37	.32	.48	.08	.4	.32	.34	.12	-.24	.3	.34	.28	.23	.43	.39	.26	-.11	-.09	.15	.32
ANX2	.59	1.	.52	.16	.29	.24	.23	.12	.09	.11	.26	.23	.39	.08	.22	.15	.17	.16	-.18	.1	.15	.06	.12	.26	.23	.23	-.1	-.02	.09	.12
ANX3	.51	.52	1.	.54	.49	.47	.33	.41	.41	.36	.48	.42	.64	.23	.37	.31	.22	.35	-.25	.29	.49	.26	.24	.47	.39	.39	.11	.24	.27	.28
AT1	.34	.16	.54	1.	.48	.57	.26	.56	.62	.57	.46	.31	.43	.31	.45	.37	.35	.31	-.28	.62	.84	.48	.39	.41	.38	.33	.23	.33	.49	.35
AT2	.3	.29	.49	.48	1.	.67	.48	.44	.44	.41	.59	.41	.53	.29	.35	.38	.31	.28	-.2	.34	.4	.29	.37	.54	.44	.68	.21	.27	.29	.33
AT3	.24	.24	.47	.57	.67	1.	.48	.44	.49	.44	.52	.33	.48	.28	.33	.42	.32	.32	-.25	.39	.54	.33	.3	.44	.39	.46	.3	.36	.41	.29
AT4	.17	.23	.33	.26	.48	.48	1.	.28	.27	.3	.28	.26	.37	.13	.15	.23	.13	.19	-.1	.11	.2	.08	.1	.24	.16	.29	.13	.23	.17	.16
BI1	.3	.12	.41	.56	.44	.44	.28	1.	.8	.76	.42	.29	.4	.27	.42	.38	.25	.24	-.22	.58	.5	.4	.48	.47	.42	.34	.18	.33	.38	.53
BI2	.27	.09	.41	.62	.44	.49	.27	.8	1.	.81	.45	.24	.38	.3	.43	.45	.28	.23	-.31	.64	.6	.46	.48	.42	.37	.32	.25	.37	.48	.43
BI3	.28	.11	.36	.57	.41	.44	.3	.76	.81	1.	.41	.21	.35	.24	.43	.48	.33	.21	-.27	.62	.54	.45	.48	.4	.36	.3	.18	.28	.42	.53
EE1	.37	.26	.48	.46	.59	.52	.28	.42	.45	.41	1.	.53	.62	.31	.39	.43	.4	.43	-.23	.43	.47	.4	.33	.59	.51	.66	.22	.29	.37	.33
EE2	.32	.23	.42	.31	.41	.33	.26	.29	.24	.21	.53	1.	.66	.15	.35	.27	.24	.24	-.19	.15	.23	.12	.19	.56	.47	.59	-.02	.05	.17	.24
EE3	.48	.39	.64	.43	.53	.48	.37	.4	.38	.35	.62	.66	1.	.23	.4	.41	.3	.34	-.23	.29	.38	.28	.28	.67	.52	.57	.05	.19	.24	.4
FC1	.08	.08	.23	.31	.29	.28	.13	.27	.3	.24	.31	.15	.23	1.	.43	.37	.3	.34	-.2	.3	.22	.25	.2	.33	.35	.2	.16	.29	.24	.21
FC2	.4	.22	.37	.45	.35	.33	.15	.42	.43	.43	.39	.35	.4	.43	1.	.61	.58	.23	-.32	.34	.38	.38	.21	.51	.51	.28	.06	.13	.23	.41
FC3	.32	.15	.31	.37	.38	.42	.23	.38	.45	.48	.43	.27	.41	.37	.61	1.	.69	.25	-.3	.34	.38	.46	.24	.51	.58	.33	.15	.18	.25	.45
FC4	.34	.17	.22	.35	.31	.32	.13	.25	.28	.33	.4	.24	.3	.3	.58	.69	1.	.12	-.32	.28	.36	.34	.12	.41	.49	.31	.08	.11	.22	.35
FC5	.12	.16	.35	.31	.28	.32	.19	.24	.23	.21	.43	.24	.34	.34	.23	.25	.12	1.	-.13	.28	.29	.25	.22	.32	.3	.25	.24	.3	.25	.1
FC6	-.24	-.18	-.25	-.28	-.2	-.25	-.1	-.22	-.31	-.27	-.23	-.19	-.23	-.2	-.32	-.3	-.32	-.13	1.	-.32	-.29	-.31	-.22	-.22	-.26	-.16	-.06	-.13	-.14	-.3
PE1	.3	.1	.29	.62	.34	.39	.11	.58	.64	.62	.43	.15	.29	.3	.34	.34	.28	.28	-.32	1.	.68	.56	.62	.31	.34	.25	.11	.25	.49	.45
PE2	.34	.15	.49	.84	.4	.54	.2	.5	.6	.54	.47	.23	.38	.22	.38	.38	.36	.29	-.29	.68	1.	.56	.4	.31	.3	.3	.22	.3	.57	.37
PE3	.28	.06	.26	.48	.29	.33	.08	.4	.46	.45	.4	.12	.28	.25	.38	.46	.34	.25	-.31	.56	.56	1.	.3	.3	.32	.26	.16	.23	.38	.4
PE4	.23	.12	.24	.39	.37	.3	.1	.48	.48	.48	.33	.19	.28	.2	.21	.24	.12	.22	-.22	.62	.4	.3	1.	.37	.38	.29	.06	.17	.3	.38
SE1	.43	.26	.47	.41	.54	.44	.24	.47	.42	.4	.59	.56	.67	.33	.51	.51	.41	.32	-.22	.31	.31	.3	.37	1.	.72	.59	.02	.12	.24	.38
SE2	.39	.23	.39	.38	.44	.39	.16	.42	.37	.36	.51	.47	.52	.35	.51	.58	.49	.3	-.26	.34	.3	.32	.38	.72	1.	.49	.09	.17	.19	.41
SE3	.26	.23	.39	.33	.68	.46	.29	.34	.32	.3	.66	.59	.57	.2	.28	.33	.31	.25	-.16	.25	.3	.26	.29	.59	.49	1.	.19	.16	.21	.24
SI1	-.11	-.1	.11	.23	.21	.3	.13	.18	.25	.18	.22	-.02	.05	.16	.06	.15	.08	.24	-.06	.11	.22	.16	.06	.02	.09	.19	1.	.74	.33	.01
SI2	-.09	-.02	.24	.33	.27	.36	.23	.33	.37	.28	.29	.05	.19	.29	.13	.18	.11	.3	-.13	.25	.3	.23	.17	.12	.17	.16	.74	1.	.37	.13
SI3	.15	.09	.27	.49	.29	.41	.17	.38	.48	.42	.37	.17	.24	.24	.23	.25	.22	.25	-.14	.49	.57	.38	.3	.24	.19	.21	.33	.37	1.	.3
UB1	.32	.12	.28	.35	.33	.29	.16	.53	.43	.53	.33	.24	.4	.21	.41	.45	.35	.1	-.3	.45	.37	.4	.38	.38	.41	.24	.01	.13	.3	1.

When comparing the item correlations, we can see that of all the variables, ANX, AT, BI, EE and SE seem to be the closest to having at least some level of convergent validity. BI's items have the largest correlation among themselves with all the values being 0,76 or bigger. ANX's and EE's items correlate with values over 0,5 and SE and AT are quite close to the same limit. BI's items are the closest to supporting discriminant validity. ANX is also close, but especially the difference between ANX3 and other items is not that significant.

Table 49: Combined UTAUT & TAM model fit

	Saturated Model	Estimated Model
SRMR	0.072	0.102
Chi-Square	1601.8	1813.7
NFI	0.705	0.666

In Table 48 we see that, like in TAM, the SRMR is below 0,08, chi-square returns a P-value of 0,001 and NFI does not reach the proposed threshold value of 0,9.

5.4 Moderating Variables

The results of testing moderating variables age, sex, employee's managerial position, the division the employee is working in and their awareness of SAT are compared in the same chapter to make the comparison easier. The results are obtained by conducting a multigroup analysis in SmartPLS 3. Each moderating variable was tested separately for each model. In the results, the second column shows the difference in the path coefficients of the variables tested. Then, T- and P-values are given for the result. For example, P-value (<40 vs >=40) means the significance of age affecting employees under 40 years compared to employees that are 40 years old or older. The results for age are presented in Table 50, Table 51, Table 52 and Table 53.

Table 50: UTAUT parametric test for age as a moderating variable, behavioral intention as the dependent variable

	Path Coefficients-diff (| <40 - >=40 |)	t-Value(<40 vs >=40)	p-Value(<40 vs >=40)
EE -> BI	0.059	0.575	0.566
PE -> BI	0.182	1.759	0.080
SI -> BI	0.083	0.797	0.426

Table 51: UTAUT parametric test for age as a moderating variable, use behavior as the dependent variable

	Path Coefficients-diff (| <40 - >=40 |)	t-Value(<40 vs >=40)	p-Value(<40 vs >=40)
FC -> UB	0.005	0.052	0.959

Table 52: TAM parametric test for age as a moderating variable

	Path Coefficients-diff (| <40 - >=40 |)	t-Value(<40 vs >=40)	p-Value(<40 vs >=40)
AT -> BI	0.194	1.551	0.122
EE -> AT	0.039	0.400	0.689
EE -> PE	0.175	1.696	0.091
PE -> AT	0.050	0.538	0.591
PE -> BI	0.225	1.967	0.050

Table 53: Combined UTAUT & TAM parametric test for age as a moderating variable

	Path Coefficients-diff (| <40 - >=40 |)	t-Value(<40 vs >=40)	p-Value(<40 vs >=40)
ANX -> AT	0.011	0.101	0.920
AT -> BI	0.165	1.141	0.255
EE -> AT	0.017	0.155	0.877
EE -> BI	0.047	0.416	0.678
EE -> PE	0.179	1.604	0.110
FC -> AT	0.006	0.056	0.956
FC -> UB	0.005	0.050	0.960
PE -> AT	0.007	0.059	0.953
PE -> BI	0.168	1.316	0.189
SE -> EE	0.079	1.212	0.227
SI -> AT	0.043	0.398	0.691
SI -> BI	0.003	0.028	0.977
UB -> BI	0.090	1.247	0.214

Age was not found significant in any of the models. The relation between PE and BI in TAM was the closest of being affected by age, but the P-value (0,050) cannot be accepted due to rounding of the number. Next we take a look at sex as a moderating variable (*Table 54*, *Table 55*, *Table 56* and *Table 57*).

Table 54: UTAUT parametric test for sex as a moderating variable, behavioral intention as the dependent variable

	Path Coefficients-diff (| Female - Male |)	t-Value(Female vs Male)	p-Value(Female vs Male)
EE -> BI	0.098	0.685	0.494
PE -> BI	0.122	0.812	0.418
SI -> BI	0.039	0.250	0.803

Table 55: UTAUT parametric test for sex as a moderating variable, use behavior as the dependent variable

	Path Coefficients-diff (| Female - Male |)	t-Value(Female vs Male)	p-Value(Female vs Male)
FC -> UB	0.047	0.379	0.705

Table 56: TAM parametric test for sex as a moderating variable

	Path Coefficients-diff (| Female - Male |)	t-Value(Female vs Male)	p-Value(Female vs Male)
AT -> BI	0.036	0.216	0.829
EE -> AT	0.223	1.747	0.082
EE -> PE	0.083	0.588	0.557
PE -> AT	0.024	0.206	0.837
PE -> BI	0.010	0.063	0.950

Table 57: Combined UTAUT & TAM parametric test for sex as a moderating variable

	Path Coefficients-diff (| Female - Male |)	t-Value(Female vs Male)	p-Value(Female vs Male)
ANX -> AT	0.256	1.839	0.067
AT -> BI	0.064	0.322	0.748
EE -> AT	0.166	1.173	0.242
EE -> BI	0.132	0.807	0.420
EE -> PE	0.107	0.704	0.482
FC -> AT	0.172	1.100	0.272
FC -> UB	0.046	0.343	0.732
PE -> AT	0.110	0.830	0.407
PE -> BI	0.045	0.255	0.799
SE -> EE	0.115	1.355	0.177
SI -> AT	0.121	0.842	0.400
SI -> BI	0.005	0.034	0.973
UB -> BI	0.006	0.057	0.954

There is no support for sex having a significant effect on any of the models. The role of employee's managerial position is assessed in Table 58, Table 59, Table 60 and Table 61.

Table 58: UTAUT parametric test for managerial position as a moderating variable, behavioral intention as the dependent variable

	Path Coefficients-diff (| Manager - NonManager|)	t-Value(Manager vs NonManager)	p-Value(Manager vs NonManager)
EE -> BI	0.094	0.765	0.445
PE -> BI	0.101	0.827	0.409
SI -> BI	0.053	0.438	0.662

Table 59: UTAUT parametric test for managerial position as a moderating variable, use behavior as the dependent variable

	Path Coefficients-diff (| Manager - NonManager |)	t-Value(Manager vs NonManager)	p-Value(Manager vs NonManager)
FC -> UB	0.066	0.645	0.520

Table 60: TAM parametric test for managerial position as a moderating variable

	Path Coefficients-diff (| Manager - NonManager|)	t-Value(Manager vs NonManager)	p-Value(Manager vs NonManager)
AT -> BI	0.189	1.317	0.189
EE -> AT	0.111	1.062	0.289
EE -> PE	0.145	1.177	0.240
PE -> AT	0.156	1.631	0.104
PE -> BI	0.268	1.926	0.055

Table 61: Combined UTAUT & TAM parametric test for managerial position as a moderating variable

	Path Coefficients-diff (| Manager - NonManager|)	t-Value(Manager vs NonManager)	p-Value(Manager vs NonManager)
ANX -> AT	0.096	0.760	0.448
AT -> BI	0.352	2.082	0.038
EE -> AT	0.202	1.626	0.105
EE -> BI	0.261	1.803	0.072
EE -> PE	0.152	1.155	0.249
FC -> AT	0.098	0.723	0.470
FC -> UB	0.040	0.362	0.717
PE -> AT	0.125	1.055	0.292
PE -> BI	0.172	1.094	0.275
SE -> EE	0.026	0.404	0.687
SI -> AT	0.088	0.762	0.447
SI -> BI	0.107	0.875	0.382
UB -> BI	0.033	0.351	0.726

In the combined model of UTAUT & TAM managerial position seems to affect the relation between AT and BI at the 0,05-significance level. The result implies that for managers attitude seems to have more importance when estimating their future use of SAT. However, the same relation was also tested in TAM and was not found to be significant. Table 62, Table 63, Table 64 and Table 65show the results for the employee's division.

Table 62: UTAUT parametric test for division as a moderating variable, behavioral intention as the dependent variable

	Path Coefficients-diff (| Construction - Maintenance |)	Path Coefficients-diff (| Construction - Planning |)	Path Coefficients-diff (| Maintenance - Planning |)	t-Value (Construction vs Maintenance)	t-Value (Construction vs Planning)	t-Value (Maintenance vs Planning)	p-Value (Construction vs Maintenance)	p-Value (Construction vs Planning)	p-Value (Maintenance vs Planning)
EE -> BI	0.060	0.086	0.027	0.338	0.519	0.221	0.736	0.604	0.826
PE -> BI	0.121	0.077	0.198	0.793	0.629	1.676	0.429	0.530	0.096
SI -> BI	0.369	0.059	0.310	2.443	0.392	2.393	0.016	0.695	0.018

Table 63: UTAUT parametric test for division as a moderating variable, use behavior as the dependent variable

	Path Coefficients-diff (| Construction - Maintenance |)	Path Coefficients-diff (| Construction - Planning |)	Path Coefficients-diff (| Maintenance - Planning |)	t-Value (Construction vs Maintenance)	t-Value (Construction vs Planning)	t-Value (Maintenance vs Planning)	p-Value (Construction vs Maintenance)	p-Value (Construction vs Planning)	p-Value (Maintenance vs Planning)
FC -> UB	0.152	0.064	0.215	1.383	0.450	1.788	0.169	0.653	0.076

Table 64: TAM parametric test for division as a moderating variable

	Path Coefficients-diff (| Construction - Maintenance |)	Path Coefficients-diff (| Construction - Planning |)	Path Coefficients-diff (| Maintenance - Planning |)	t-Value (Construction vs Maintenance)	t-Value (Construction vs Planning)	t-Value (Maintenance vs Planning)	p-Value (Construction vs Maintenance)	p-Value (Construction vs Planning)	p-Value (Maintenance vs Planning)
AT -> BI	0.175	0.073	0.102	0.946	0.421	0.631	0.346	0.675	0.529
EE -> AT	0.092	0.056	0.147	0.543	0.315	1.138	0.588	0.753	0.257
EE -> PE	0.162	0.009	0.170	1.085	0.060	1.187	0.280	0.952	0.237
PE -> AT	0.099	0.126	0.027	0.607	0.763	0.244	0.545	0.447	0.808
PE -> BI	0.019	0.107	0.088	0.109	0.718	0.622	0.913	0.474	0.535

Table 65: Combined UTAUT & TAM parametric test for division as a moderating variable

	Path Coefficients-diff (| Construction - Maintenance |)	Path Coefficients-diff (| Construction - Planning |)	Path Coefficients-diff (| Maintenance - Planning |)	t-Value (Construction vs Maintenance)	t-Value (Construction vs Planning)	t-Value (Maintenance vs Planning)	p-Value (Construction vs Maintenance)	p-Value (Construction vs Planning)	p-Value (Maintenance vs Planning)
ANX -> AT	0.085	0.148	0.233	0.611	1.091	1.933	0.542	0.277	0.055
AT -> BI	0.062	0.090	0.027	0.265	0.444	0.148	0.791	0.658	0.883
EE -> AT	0.027	0.066	0.094	0.175	0.395	0.660	0.862	0.694	0.510
EE -> BI	0.064	0.082	0.018	0.331	0.451	0.127	0.741	0.652	0.899
EE -> PE	0.198	0.027	0.171	1.197	0.170	1.169	0.233	0.865	0.244
FC -> AT	0.139	0.066	0.205	0.839	0.439	1.439	0.403	0.661	0.152
FC -> UB	0.147	0.081	0.227	1.151	0.553	1.985	0.252	0.581	0.049
PE -> AT	0.201	0.079	0.121	1.233	0.475	0.951	0.220	0.636	0.343
PE -> BI	0.114	0.098	0.212	0.596	0.582	1.471	0.552	0.562	0.143
SE -> EE	0.045	0.139	0.185	0.810	1.412	2.006	0.420	0.160	0.047
SI -> AT	0.197	0.008	0.205	1.415	0.052	1.680	0.159	0.958	0.095
SI -> BI	0.290	0.012	0.302	1.665	0.076	2.332	0.098	0.940	0.021
UB -> BI	0.071	0.070	0.001	0.649	0.641	0.010	0.518	0.522	0.992

Due to different answer rates in different divisions, only three divisions (maintenance, construction and planning) were chosen for the moderating variable analysis. These division had the highest answer rates and the number of respondents in each division were close to each other.

The effect of division on the relation between SI and BI in UTAUT was significant at the 0,05. According to the results, SI seems to have bigger impact on employees in the construction division than on employees in the maintenance division. Also, people in the maintenance division seem to be affected more by SI than people in the planning division. However, there was no significant effect found when comparing the construction and planning division.

Division seems to be a significant moderating variable at the 0,05 level also for FC and UB, SE and EE and SI and BI in the combined model. The results imply that, like in UTAUT, SI has a bigger impact on employees in the maintenance division than in the planning division. Also, the maintenance division is affected more by FC and SE than the planning division. Table 66 and Table 67 show the effect of employee's awareness.

Table 66: UTAUT parametric test for awareness as a moderating variable, behavioral intention as the dependent variable

	Path Coefficients-diff (| HaveTried - KnowSAT |)	Path Coefficients-diff (| HaveTried - NotFamiliar |)	Path Coefficients-diff (| KnowSAT - NotFamiliar |)	t-Value (HaveTried vs KnowSAT)	t-Value (HaveTried vs NotFamiliar)	t-Value (KnowSAT vs NotFamiliar)	p-Value (HaveTried vs KnowSAT)	p-Value (HaveTried vs NotFamiliar)	p-Value (KnowSAT vs NotFamiliar)
EE -> BI	0.136	0.162	0.298	1.185	1.088	2.197	0.237	0.278	0.029
PE -> BI	0.063	0.198	0.135	0.584	1.293	0.989	0.560	0.198	0.324
SI -> BI	0.123	0.184	0.307	1.140	1.171	2.284	0.256	0.243	0.024

Table 67: TAM parametric test for awareness as a moderating variable

	Path Coefficients-diff (| HaveTried - KnowSAT |)	Path Coefficients-diff (| HaveTried - NotFamiliar |)	Path Coefficients-diff (| KnowSAT - NotFamiliar |)	t-Value (HaveTried vs KnowSAT)	t-Value (HaveTried vs NotFamiliar)	t-Value (KnowSAT vs NotFamiliar)	p-Value (HaveTried vs KnowSAT)	p-Value (HaveTried vs NotFamiliar)	p-Value (KnowSAT vs NotFamiliar)
AT -> BI	0.212	0.284	0.072	1.660	1.708	0.495	0.098	0.090	0.621
EE -> AT	0.016	0.053	0.037	0.144	0.436	0.308	0.886	0.663	0.758
EE -> PE	0.196	0.092	0.104	1.484	0.588	0.663	0.139	0.558	0.508
PE -> AT	0.058	0.030	0.029	0.551	0.240	0.269	0.582	0.811	0.788
PE -> BI	0.195	0.332	0.136	1.667	1.971	0.925	0.097	0.050	0.356

Due to limitations in data, it was not possible to calculate the effect of awareness on the combined model and the relation between FC and BI in UTAUT. The groups were divided into employees who had tried SAT (HaveTried), know what SAT is about (KnowSAT) and who are not familiar with SAT (NotFamiliar). The effect of awareness was significant at the 0,05 level for the relations between EE and BI and SI and BI in TAM. The results imply, that effort expectancy and social influence have more importance to people who have not tried SAT, but know what the software is about than to people who are not familiar with SAT.

6 Discussion

All the significant relations found in this study are presented in Table 68.

Table 68: Compilation of all the significant relations found in this study

Relation	Model	Level of significance
PE->BI	UTAUT	0.001
	TAM	0.001
	Combined model	0.001
EE->PE	TAM	0.001
	Combined model	0.001
EE->AT	TAM	0.001
	Combined model	0.001
PE->AT	TAM	0.001
	Combined model	0.01
FC->UB	UTAUT	0.001
	Combined model	0.001
AT->BI	TAM	0.05
SI->AT	Combined model	0.05
SE->EE		0.001
UB->BI		0.001
Indirect effects		
EE->PE-> AT	TAM	0.001
EE->PE->BI	TAM	0.001
EE->AT->BI	TAM	0.05
EE->PE->AT->BI	TAM	0.05
SE->EE->AT	Combined model	0.001
FC->UB->BI		0.001
SE->EE->PE		0.001
SE->EE->PE->AT	Combined model	0.01
SE->EE->PE->BI		0.01

Moderating variable	Relation	Model	Level of significance	Groups compared
Division	SI->BI	UTAUT	0.05	Construction vs maintenance
		UTAUT	0.05	Maintenance vs planning
		Combined model	0.05	Maintenance vs planning
	FC->UB	Combined model	0.05	Maintenance vs planning
	SE->EE		0.05	Maintenance vs planning
Managerial position	AT->BI	Combined model	0.05	Managers vs non-managers
Awareness	EE->BI	UTAUT	0.05	Employees who know what SAT is
	SI->BI	UTAUT	0.05	vs employees who do not

Share of significant results		
# of relations studied	22	
# of significant relations	9	
% of significant relations	41 %	
# of indirect effects studied	15	
# of significant indirect effects	9	
% of significant indirect effects	60 %	
# of relations tested with moderating variables		22
# of significant relations tested with moderating variables		6
% of significant relations tested with moderating variables		27 %

All the relations that were found significant, were significant in all the models that tested those relations, except for AT->BI. Performance expectancy's effect on behavioral intention was the only relation studied and supported by all three models. At the 0,001-level of significance effort expectancy's effect on performance expectancy and attitude and facilitating conditions' effect on use behavior were supported by two models. Performance

expectancy's effect on attitude was significant at the 0,001 level in TAM and at the 0,01 level in the combined model. Attitude's effect on behavioral intention was supported in TAM at the 0,05 level. Social influence's effect on attitude (0,05-level of significance), self-efficacy's effect on effort expectancy (0,001-level of significance) and use behavior's effect on behavioral intention (0,001-level of significance) were supported by the combined model. When studying indirect effects, there were chains of effects entailing relations that had not been tested significant, but contributed to the significance of a relation consisting of three or more variables. Attitude's effect on behavioral intention was not found significant, but the relations EE->AT->BI and EE->PE->AT->BI tested significant at the 0,05 level in TAM. All other indirect effects included single relations that had been found significant.

There were a few significant relations found when testing them with moderating variables. Studying the effect of employee's division shows us, that there were some differences between divisions in the effect of social influence, facilitating conditions and self-efficacy. It is possible that social influence could vary between divisions, because employees in different tasks can have different perspectives toward software development. Also, since employees in the planning division tend to work more with computers than in the planning division, there could a difference in the general level of self-efficacy between these two divisions. All these speculations about the validity of moderating variables have only a light theoretical background and do not contribute to the core findings of this study.

The percentage share of significant relations found was 41 %, which is not a convincingly high number compared to the vast theoretical background technology adoption research has. However, it is interesting that the amount of significant indirect effects was 60 % of all indirect effects tested. This could imply, that by studying more the relations of individual constructs and their items we could be able to compile more accurate constructs and create better surveys. The percentage rate of significant effects by moderating variables was 27 %. This part of the study was almost purely explorational, but still gives us ideas about conducting technology adoption research in new ways. The results of the hypothesis are presented in Table 69.

Table 69:Results of the hypothesis

Hypothesis	Condition	Result based on the level of significance
H1	PE will have a positive effect on BI	Supported*
H2	EE will have a positive effect on BI	Not supported
H3	EE will have a positive effect on PE	Supported*
H4	SE will have a positive effect on EE	Supported*
H5	SI will have a positive effect on BI	Not supported
H6	AT will have a positive effect on BI	Supported[A]
H7	UB will have a positive effect on BI	Supported*
H8	PE will have a positive effect on AT	Supported**
H9	EE will have a positive effect on AT	Supported*
H10	SI will have a positive effect on AT	Supported***
H11	ANX will have a negative effect on AT	Not supported
H12	FC will have a positive effect on AT	Not supported
H13	FC will have a positive effect on UB	Supported*

All the hypothesis supported were significant in all of the models that tested for those hypothesis.
If different models resulted in different levels of significance, the lower level of significance is shown here.
[A] H6 was only supported in TAM
** Significant at the 0.001 level*
*** Significant at the 0.01 level*
**** Significant at the 0.05 level*

As turned out earlier, hypothesis 1,3,4,7,8,9 and 10 were supported based on the level of significance of each relation in question. All the relations presented in TAM were found to be significant in this study. UTAUT did not perform as well; of the four relations studied in this paper, two were found to be significant. However, it has to be stated here that UTAUT was not studied in the original form it was meant to in the article by Venkatesh et al. (2003). By dividing the framework into two components where behavioral intention and use behavior were tested separately can affect the results significantly. On the other hand, it is common to not study UTAUT in its original form (Williams et al. 2015). Also, in this study we could have observed the relation between use behavior and behavioral intention in UTAUT, even though the study is not longitudinal, i.e. use behavior in this study measured the subjective use rate of the respondent at the time of taking the survey. This method was applied e.g. by Kijsanayotin et al. (2009), but since it is not in line with the original framework, this practice was rejected in this study.

Of the thirteen relations studied, five relations were not found to be significant. Of these five relations, anxiety's effect on attitude and facilitating conditions' effect on attitude were relations not covered in UTAUT or TAM. This could mean that those two relations did

not have sufficient theoretical and/or empirical background to be tested like we did in this paper. Also, estimating users' anxiety toward using a software could be a bit too excessive, since we live in a world where new software are more a rule than an exception.

It was interesting, that effort expectancy did not seem to affect behavioral intention. The relation has been studied a lot, but unlike in UTAUT, effort expectancy and behavioral intention did not have a direct relation in TAM. As Davis (1985), and many others write, effort expectancy seems to be most importantly a significant construct affecting behavioral intention *through* performance expectancy.

Why did not social influence seem to affect behavioral intention? There was weak support for social influence affecting attitude, so maybe we would need to reassess the role of social influence as affecting behavioral intention indirectly. Another reason for the hypothesis not being supported could be that the implementation process had only been going on for three months before the survey. During the first three months, it could have been possible, that only the IT-savvy, enthusiastic early adopters had been showing interest toward SAT, thus having a disproportionately large share of them in the survey. It could be that if one is interested in new software through intrinsic motivation, social influence does not have a significant effect on their adoption process. Same kind of reasons could explain why facilitating conditions was not found to be a significant factor. One might not care about formal guidance and company level communication if they find the software's interface to be relatively easy to use.

Of the relations that were found significant, self-efficacy's effect on effort expectancy, social influence's effect on attitude and use behavior's effect on behavioral intention were not included in TAM or UTAUT. This suggests that the combined model was functional, to some extent, to handle the variables taken from TAM and UTAUT and the new relations set between those variables. However, the combined model was only used to test how the two other commonly used frameworks would behave together. The combined model can be improved a lot and it is important to study the correlations between different variables to compose a more concise and coherent model. It also needs to be noted that when comparing the relations and which of the would be the most prominent ones, only few relations were included in all three models. This means that organizing the relations from the strongest to the weakest is not reasonable in this case.

It is interesting to see how the results of this paper compare to previous research. As we see in Tables 1 and 2, TAM has not always reached consistently high results. However, the results in this paper (100 % of relations significant in TAM) are close to the meta-study

by Schepers & Wetzels (2007) where the share of significant relations was between 90 % and 100 %. In the study of Ma & Liu (2004) the share of significant relations, however, was between 53 % and 64 %.

In Table 3 we see that the share of significant relations in the meta-study of UTAUT by Williams et al. (2015) was approximately between 60 % and 80 %. The results of this paper (50 % of relations significant) therefore score clearly below other previous research. However, as we can see in Table 70, the results by Dwivedi et al. (2011) suggest smaller shares of significant relations found in studies applying UTAUT. The results of this paper are closer to the results of Dwivedi et al. (2011).

Table 70: Meta-study on significant relations in UTAUT by Dwivedi et al. (2011)

Variables	Significant relations/ number of relations studied			Number of not applicaple results/ total		
PE & BI	25/43	=	58 %	18/43	=	42 %
EE & BI	19/43	=	44 %	19/43	=	44 %
SI & BI	22/43	=	51 %	18/43	=	42 %
FC & BI	9/43	=	21 %	32/43	=	74 %
FC & UB	14/43	=	33 %	27/43	=	63 %
BI & UB	9/43	=	19 %	35/43	=	81 %

In general, and according to the meta-studies, TAM has seemed to function better than UTAUT. However, it is not certain why. It could be because of TAM had already been around for approximately twenty years before Venkatesh created UTAUT. It is possible that when a theory has established its place in the scientific field, it could steer research into a certain direction where testing and finding support for the theory becomes a priority.

Of the relations studied in the combined model 62 % of them were found to be significant. Of these significant relations, four were included in TAM (EE & AT, EE & PE, PE & AT and PE & BI) whereas the relation between attitude and behavioral intention was not found significant. When comparing the combined model to UTAUT, the relations between PE & BI and FC & UB were found significant in both models. Respectively the relations between SI & BI and EE & BI were found not significant. Based on these results, the combined model produced almost the same results as UTAUT and TAM did individually: one significant result in TAM was found not significant in the combined model.

Of the new relations in the combined model that were not included in UTAUT or TAM, SE & EE, SI & AT and UB & BI were found significant. The relations between ANX & AT and FC & AT were not included in UTAUT or TAM and were found not significant in the combined model. Based on these results, there is at least slight evidence that the combined model is able to produce similar results than UTAUT and TAM.

When considering the other results than just the T- and P-values, it cannot be stated with a 100 % certainty that the relations found significant based on their P-values actually have valid prediction power in real life. There were problems with item loadings. For some constructs, the items loaded inconsistently and sometimes the loadings were too low to be considered reliable indicators of the construct in question. There were also inconsistencies in the values of Cronbach's alpha, composite reliability and average variance extracted. Presence of convergent and discriminant validity was weak, which we noticed e.g. by testing the inter-item correlations with Fornell-Larcker criterion. Inter-construct correlations and covariances varied, which creates a question whether the constructs measured what they were supposed to measure well enough. This potential problem was assessed when creating the survey questions by using existing research as an example. However, the role of having the right questions in the survey is crucial for this kind of a study.

7 Limitations of the Study

There are different types of innovations and technologies, in this paper we studied only one. The results could be different when observing the adoption process of a different type of technology, or especially when studying a group or a bundle of innovations together. Williams et al. (2015) write that the most common weaknesses of UTAUT studies are for example studying only one organization, department or age group and studying only a single task. However, Antonioli & Della Torre (2016) state that studying different innovations in the same study can blur the differences between the innovations, thus giving inaccurate information on the real adoption process. To really understand the adoption process, one should think of conducting a longitudinal study, so that we can see how behavioral intention translates into actual use behavior in the future.

The survey did not suffer from strong response bias considering the answer technique of the respondents. However, the weakness of conducting a survey lies in reaching an evenly distributed group of employees, opinion-wise. During the implementation process it was clear that some employees are not interested or explicitly object the adoption of new software. It is likely, that employees from these groups might not be interested in taking the survey. By arranging interviews, these people would have been heard better, but due to the lack of resources this method was not possible. In their meta-analysis on nonresponse bias research Groves & Peytcheva (2008) write that interest in the topic being surveyed can create a disproportionate share of "interested people" answering the survey. On the other hand, Davern (2012) writes that there is a certain "fixation" in the scientific field towards response rates and their potential positive correlation to nonresponse bias. In their meta study Choudrie & Dwivedi (2005) write that technology adoption studies use mainly two approaches: surveys (74 % of articles) and case studies (26 % of articles). The authors recommend the case study method when a researcher is e.g. employed in the company, because the method makes it possible to create a more precise picture of the situation in the organization.

Considering the survey, there are aspects that require critical evaluation. Slater & Garau (2007) write that asking questions that could have only binary responses, but have e.g. a 7-point Likert scale, can result in the two ends of the scale getting ticked the most. There was no sign of this kind of behavior, but the "fully agree" side of the scale might have gotten a disproportionate share of responses from employees wanting to give "socially

acceptable answers" Garland (1991). After all, technology has an increasingly important role in companies and therefore it can be difficult to oppose that kind of development. The survey questions were not tested thoroughly; they were sent to eight people, of which three gave feedback. However, by using pre-tested and validated questions from previous research we were able to get around the time-consuming phase of drafting our own questions and validating them. This method also contributes to the testing of similar items.

Also, the questions were bundled under specific categories, i.e. every question measuring effort expectancy came one after another. By randomizing the order, people might had had to think about the individual questions more thoroughly. The assumption here was that it would be easier for the respondent to understand the constructs when same type of questions are bundled together.

The number of items could have been larger also. Costello & Osborne (2005) recommend using at least five items per constructs and the item loadings should be over 0,50. This creates a situation where one has to decide whether the robustness or the number of constructs is more important. A survey having too many questions might become too heavy for the respondents, which might result in response bias and the response rate. The construct measuring use behavior should also be objective instead of subjective (Turner et al. (2010). In this paper, we collected a rough estimate of the employees' present use of SAT.

A big question in this kind of studies is the use of parametric tests. There has been a lot of controversy over the use of parametric tests on ordinal data, such as Likert scales, especially over treating the data as interval data (Jamieson, 2004). According to Allen & Seaman (2007), ordinal data that Likert scales produce is not suitable for parametric analysis, but for non-distributed analysis that use e.g. rank, median or range. Norman (2010) states that "*Parametric statistics can be used with Likert data, with small sample sizes, with unequal variances, and with non-normal distributions, with no fear of ''coming to the wrong conclusion''. These findings are consistent with empirical literature dating back nearly 80 years. The controversy can cease (but likely won't)*". There is no consensus over the use of parametric tests, but it is good to be aware of the limitations the method might include. Parametric tests are widely used in technology adoption studies, and to test the models in this paper these tests had to be applied to make the results comparable.

Venkatesh et al. (2003) write that "*Given that UTAUT explains as much as 70 percent of the variance in intention, it is possible that we may be approaching the practical limits of our ability to explain individual acceptance and usage decision in organizations*". However, a problem that all technology acceptance studies have is that the results have not

been fuly replicable. Attuquayefio & Addo (2014) review 20 studies that applied UTAUT and write that EE, PE and SI do not correlate consistently with the intention to use the technology. King & He (2006) write that even though TAM is a "*powerful and robust tool*" and that the understandability and simplicity of TAM has made it popular, the results presented in the original article by Davis (1985) have not been repeated in all studies and variation has been significant when comparing different research contexts. Lee et al. (2003) write that considering TAM, the task type that is being studied affects the way users perceive the technology being used, which prevents the results from being generalized and on the other hand does not support large studies where the task type is too broad.

In their meta study on TAM Lee et al. (2003) state that many studies have commented TAM to be so popular a theory that it inhibits the development of new theories and that is why research on technology adoption tends be only incremental. Benbasat & Barki (2007) state that existing TAM research has not been focusing on the design of the information system and that it has encountered its limits and new ways of studying IS adoption are needed. Turner et al. (2010) write that one of TAM's weaknesses is that it neglects the assessment of utility of a technology, which in the end is the only reason why new technology is introduced into an organization. The authors continue that the same applies to UTAUT. Williams et al. (2011) comment that compared to the number of citations, which is high, the actual use of UTAUT in research is relatively low.

It can be criticized that the role of Venkatesh in this study is too big, because in addition to compiling UTAUT, Venkatesh has been updating also TAM. Venkatesh et al. (2007) write that the study of technology adoption has suffered from the influence and authority of TAM by leading many of the following studies just to add minor parts to existing theory. For future research, new approaches are needed in technology adoption research. For example, Heidenreich & Handrich (2015) write about passive innovation resistance (PIR) and that how that point of view has been neglected in adoption studies, because according to the authors studies tend to focus on finding out factors that enhance the innovation adoption process. It also needs to be taken into consideration that the share of digitally native employees is increasing constantly, and in an especially fast pace in Finland, where the relatively big generation of baby boomers is retiring. How important will innovation adoption be in thirty years?

8 Conclusions

The theoretical contributions of this study are related to testing two existing models and studying whether a symbiosis between the two models can be achieved. Based on the results, behavioral intention to use the new software is affected by performance expectancy, attitude and current use behavior. Mediating effects between self-efficacy and effort expectancy and effort and performance expectancy were found. Attitude was also found to be affected by performance expectancy, effort expectancy and social influence. Also, there was a significant relation between facilitating conditions and use behavior.

Even though a few significant relations were found using moderating variables, the results were not very consistent and thoroughly evaluated. However, the use of new moderating variables can give ideas on how to take into consideration new aspects in technology adoption research. Studying the indirect effects between variables can also make us understand better how different constructs behave together and what types of chains of effects should be considered when estimating factors that can change an individual perception towards new technology. Also, studying a SaaS product with platform-like attributes is relatively new to the field of innovation adoption research. After all, TAM is based on adopting PCs in the 80's.

This study contributes also to the practical technology implementation management done in organizations by showing how one should examine different aspects when assessing the validity of the implementation process. It is not always necessary to focus on the big picture, if some elements in the adoption process seem to have relatively more importance to the company. This type of study shows a company what are the potential foxholes of its implementation processes. It can also help companies to dissect its organizational chart to evaluate if there are differences inside the company.

The purpose of this study was to show how the two models work together. There is a lot in common in innovation adoption studies and choosing the right variables can be a difficult task and it depends also on the personal interests if the researcher. The topic can be approached from many directions and it is interesting to see, which paths technology adoption research is going to take in the future. However, there is still demand for this kind of research, as turns out in the comment from an employee working in the company:

"*With the average age that we have in our team it's not worth the effort to start learning to use this new software. None of us films anything while working and no one is interested in searching for existing footage. We don't use Yammer and not everyone can even write a text message. We have all the tools we need here: a hammer and a crowbar."*

Appendix: Survey Questions

Appendix 1: Survey questions (translated from Finnish)

1. Age
2. Sex
3. Are you in a managerial position?
    a. No
    b. Yes, I have less than 10 subordinates
    c. Yes, I have 10 or more subordinates
4. What is your division?
    a. Construction
    b. Maintenance
    c. Machines
    d. Design
    e. Materials
    f. Strategy and Development
    g. Communications and Marketing
    h. Business Support
    i. Financial administration
    j. IT
    k. HR
    l. Procurement
5. Which of the following describes the best your experience in using SAT?
    a. I have tried SAT
    b. I have not tried SAT, but I knew before taking this survey approximately what SAT is about
    c. I had not heard of SAT before taking this survey, or I did not know what SAT is about
6. Where did you hear from SAT?
    a. I have not heard of SAT before
    b. News on the intranet
    c. Intranet

    d. I have attended a presentation about SAT
    e. Yammer
    f. Colleague
    g. Text message
    h. Other
7. SAT would probably be useful in my work
8. In general, SAT seems like a useful application
9. The features of SAT are sufficient considering my work
10. The usefulness of SAT depends on the number of people using it: the more people use it, the more useful it is for myself
11. I believe I would learn to use SAT easily
12. I learn to use new software easily
13. Learning to use SAT would require a lot of learning from me
14. Using SAT is a good idea
15. I like using new software and applications
16. Developing new software for the employees of VR Track is a good idea
17. New software are proposed to be implemented too often
18. The threshold for asking help from my colleagues for using SAT is low
19. Encouragement and showing example by my manager(s) to use SAT would probably increase my own use of SAT
20. Encouragement and showing example by my colleagues to use SAT would probably increase my own use of SAT
21. My colleagues are able to help me in using SAT
22. I know where I can get help for using SAT
23. Instructions for using SAT is sufficient
24. There has been enough communication about SAT
25. I believe I can use SAT without outside help
26. I believe using SAT is difficult
27. I have the knowhow to use SAT
28. I hesitate using SAT, because I do not know what one can do with it
29. I hesitate using SAT, because I am afraid of adding useless material into it
30. The idea of using SAT makes me feel anxious
31. I use SAT in my work approximately
    a. Daily

   b. Once a week
   c. Biweekly
   d. Once a month
   e. Less than once a month
   f. I do not use SAT

32. I intend to use SAT during 2017
33. My use of SAT will likely increase
34. I will likely use SAT regularly in the future
35. I feel belonging to the user group of SAT (SAT is meant for workers like I)
36. Which of the following would describe your potential use of SAT?
   a. I believe that my use of SAT would be limited to filming videos and pictures for others to watch
   b. I believe that my use of SAT would be limited to watching videos and pictures
   c. I believe that I would use SAT diversely by both filming and watching the footage
   d. I do not know how I would use SAT
37. Which kind of tasks SAT could be used for?
38. How would you like SAT to be developed?
39. How would SAT be implemented the best among the employees? How could that be enhanced?
40. Write down your email address, if you want to participate in the lottery of the headset and power banks. All the asnwers will be handeld anonymously.

Appendix 2: Original survey questions in Finnish

1. Ikä
2. Sukupuoli (mies/nainen)
3. Oletko esimiesasemassa?
    a. En ole
    b. Kyllä, minulla on alle 10 alaista
    c. Kyllä, minulla on 10 tai enemmän alaista
4. Mikä on liiketoimintayksikkösi?
    a. Rakentaminen
    b. Kunnossapito
    c. Koneet
    d. Suunnittelu
    e. Materiaalit
    f. Strategia ja kehitys
    g. Viestintä ja markkinointi
    h. Liiketoimintojen tuki
    i. Talous
    j. IT
    k. HR
    l. Hankinta
5. Mikä seuraavista kuvaa parhaiten kokemustasi Tilannekuvapalvelun käytöstä:
    a. Olen kokeillut Tilannekuvapalvelua
    b. En ole kokeillut, mutta tiesin ennen tätä kyselyä pääpiirteittäin mistä Tilannekuvapalvelussa on kyse
    c. En ollut kuullut Tilannekuvapalvelusta ennen tätä kyselyä, tai en tiennyt mistä siinä on kyse
6. Mitä kautta olet kuullut Tilannekuvapalvelusta?
    a. En ole kuullut Tilannekuvapalvelusta aiemmin
    b. Uutinen intranetisä
    c. Intranet
    d. Olen ollut järjestetyssä Tilannekuvapalvelun esittelyssä
    e. Yammer
    f. Työkaveri

    g. Tekstiviesti-ilmoitus
    h. Muu, mikä?
7. Tilannekuvapalvelu olisi todennäköisesti hyödyllinen omassa työssäni
8. Tilannekuvapalvelu vaikuttaa yleisesti ottaen hyödylliseltä sovellukselta
9. Tilannekuvapalvelun ominaisuudet ovat riittävät oman työni suhteen
10. Tilannekuvapalvelun hyödyllisyys riippuu sen käyttäjämäärästä: Mitä enemmän trackiläisiä sitä käyttää, sitä hyödyllisempi se on itselleni.
11. Uskoisin oppivani Tilannekuvapalvelun käyttämisen vaivattomasti
12. Opin uusien ohjelmistojen käytön helposti
13. Tilannekuvapalvelun käyttäminen vaatisi paljon opettelua minulta
14. Tilannekuvapalvelun käyttäminen on hyvä idea
15. Pidän uusien ohjelmistojen ja sovellusten käyttämisestä
16. Uusien ohjelmistojen kehittäminen VR Trackin työntekijöille on hyvä idea
17. Uusia ohjelmistoja esitetään käyttöönotettavaksi liikaa
18. Kynnys avun pyytämiseen työkavereiltani Tilannekuvapalvelun käyttämiseen on matala
19. Kannustus ja esimerkin näyttäminen ESIMIEHELTÄNI tai TYÖNJOHTAJALTA Tilannekuvapalvelun käyttämiseen lisäisi todennäköisesti omaa Tilannekuvapalvelun käyttöäni
20. Kannustus ja esimerkin näyttäminen TYÖKAVEREILTANI Tilannekuvapalvelun käyttämiseen lisäisi todennäköisesti omaa Tilannekuvapalvelun käyttöäni
21. Työkaverini kykenevät auttamaan minua Tilannekuvapalvelun käytössä
22. Tiedän, mistä saan apua Tilannekuvapalvelun käyttämiseen
23. Ohjeistus Tilannekuvapalvelun käyttämiseen on riittävä
24. Tilannekuvapalvelusta on viestitty ja kerrottu tarpeeksi
25. Uskon pystyväni käyttämään Tilannekuvapalvelua ilman ulkopuolista apua
26. Uskon Tilannekuvapalvelun käytön olevan vaikeaa
27. Minulla on tarvittava tietotaito Tilannekuvapalvelun käyttämiseksi
28. Epäröin Tilannekuvapalvelun käyttöä, koska en tiedä mitä sillä saa tehdä
29. Epäröin Tilannekuvapalvelun käyttöä, koska pelkään lisääväni sinne turhaa materiaalia
30. Ajatus Tilannekuvapalvelun käyttämisestä on ahdistava
31. Käytän Tilannekuvapalvelua työssäni suunnilleen
    a. Päivittäin

   b. Viikoittain
   c. Kerran kahdessa viikossa
   d. Kerran kuukaudessa
   e. Harvemmin kuin kerran kuukaudessa
   f. En käytä Tilannekuvapalvelua

32. Aion käyttää Tilannekuvapalvelua vuoden 2017 aikana
33. Tilannekuvapalvelun käyttöni tulee todennäköisesti lisääntymään
34. Tulen todennäköisesti käyttämään Tilannekuvapalvelua tasaisin väliajoin tulevaisuudessa
35. Koen kuuluvani Tilannekuvapalvelun kohderyhmään (Tilannekuvapalvelu on tarkoitettu itseni kaltaiselle työntekijälle)
36. Mikä seuraavista kuvaisi mahdollista Tilannekuvapalvelun käyttöäsi?
   a. Uskon, että Tilannekuvapalvelun käyttöni rajoittuisi ainoastaan videoiden ja kuvien kuvaamiseen muiden katseltaviksi
   b. Uskon, että Tilannekuvapalvelun käyttöni rajoittuisi ainoastaan videoiden ja kuvien katselemiseen
   c. Uskon, että käyttäisin Tilannekuvapalvelua monipuolisesti sekä kuvaten että katsellen videoita ja kuvia
   d. En tiedä miten käyttäisin Tilannekuvapalvelua
37. Minkälaisissa työtehtävissä Tilannekuvapalvelua voisi käyttää?
38. Miten haluaisit Tilannekuvapalvelua kehitettävän?
39. Miten Tilannekuvapalvelu saataisiin parhaiten työntekijöiden käyttöön? Miten sitä voitaisiin edesauttaa?
40. Kirjoita tähän sähköpostiosoitteesi, jos haluat osallistua kuulokkeiden ja varavirtalähteiden arvontaan. Vastaukset käsitellään anonyymisti.

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