A Study on Factors Influencing Acceptance of Using Mobile Electronic Identification Applications in Sweden
Abstract

Mobile technology has become increasingly common in today’s society, enabling a whole new set of advantageous services that has a profound impact on our daily lives. This has led to that the mobile electronic identification application (mobile eID app) software has emerged, creating the possibility for users to authenticate important tasks and validating one’s identity through a mobile device. Existing literature on mobile electronic identification (mobile eID) has touched upon several aspects of this phenomenon, however, no specific research related to the user acceptance has been conducted. Thus, this paper seeks to identify the influencing factors that lead to the acceptance of using a mobile eID app. To analyze the adoption behavior of mobile eID app users, a conceptual, and later refined model consisting of 7 factors and the relationship between these were proposed. This model was based on the well-researched Technology Acceptance Model (TAM) and extended to better fit the subject of this research. 13 hypotheses based on already existing research within the field of mobile service application acceptance were proposed and Sweden, having heavily implemented this phenomenon into the society, served as this study’s empirical site. The required primary dataset for hypotheses testing was collected through conducting a questionnaire distributed using a convenience sampling method. The gathered data was analyzed through the statistical software programs SPSS and SPSS AMOS to see if correlations between factors existed. The result showed that 10 hypotheses were accepted, and 3 hypotheses were rejected. This concludes that the factors influencing the acceptance of using mobile eID apps to validate one's identity online in Sweden are the following ranging from the largest effect to the least effect: perceived usefulness of a mobile eID app, subjective norm, perceived ease of use of a mobile eID app, perceived convenience of a mobile eID app, attitude towards using a mobile eID app, and perceived security of a mobile eID app. The findings of this study advance the theory within technology acceptance and contributes to the foundation for future research within the field of mobile electronic identification as well as for user acceptance within related subjects.
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## Abbreviations

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<th>Abbreviations</th>
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<tr>
<td>AGFI</td>
<td>Adjusted Goodness-of-Fit</td>
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<td>App</td>
<td>Application</td>
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<td>CFI</td>
<td>Comparative Fit Index</td>
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<td>eID</td>
<td>Electronic Identification</td>
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<td>GFI</td>
<td>Goodness-of-Fit Index</td>
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<td>IFI</td>
<td>Incremental Fit Index</td>
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<tr>
<td>Mobile eID</td>
<td>Mobile Electronic Identification</td>
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<td>Mobile eID app</td>
<td>Mobile Electronic Identification Application</td>
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<tr>
<td>NFI</td>
<td>Normed Fit Index</td>
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<tr>
<td>RMR</td>
<td>Root Mean Square Residual</td>
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<td>RMSEA</td>
<td>Root Mean Square Error of Approximation</td>
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<td>SRMR</td>
<td>Standardized Root Mean Square Residual</td>
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<td>TAM</td>
<td>Technology Acceptance Model</td>
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<tr>
<td>TLI</td>
<td>Tucker-Lewis Index</td>
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<tr>
<td>TPB</td>
<td>Theory of Planned Behavior</td>
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<tr>
<td>TRA</td>
<td>Theory of Reasoned Action</td>
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<tr>
<td>UTAUT</td>
<td>Unified Theory of Acceptance and Use of Technology</td>
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<tr>
<td>($\chi^2$/df)</td>
<td>Relative Chi-square</td>
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1 Introduction

This chapter introduces the reader to the background of the study as well as to the underlying incentives behind the study. It includes the sections: background, problem discussion, purpose, research question, and delimitations.

1.1 Background

According to Statista (2018), the worldwide smartphone usage has been increasing at a rate over 10% annually for the last 5 years, amounting to 2.32 billion in 2017, and is predicted to continue to grow immensely in the upcoming years. This is most apparent in developed countries such as Sweden with over 82% smartphone penetration (Statista, 2018). In 2016, for the first time in history, worldwide usage of the internet was mostly utilized through smartphones instead of desktop computers. In addition to that, other statistics show that Android OS and IOS based devices combined exceed the Windows-based OS in internet usage by far, indicating that there is a significant user base that also uses the internet through other mobile devices such as tablets (StatCounter, 2018). All these facts are implying that the society is moving towards a more mobile-based one. The reason for why mobile devices have increased tremendously over the last years is mainly due to the revolutionary advancement of smartphones and tablets, giving access to a virtual environment and digital identities where users can browse entertainment, information, and services that were previously not accessible (Gökçearslan, Mumcu, Haşlaman & Çevik, 2016).

Correspondingly, traditional systems that previously required long paper-work processes (such as banking, ordering, making transactions et cetera) have increasingly been introduced to online platforms, presenting a refined and effective new way of performing these tasks (Digitaltrend, 2018). Mobile applications, or as it is more commonly known, mobile “apps” is a software developed for smartphones and mobile devices (Rahman & Sahibuddin, 2013). In 2017, the most popular app categories were social media, entertainment, business, and news. (Hartmans, 2018; Statista, 2018). Despite the major focus on entertainment, it can be observed that due to the advancement in technology, there has been a rise in applications that handle substantial and significant personal information (Financial Times, 2018). This expansion has assisted the development of applications in numerous fields, one being mobile banking. These mobile service applications can contribute to the improvement in economic efficiency as can be seen in the case of Kenya where it enabled consumers to, at a low cost, efficiently utilize the banking functions despite the limitations of traditional banking (Brendah, 2017). A rather new phenomenon which also relates to the handling of important personal information is that people now can identify and validate themselves through online services. This have led to the development of a research field within identification means for people validating their identity, calling it Electronic identification (eID) (Axelsson & Melin, 2012).
Electronic identification is of major importance for complex e-services which requires secure methods for validating identities, and for the signing of documents (Axelsson & Melin, 2012). Hence, to truly develop an online society enabling smooth and secure online service delivery, data protection, as well strong online-fraud protection, the implementation and improvement of eID may be of great importance (Dutch Ministry of the Interior and Kingdom Relations, 2018). This implementation can be observed in many developed European countries but is particularly prevalent in the Nordic region with Denmark having the highest user-to-population rate amounting to over 90%. In Sweden, a country with over 76% user-to-population rate, eID is comparatively less implemented. However, over 90% of the eID user base in Sweden are performing electronic identification via mobile devices; a mean of validating one’s identity which is not as common in its Nordic neighbors (NemID, 2018; BankID, 2018). As the demographic behavior in Sweden is moving towards using mobile devices as an alternative or replacement for traditional means when accessing e-services, it is increasingly important to further explore and understand what influences the acceptance of electronic identification using mobile devices. Axelsson and Melin (2012) contributed to one of the initial studies within this field by studying citizens’ attitude towards eID in a public Swedish e-service context. While this research concluded that usability and security are important themes in regard to the trust of using this method of validating identities, they suggest further research on the several factors that may be influencing the intention to use electronic identification. Due to this field being relatively unexplored with seemingly no research done on the acceptance of mobile eID apps in Sweden (Axelsson & Melin, 2012), together with that the acceptance towards using mobile eID apps have not yet reached full implementation in the Swedish society, this research aims to find evidence of influencing factors on acceptance of mobile eID apps in Sweden.

1.2 Problem Discussion

Previous research on the topic of electronic identification has focused on how to implement new platforms of eID (Zwilling, 2017), security and privacy enhancements (Buchmann, Rathgeb, Baier & Busch, 2014), as well as the attitude towards electronic identification in a public context (Axelsson & Melin, 2012). As Axelsson and Melin (2012) call for future research within the specific topic of electronic identification acceptance, it may be assumed that no research has covered this topic before. Other related topics on acceptance which include authentication to perform specific transactions, involving highly evolved security systems and bank-related activities, have all identified different factors that influence the acceptance of a mobile service applications (Schiertz, Schilke & Wirtz, 2010; Kim, Mirusmonov & Lee, 2010). However, as different technologies and fields of studies call for different factors of influence (Yoon & Kim, 2007; Gefen, Karahanna & Straub, 2003), and that adoption and acceptance models needs to be enlarged to better fit the characteristics for the specific services (Mallat, Rossi, Tuunainen & Öörni, 2006), the particular factors related to the acceptance of mobile eID apps cannot be defined without proper research on the topic, as suggested by Axelsson and Melin (2012). Hence, a gap is presented within the field of technology acceptance, a gap which this research seeks to address. This could be an important addition to the field due to the phenomenon handling information closely related to people’s identity (e.g. personal banking information, log-in details, transaction logs et cetera). The potential risk of neglecting the
influential factors on mobile eID acceptance, could in a longer perspective, decrease the likelihood of fully implementing this application; stalling the progress towards a more mobile society.

The research adds both theoretical and managerial value to the existing literature within service management. First, the results of this research provide vital information to the electronic identification field, filling a gap which was suggested in previous research (Axelsson & Melin, 2012). The existing information on the subject can explain the characteristics of the technology and how it is being used, but as to what factors of influence that affect this already heavily implemented technology to be accepted to be used as a mean of validating one’s identity online is an area that prior to this research was unexplored. By exploring this, one can better understand what influential factors that are apparent in the process of accepting this technology. Second, the classification of external variables into technology-related constructs adds value and gives a profound understanding of the linkage between personal perceptions and specific system characteristics. Third, the study offers the potentiality of deriving managerial implications on how to better and more effectively market, develop, and improve mobile eID apps. This is of great importance due to the expanding mobile society leading to the vast implication and growing interest in adopting mobile eID apps as an alternative to traditional ways of validating one’s identity. Fourth, from a more academic perspective, through implementing a previously well-used model and extending it to test mobile eID app acceptance, this research is able to further test the credibility of the model in a new setting of mobile service application. It also further increases the scope of the model adding value to future researchers studying technology acceptance. By identifying and conceptualizing the drivers that lead to the acceptance of a mobile eID app, together with the developed model itself, academics and researchers are also presented a solid foundation and starting point for future investigations both within the field of technology acceptance as well as studies related to the phenomenon of mobile electronic identification.

1.3 Purpose
The purpose of this paper is to identify influential factors on acceptance of mobile electronic identification applications in Sweden.

1.4 Research Question
What factors influence user acceptance of mobile electronic identification applications in Sweden?

1.5 Delimitation
Due to the novelty of the topic, and to prevent clashes with other related topics, this study seeks to limit the research in several ways. The focus will be on user acceptance of mobile eID apps and not the phenomenon of electronic identification. The technical aspects of mobile eID apps will not be discussed, neither will the specific processes and procedures related to the usage of
the application be elaborated upon in the analysis and discussion of the data gathered. This is due to it not adding value to the research purpose of determining the factors of overall acceptance. Another delimitation in this study is the sole focus on individual consumers rather than on companies; adding credibility to that the data will be derived from behavioral incentives related to the individuals’ perception rather than profit-seeking incentives.
2. Frame of Reference

This chapter will provide an explanation to important terminologies and some background information on technology acceptance theories and mobile applications. Furthermore, a model including 13 hypotheses based on previous TAM studies researching mobile service application user acceptance is proposed.

2.1 Terminology

2.1.1 Mobile Application

A mobile application can be defined as an IT software which can be accessed from a mobile operating system installed on a handheld device (e.g. tablets and smartphones) (Hoehle & Venkatesh, 2015). The most prominent of mobile handheld operating systems are currently Android, IOS, and Windows Phone; all offering a well-established application store. The application can either be downloaded and installed from these application stores (e.g. Google Play, App Store, and Microsoft Store), or they may be pre-installed by the developer of the handheld device. Some mobile applications are tailored to work for people that are on the move through a broadband cellular network or a wireless network (Gahran, 2011), adding accessibility, mobility, and convenience for the user. The applications available are divided into various categories, including but not limited to books, business, finance, games, economy, communication, and lifestyle (Apple, 2018; Google, 2018) depending on the characteristics and properties of the application.

2.1.2 Mobile Electronic Identification Applications

According to the European Commission (2018), electronic identification is a mean for users to perform online services and transactions through secure online identity verification. It is a system that through an electronic device enables the user to verify their identity in a remote location by requesting and sending messages to the system servers using a unique combination of identity and reference (e.g. cryptographs and codes) (Gray, 2006). Electronic identification comes in many forms including electronic identification cards, desktop-based programs, and mobile applications.

Mobile electronic identification applications can be downloaded to a mobile device and be used as an optional substitute to verify one's identity online (Financial Times, 2018). While the different methods of electronic identification have both its benefits and disadvantages, mobile applications are often deemed to be the most portable and accessible as they only require the user to own a smartphone or equivalent mobile device and no additional physical objects such as ID cards or ID reader. There are currently a couple of eID options in Sweden, these are BankID, Mobilt BankID, and Telia e-legitimation, but only Mobilt BankID provides a mobile service application (Signicat, 2018). Even though these eID options exist in Sweden, according to the statistics, more than 90% of the eID user base in Sweden use the mobile application version. In addition, BankID has over 76% market penetration (BankID, 2018). This signifies
that mobile electronic identification is a prevalent and well accepted way of identification in the society, a situation which indicates that Sweden is a suitable empirical site for this research to identify the factors of acceptance of mobile eID apps.

2.1.3 User Acceptance

Davis (1989) refer “user acceptance” to the intention to use and adoption of a technology and therefore act as a predominant variable to the determine whether a user accept or not the usage of a technology. The user, in this case, would be the potential or actual consumer handling and interacting with the interface of the technology with the intent to utilize on the benefit that comes from the experience. User acceptance is frequently used in studies regarding usage behavior (Davis, 1989; Mallat et al., 2006; Schiertz et al., 2010) strengthening the implementation of this concept to research dealing with the acceptance of mobile service applications.

2.2 Technology Acceptance Theories

Technology acceptance models can be applied in order to verify what factors that are predominant for the value of using a technology to be realized (Devolder, Pynoo, Sijnave, Voet & Duyck, 2012). Several models within this area have been created and elaborated upon during the last decades with Fishbein and Ajzen’s (1975) work on the Theory of Reasoned Action (TRA) which describes the importance of social psychology when studying behavior, being the first. This model seeks to explain and define any human behavior and linking them to the behavioral intention to perform the behaviors. The various factors in play are attitude toward act or behavior, subjective norm, behavioral intention, and behavior; all serving as determinants to the likelihood that if a person intends to perform an action, it most likely will (Fishbein & Ajzen, 1975). Ajzen later ought to extend the TRA by showing the effect which the factor of perceived behavioral control had on the intention and behavior. By doing this, the theory of planned behavior (TPB) was created which aimed to further strengthen the accuracy of which attitudes towards the behavior, perceived control over the behavior, as well as the subjective norms with respect to the behavior, plays a role when dealing with the complexities regarding human social behavior (Ajzen, 1991). A model that seems to unify both TPB and TRA; incorporating the focus of technology acceptance, is the Technology Acceptance Model (TAM) which was first proposed by Davis (1986). This model is the most influential of research models explaining information technology adoption and has been recognized useful when studying acceptance in a variety of contexts related to information technology (Kim et al., 2010). The central message of this model is that technology users make rational decisions regarding using a technology (Kim et al. 2010). The factors that are needed to take into account to make these rational decisions, and which are said to be determinants to user attitude and behavior, are perceived usefulness and perceived ease of use (Davis, 1986). Venkatesh and Davis (2000) were two of the most influential scholars to expand the model making a new standardized model within technology acceptance by introducing new factors and excluding the factor of attitude calling it TAM2. The Unified Theory of Acceptance and Use of Technology (UTAUT) is another standardized model developed by comparing and unifying already existing models.
within the subject of information systems (Venkatesh, Morris, Davis & Davis 2003). This model also excludes the factor of attitude and suggests four key factors which all act as determinants of usage intention and behavior. These factors are effort expectancy, performance expectancy, social influence, and facilitating conditions; connecting these to the moderating constructs of age, gender, voluntariness of use, and experience (Venkatesh et al., 2003).

These studies, with its respective factors, can all be linked to the subject of this report. However, as mobile electronic identification is a kind of information technology, UTAUT and TAM, the models dealing specifically with technology acceptance, can be seen as possessing the most relevant characteristics to this report. Although both these models continue to be extended and improved in new research which further adds legitimacy to the usage of these models, TAM is the most influential and applied between the two (Kim et al., 2010). It also, in contrast to UTAUT, include attitude as a major determinant of user acceptance, which has proven to have a significant effect on mobile application acceptance before (Schiertz et al., 2010; Huang, Lin & Chuang, 2007; Park & Kim, 2013). Hence, it is used as the core model of this research. There are several benefits of using TAM when identifying determining factors of acceptance of technology. First, it possesses consistent tools of measurement, empirical soundness, and conciseness (Schiertz et al., 2010; Kim & Garrison, 2008). Second, it explains a great part of the variance in usage intentions (Schiertz et al., 2010). Third, since it has been applied in many researches before, it offers a wide range of questions related to each factor; adding reliability to the relevance of the questions asked in the questionnaire. Even though it is a very useful model when explaining the behavioral intention of a technology, the author himself states that extended variables related to the specific technology are needed to be addressed in order to better understand the acceptance of it (see figure 2.1) (Davis, 1989).

![Figure 2.1 Technology Acceptance Model (Davis et al., 1989)](image)

2.3 User Acceptance Studies of Various Mobile Applications

Although the original TAM was not developed with the intention of explaining the acceptance for mobile applications specifically; by it being a rather new phenomenon that was not present at the time of the TAM development in the 80s, it still has served as a great foundation for researchers to further expand on to more accurately explain which factors that influence the acceptance of using mobile applications (Marangunić & Granić, 2014). Even if the previous
research related to user acceptance of mobile applications which involves verification, authentication, and handling of important transactions are scarce, some contributions to the subject in question have been done.

In 2003, Legris et al. made an empirical analysis using only the core TAM and concluded that the results are not entirely clear and dependable which led to the proposal that new factors and extensions are required and integrated to the model with emphasis on social and human perspectives. This aligns with what was initially proposed by Venkatesh and Davis (2000). Despite the criticism, King and He (2006), through a meta-analysis, demonstrated that TAM was still a reliable and robust statistical model. Additionally, by conducting the research in various fields, they further strengthened the legitimacy of TAM’s broader applicability. Schierz et al. (2010) published a research about mobile payment services. In this paper, the authors incorporated the idea of also utilizing the original TAM as the core and added additional extensions such as perceived security and perceived compatibility related to social context. They concluded that factors pertaining to the individual user characteristics were vital to better fit the model into a mobile context. Same year Watzdorf, Ippisch, Skorna, and Thiesse (2010) carried out a study on the general acceptance of mobile applications adding the factor of perceived trust; stating that it is different from perceived security. However, the new factor was found to have little to no significant influence on the acceptance of mobile applications in general. On the contrary, in the more specific field of citizens’ attitude towards electronic identification in Sweden, Axelsson and Melin (2012) concluded that usability is more influential compared to security when using electronic identification as a mean of validating one's identity. As Axelsson and Melin’s study was based on limited data; a qualitative research on only one focus group, the author suggests that further studies relating to national development and implementation processes focusing on the adoption and acceptance of electronic identification is needed (Axelsson & Melin, 2012). As performing electronic identification in Sweden is mostly done via mobile eID apps, this research aims to study the influencing factors that are linked to the acceptance of such applications.

2.4 Hypotheses

The hypotheses are mainly structured around the core TAM model (Davis, Bagozzi & Warshaw, 1989) but also incorporates additional external factors frequently applied in previous research thus further expanding on the exploration within the field of mobile eID acceptance. The factors combine 13 hypotheses which are discussed in relation to each other as can be seen in the conceptual model below (see figure 2.2). When constructing the conceptual model, several criteria were applied to limit the choice of factors. First, the factors had to be tested in research related to mobile services before. Second, the factors must have had demonstrated a positive direct or indirect correlation to the intention to use the specific technology. Lastly, the articles used had to be peer-reviewed technology acceptance articles cited several times.
2.4.1 Intention to Use and Attitude Towards Mobile Electronic Identification Applications

*Intention to use* can be related to the purpose or aim to practice and use a specific technology. According to Schiertz et al. (2010), to fully recognize the acceptance of applying a technology into one’s life, the intention to use is applied as a suitable proxy of identification. Intention to use can, according to the initial founder of the core TAM model (Davis et al., 1989), jointly be determined by the key factor of attitude towards using a technology; the degree of personal value (positive or negative) that is experienced through using a technology. Despite Venkatesh et al.’s (2003) statement on that when factors related to performance and effort are included in the model, attitude is to be excluded, it can still be observed in mobile service acceptance research that a positive relationship between the two factors indeed exists (Schiertz et al., 2010; Huang et al., 2007; Lee, Park, Chung & Blakeney, 2012; Park & Kim, 2013). Due to this, the following hypothesis is adopted.

Hypothesis 1: *The attitude towards using a mobile electronic identification application has a positive effect on the intention to use a mobile electronic identification application.*

2.4.2 Perceived Ease of Use

Like intention to use, perceived ease of use is another factor that was proposed in the original TAM that has proven to have a great impact on both the usefulness and intention to use a new
mobile service application directly or indirectly (Huang et al., 2007; Kim et al., 2010; Schiertz et al., 2010; Lee et al., 2012; Kim & Garrison, 2008; Venkatesh & Davis 2000). The factor is defined as “... the degree to which a person believes that using a particular system would be free of effort” (Davis, 1986, p.320). It is reasoned that the less effort that is required to utilize a system, the more it should increase the positive impact on the performance, i.e. affect the usefulness. Additionally, throughout the last decades, numerous researchers have also revealed similar evidence that indicates the substantial effect of perceived ease of use on intention (Davis et al. 1989; Venkatesh & Davis 2000; Agarwal & Prasad, 1999; Al-Somali, Gholami & Clegg, 2009; Kim et al., 2010). Thus, that both perceived usefulness and intention to use is positively influenced by perceived ease of use is proposed herein.

Hypothesis 2: Perceived ease of use of a mobile electronic identification application has a positive effect on the perceived usefulness of a mobile electronic identification application.

Hypothesis 3: Perceived ease of use of a mobile electronic identification application has a positive effect on the intention to use a mobile electronic identification application.

2.4.3 Perceived Usefulness

Perceived usefulness, a factor also included in the core TAM, is well studied within the field of technology acceptance and is said to be a major determinant for the attitude towards accepting a new mobile service (Schierz et al., 2010). According to Davis (1989), perceived usefulness is referred to as the extent to which people believe if the new technology will enhance their performance at a given task. Being a core factor of the original TAM, studying the correlation between both perceived usefulness and attitude, as well as perceived usefulness and intention to use, perceived usefulness possesses major implication value to researchers that have studied the acceptance of mobile service applications throughout the last decade, all which has seen a positive relationship between the factors (Huang et al., 2007; Park & Kim, 2013). Following these studies and implementing it to the focus of mobile eID apps, this research hypothesize that perceived usefulness has a positive effect on both the intention to use as well as the attitude towards using mobile eID apps.

Hypothesis 4: Perceived usefulness of a mobile electronic identification application has a positive effect on the attitude towards using a mobile electronic identification application.

Hypothesis 5: Perceived usefulness of a mobile electronic identification application has a positive effect on the intention to use a mobile electronic identification application.

2.4.4 Perceived Security

When making decisions regarding adopting a new technology, user do not only evaluate its potential benefits, but they do also put a considerable amount of thoughts to the risks that usually comes with the new innovation (Lim, 2003; Mitchell, 1999). Perceived security conceptualizes the danger of personal information and identification being compromised and
has been a critical concern for consumers due to the inherent severeness followed by this event (Yang & Padmanabhan, 2010). As mobile technology advances, the security encompassed with the new products have correspondingly advanced (Chin, Felt, Sekar & Wagner, 2012). Despite that, due to that using mobile eID apps may be a new experience to most consumers as well as it being a service which is already inherently more difficult to assess, consumers may consequently perceive the applications with higher risks (Gefen et al., 2003). Taking that into consideration, and in combination with the risk of privacy invasion, the authors of this study theorize that high perceived security will have a positive impact on both the attitude and intention to use a mobile eID app; relationships which has been proved by researchers studying mobile service applications and mobile online banking acceptance before (Park & Kim, 2013; Schiertz et al., 2010; Pikkarainen, Pikkarainen, Karjaluoto & Pahnila, 2004)

Hypothesis 6: Perceived security of a mobile electronic identification application has a positive effect on the attitude towards using a mobile electronic identification application.

Hypothesis 7: Perceived security of a mobile electronic identification application has a positive effect on the intention to use a mobile electronic identification application.

2.4.5 Subjective Norm

As the decision process of the human being is generally unconsciously affected by what other people think and do (Webster and Trevino, 1995), the choice of whether or not to accept the employment of a new technology can therefore be said to relate to the social context of the decision maker. This argument is further strengthened by Venkatesh and Morris (2000) who puts emphasis on the behavior of adopters of new technologies and relating this to social influence. Another approach to subjective norm was taken by Fishbein and Ajzen’s study on acceptance of new technology which examined and concluded that people, to some extent, use new technology only to comply with others’ instead of relying on their own beliefs and feelings (Davis et al., 1989) By incorporating the social factor of subjective norm, defined as whether or not one should perform a specific behavior due to the influence of the ones who are most important to him or her (Schiertz et al., 2010), this study intertwine internal factors with external ones. By doing this, it expands the context to which this study adheres by proposing four hypotheses related to the factor of subjective norm; all which has been proved in studies within subjects related to the acceptance of mobile service applications. These are: subjective norm has a positive effect on perceived ease of use (Bhatti, 2007), subjective norm has a positive effect on perceived usefulness (Bhatti, 2007; Lee et al., 2012), subjective norm has a positive effect on attitude (Schiertz et al., 2010), and subjective norm has a positive effect on the intention to use (Bhatti, 2007; Lee et al., 2012).

Hypothesis 8: Subjective norm has a positive effect on the perceived ease of use of a mobile electronic identification application.

Hypothesis 9: Subjective norm has a positive effect on the perceived usefulness of a mobile electronic identification application.
Hypothesis 10: Subjective norm has a positive effect on the attitude towards using a mobile electronic identification application.

Hypothesis 11: Subjective norm has a positive effect on the intention to use a mobile electronic identification application.

2.4.6 Perceived Convenience

Perceived convenience is a multidimensional concept which has been approached by many authors throughout the last couple of decades (Berry, Seiders & Grewal, 2002). Even though many researchers has expanded and further tried to conceptualize convenience, including Brown (1989) which identified five dimensions (time, place, acquisition, use, and execution) that a product or service possess and which all can be scaled in some fashion, and Yale and Venkatesh (1985) which recognized six aspects of convenience: time utilization, accessibility, portability, appropriateness, handiness, and avoidance of unpleasantness; it is apparent that time and place are two recurring subfactors that frequently has been discussed in relation to convenience. Hence, to add clarity, and also to distinguish convenience from perceived ease of use, time and place will be the main focus when determining perceived convenience in this study. Mobile electronic identification, a mean of identification which can be dependent of time of usage as well as being highly mobile in the sense of accessibility (online and through mobile devices), clearly relates to the characteristics of convenience. It is therefore hypothesized to have a positive relationship to the perceived ease of use and perceived usefulness of a mobile eID app, relationships confirmed to be true by another researcher studying the acceptance of mobile payment services (Kim et al., 2010).

Hypothesis 12: Perceived convenience of a mobile electronic identification application has a positive effect on the perceived ease of use of a mobile electronic identification application.

Hypothesis 13: Perceived convenience of a mobile electronic identification application has a positive effect on the perceived usefulness of a mobile electronic identification application.
3. Methodology

This chapter provides discussion on the research methodology applied in the research. First, it addresses the research method, philosophy, and approach. Second, the way of collecting the data, analyzing the data, as well as making sure that the data is credible is elaborated upon. Lastly, a detailed description of the model fit indices used in the research is presented.

3.3 Research Method

For this research, a quantitative research approach was chosen to further gain knowledge about user acceptance of mobile electronic identification applications. According to Bryman and Bell (2011), different from qualitative research who focus on exploring and understanding through underlying factors (such as reasons, opinions, and motivations), quantitative research incorporates the use and analysis of quantitative data; which is data that can be quantified into numbers to find a pattern of association. Because quantitative research requires data that are quantifiable, quantitative research is frequently used as a synonym for any data collection technique associated with questionnaires, statistics et cetera (Saunders, Lewis & Thornhill, 2009). In taking a quantitative approach, the research was mainly carried out using an already established theory or model and through mathematical methods translating quantifiable observations into useful and credible data to test hypotheses that served as the basis for generalization, explanation, and interpretation for a potential casual-relationship (Bryman & Bell, 2011).

Qualitative research is most suitable to generate theories or hypotheses while quantitative research is used to assess them through quantifiable measurements. In this research, the theory behind TAM and additional latent variables extracted from previous studies within the field of technology acceptance were assessed through hypotheses testing using statistical analysis in the context of mobile eID apps. This means that a quantitative method was most appropriate for this study. This method includes many strengths, but the main advantage of this method is the generation of an objective answer that may represent the whole population as long as all the criteria (such as sample size) are satisfied. As the sample size needs to be of significant magnitude to represent the whole population, it tends to have low or no subjective variables; adding to its credibility which is difficult for qualitative research methods to achieve due to its possible inherent bias of the researcher (Collis & Hussey, 2014).

To conduct this research, a quantitative questionnaire based on the Likert-scale with a seven-point system was employed. This type of scale was most suitable because it generates a dataset with equal interval-level (i.e. respondents naturally assume the difference between “strongly agree” and “agree” is the same as the difference between “agree” and “partially agree”) which allows for sophisticated and powerful interval-level statistical analysis such as the structural equation modeling used in this research. A seven-point system was employed because it is suggested that reliability is optimized with seven response categories (Colman, Norris & Preston, 1997). To gain credible data, the questions and phrasing were all constructed and extracted from previous research that has confirmed their connection to each latent variable.
Despite that a quantitative questionnaire possess some potential bias related to demographic characteristics of the respondents, it was still the choice of method for collecting primary data due to the need for quantitative data when performing structural equation modeling. To add, as the aim of conducting primary data collection in this research was to gather a large number of respondents as well as to make generalizations out of the result, a quantitative questionnaire served as a suitable method due to its standardized nature. Interviews, in theory, could also have provided a dataset with similar features, however, due to time constraint and limited resources it would likely have been too challenging to acquire the desired response rate. Quantitative observation and experiment were not employed. This is due to that the dataset could not simply be gathered through observation and because it did not require the manipulation of independent variables (Anderson, Sweeney, Williams, Freeman & Shoesmith).

3.1 Research Philosophy

According to Crossan (2003), the philosophical aspect is an important component of a research as it encourages critical and in-depth thinking and helps the authors to generate further questions in relation to how the topic researched should be approached. The author further elaborates on this by stating that there are three main reasons why it is significant to explore philosophy in reference to research methodology. First, it might clarify the overall strategy to be used in the research. Second, it may assist the researcher when assessing among different methodologies and methods to be used in an early stage; avoiding unnecessary work that comes from redoing parts of the research due to the insufficient evaluation of methodologies. Third, it can add creativity and innovation in accordance with adopting or selecting a particular method which previously was outside the researchers’ experience. The concept of research philosophy can be related to each individuals’ assumptions, perceptions, beliefs, and nature of reality; affecting and influencing the researchers’ design of research (Saunders et al., 2009). Hence, by studying and understanding these factors of influence, one can better expose and minimize a biased view on the research. From a practical approach, the aspect of research philosophy aims to compare and reflect on different philosophical positions and to choose one and argue why the specific position was the best suited for the research (Saunders et al., 2009).

The three philosophical positions, or views, which determine the underlying approach of the research are positivism; discovering the objective of reality by focusing on empirical generalization, interpretivism; explaining a subjective reality which differs from person to person, and relativism which is a combination of positivism and interpretivism (Scotland, 2012).

In this research, a positivist position has been taken. The positivist philosophy seeks to conceptualize the truth through applying credible statements that align with facts of reality. The truth itself is not based on the individual beliefs alone, but more on the external reality from which, through examination and quantitative method application, can be verified as reliable (Crossan, 2013). In contrast, while positivism emphasizes on measuring a social phenomenon, interpretivism instead focuses on gaining an interpretative understanding of the social phenomenon. This can infer that positivism seeks to approach the phenomenon asking
“what?” or “how many?”, whereas interpretivism addresses it asking “why?” or “how?”. Due to the quantitative nature of the study; analyzing the problem through quantifiable data, and the focus on generalizing the results in the form of a “universal” model which can be applied in several contexts, the philosophical position taken fits perfectly with the methodology of this research. In this research, the observations, which are all related to hypotheses developed from existing theory, gathered through a questionnaire, have been tested and verified by applying statistical analysis tools. Through this, a model was generated and applied to the population of Sweden describing the factors that affect acceptance of mobile eID apps in the country. To develop the model, and to eliminate the possible influence of subjective attitude, a necessary sample size formula was applied to make sure that the population was sufficient in size.

3.2 Research Approach

There are three main research approaches that one can take to carry out a research. These are deduction, induction, and abduction. In short, deduction research focuses on testing a theory, induction research refers to building a theory, and abduction research is a combination of deduction and induction research (Saunders et al., 2009). As the research approach directly influence the focus of the study, great consideration in which reasoning that is the most suitable for the specific research is of paramount significance.

In this research, the deductive reasoning was applied (see figure 2.1). This reasoning is concerned with developing hypotheses based on existing theories and test it through the application of an assessment tool in order to prove the hypotheses (Saunders et al., 2009). It develops a conceptual and theoretical structure and then test it by empirical observations; moving from the general to the specific. This is in contrast to inductive research where general inferences are generated from a specific case (Collis & Hussey, 2014). In this research, a well-researched model, which has been tested and approved to be reliable an extensive number of times, was used and extended upon by incorporating other proved relationships of relevant factors, and then applied to the particular sample group. The hypotheses, which are also developed from previously tested relationships, were tested through a questionnaire and then determined if they were accepted or rejected using SPSS and SPSS AMOS.
3.4 Data Collection

Data can be categorized into two types, primary and secondary data. Primary data are data generated originally for a specific goal, gathered through experiments, questionnaires, interviews or focus groups (Collis & Hussey, 2014). Secondary data are data collected originally for another study i.e. primary data for a past study and may be found in published books, journals, database, or internal records (Collis & Hussey, 2014. Primarily, primary data, gathered through a questionnaire, was used in this research. However, secondary data related to previously hypothesized relationships between latent variables were also used.

3.4.1 Primary Data Collection

Due to non-existing secondary data on the specific combination of mobile eID apps and the various influencing factors, a questionnaire that generated the necessary data was conducted. The target population of the study consists of people in Sweden who have utilized or are utilizing any kind of mobile eID app. Because of that the early perception of a new technology is mainly based on expectations and are very likely to change post-adoption (Venkatesh & Goyal, 2010), the primary data was collected with the requirement that the sample participants must have had used any forms of mobile eID apps. Due to limitations related to time, resources and accessibility, the non-probability sampling (also referred to as non-random sampling) method of “convenience sampling” which focuses on gathering data from the part of the population that is easily accessible to the researchers (Collis & Hussey, 2014), was used. Contrasting to convenience sampling, in the snowballing sampling method (also referred to as networking sampling method), participants recruits other participants and in the judgmental sampling method (also referred to as purposive sampling method), all participants are selected.
based on certain characteristics prior to the commencement of the questionnaire (Collis & Hussey). As these two methods of sampling require either the reliance on third parties’ involvement in the distribution process and may limit the possibility of a sufficient response rate, it could have led to less control of time and reliability management. Instead, the questionnaire was distributed to easily accessible respondents that all were not chosen prior to the distribution of the questionnaire.

3.4.1.1 Saturation

For empirical findings to be considered trustworthy a necessary sample size may be required to achieve saturation. Saturation refers to the point in the process of data collection and analysis when additional data produces no additional benefit or change (Tran, Porcher, Falissard & Ravaud, 2016). For this study, the following formula has been used to estimate the number of respondents required:

$$\text{Sample size for finite population} = \frac{(Z_{\alpha/2})^2 \times \text{Population Proportion} \times (1 - \text{Population Proportion})}{\text{Margin of Error}^2} + \frac{(Z_{\alpha/2})^2 \times \text{Population Proportion} \times (1 - \text{Population Proportion})}{\text{Margin of Error}^2 \times \text{Population}}$$

Figure 3.2 Saturation Estimate Formula

Following the standards of research studies, to be able to reach a strong conclusion, the sample size was estimated with the following assumptions: confidence level at 95%, population proportion (p) at 0.5 (producing the largest sample size as p is unknown) (Anderson et al., 2010), margin of error (e) at 0.05, and population (N) at 7,530,000 (mobile eID app users in Sweden) (BankID, 2018). This produces an estimate sample size for finite population equal to 384 for this study (see figure 3.3). As the purpose of this calculation is only to provide an approximate number to reach saturation, the estimation may not reflect the reality but only give a hint on the necessary sample size.

$$\text{Sample size for finite population} = \frac{(Z_{\alpha/2})^2 \times p \times (1 - p)}{e^2} \approx 384$$

Figure 3.3 Saturation Estimate Calculation

3.4.1.2 Questionnaire

A questionnaire was designed to be able to identify the factors influencing the users’ acceptance of mobile eID apps. A questionnaire can be described as a list containing a set of questions which have been carefully selected, developed for a group of people, with the aim to address a research through finding out what a group of people think, do, or feel (Collis & Hussey, 2014). When used in interviews, it is often called an interview schedule while in quantitative research it is often referred to as a research instrument; indicating that it has been used and tested in several studies before (Collis & Hussey, 2014). To ensure the reliability of aggregation and comparison of the sample, a structured questionnaire which involved already specified close-ended questions was distributed. There are several ways of distributing the questionnaire. These are by post, by telephone, online, face-to-face, group distribution, and individual
distribution (Collis & Hussey, 2014). The questionnaire in this research was distributed through both the online and the face-to-face method.

In the online method, web-tools such as SurveyMonkey, Freeonlinesurveys and Google Form are used to create a survey and distribute it to the potential respondents via social media or email (Collis & Hussey, 2014). After gathering all the answers, the data file can be exported to programs such as Microsoft Excel, SPSS Statistics software or other statistical software tools (Collis & Hussey, 2014). In this research, Google Forms was used to create the survey and Facebook was used to distribute it. Both platforms were implemented due them possessing the qualities of low cost and convenience. In terms of low cost, both Google Forms and Facebook are free of charge with regards to the features used in this research, and in terms of convenience, both platforms possess qualities such as easy-to-use, easily accessible, and widespread usage; hence increasing the chance of reaching a greater sample size and doing it in a fast and efficient manner. By utilizing these platforms, the authors of this study were able to select the respondents according to the demographic and geographic requirements leading to accurate screening.

In the Face-to-face method, the questionnaire can be distributed to the respondents in any convenient place (e.g. on the street, in someone’s home, and in the workplace) (Collis & Hussey, 2014). Although time-consuming, this method is useful because the response rate can be high, and the data collected is highly comprehensive (Collis & Hussey, 2014). Face-to-face was used in addition to online distribution in this research in order to further increase the chance of reaching the optimum sample size, more accurate screening, and to be able to give people that are not currently using social media the chance to participate in the questionnaire.

The questionnaire was divided into two parts. The first part was related to questions regarding the participant’s personal information and characteristics (i.e. age, nationality, and gender), while the second part consisted of seven-point Likert-scale questions that were linked to the factors of acceptance of mobile eID apps (See table 3.1). The questions were provided by previous researchers (see table 3.1) that have used the TAM as their core theoretical framework and extended it with additional factors. In the questions, the factors are not mentioned specifically, but they are rather inferred from the wording and phrasing used in the questions. To attain the necessary dataset and assure that the respondents fully understood the meaning of each question, the questions were provided both in English and Swedish. In consideration of the quality of the translation, the back-translation technique was applied. Back-translation is a quality assessment method that refers to the process translating back the questionnaire to its original language (Behr, 2016). This process is done to find possible discrepancies between the original and the translated version that may arise in the process of the translation. The back-translation process was performed by bilingual individuals without previous knowledge of the original version and the questionnaire was refined until the two versions were identical before and after back-translating. Before distributing the questionnaire to the sample group, pilot testing was done by asking families and close acquaintances to play the role of respondents. Even if their knowledge about the specific subject might have been limited, they were still
helpful in the sense of spotting problems and issues related to the questionnaire and its structure (Collis & Hussey 2014).

**Table 3.1 Questions Related to the Hypotheses**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Statement</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention to use eID</td>
<td>I am currently using the mobile eID app to verify my identity</td>
<td>Kim et al.2010</td>
</tr>
<tr>
<td></td>
<td>Assuming that I have access to the mobile eID app I intend to use it</td>
<td></td>
</tr>
<tr>
<td>Attitude</td>
<td>Using the mobile eID app is a good idea</td>
<td>Park et al. 2011;</td>
</tr>
<tr>
<td></td>
<td>Using the mobile eID app is interesting</td>
<td>Schierz et al. 2010;</td>
</tr>
<tr>
<td></td>
<td>Using the mobile eID app is wise</td>
<td>Nasri &amp; Charfeddine, 2012</td>
</tr>
<tr>
<td></td>
<td>Using the mobile eID app is beneficial</td>
<td></td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>The mobile eID app is a useful method for verifying my identity</td>
<td>Schierz et al. 2010;</td>
</tr>
<tr>
<td></td>
<td>Using the mobile eID app makes verifying my identity easier</td>
<td></td>
</tr>
<tr>
<td>Perceived Ease of Use</td>
<td>The interaction with the mobile eID app is clear and understandable</td>
<td>Schierz et al. 2010;</td>
</tr>
<tr>
<td></td>
<td>It is easy to perform the steps required to use the mobile eID app</td>
<td>Al-Somali et al.2009; Kim et al.2010</td>
</tr>
<tr>
<td></td>
<td>Learning to use the mobile eID app will be or has been easy</td>
<td></td>
</tr>
<tr>
<td>Perceived Security</td>
<td>The risk of an unauthorized third party overseeing the identification process is low</td>
<td>Schierz et al. 2010;</td>
</tr>
<tr>
<td></td>
<td>I would find the mobile eID app to be secure when verifying my identity</td>
<td>Park and Kim. 2014</td>
</tr>
<tr>
<td></td>
<td>I believe my information or data will not be manipulated by inappropriate parties when using the mobile eID app</td>
<td></td>
</tr>
<tr>
<td>Subjective Norm</td>
<td>People close to me would recommend using the mobile eID app</td>
<td>Schierz et al. 2010;</td>
</tr>
<tr>
<td></td>
<td>People close to me would find using the mobile eID app beneficial</td>
<td></td>
</tr>
<tr>
<td></td>
<td>People close to me would find using the mobile eID app a good idea</td>
<td></td>
</tr>
<tr>
<td>Convenience</td>
<td>The mobile eID app is convenient because I can use it at anytime</td>
<td>Kim et al. 2010</td>
</tr>
<tr>
<td></td>
<td>The mobile eID app is convenient because I can use it in any situation</td>
<td></td>
</tr>
</tbody>
</table>

**3.4.2 Secondary Data Collection**

Secondary data are data collected from already existing libraries such as databases, internal records, and publications (Collis & Hussey, 2014). The secondary data in this research was collected in order to perform a literature review on the subject of mobile eID apps and technology acceptance. The search engines used were Jönköping University Library’s Primo, and Google Scholar to find relevant articles, journals, and books. The keywords and search terms inserted in the search engines were: Electronic identification, Mobile electronic identification, Mobile electronic identification application, Mobile eID, Mobile Electronic ID, Technology acceptance, Technology acceptance model, TAM, and User acceptance (see table 3.2).

As mentioned previously, no articles related to mobile eID apps were found. Many articles about electronic identification were related to other implications and hence, not of great relevance to this study; focusing on either object implication such as electronic chip installed in infrastructural systems, or agricultural implication such as electronic identification tags inserted in cows, sheep, and goats. This indicates that there is a lack of research done in not only the specific field of this study but also in its surrounding areas. The data collected assisted in developing the hypotheses for this research by extracting the results from previously proved existing relationships between factors within the field of technology acceptance.
### Table 3.2 Secondary Data Table

<table>
<thead>
<tr>
<th>Theoretical Term</th>
<th>Key Words</th>
<th>Data</th>
<th>Selected Articles and Books</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAM</td>
<td>“Technology acceptance”, “Technology acceptance model”, “TAM”, “User acceptance”</td>
<td>Google Scholar (53000), Primo (7212)</td>
<td>21 articles</td>
</tr>
<tr>
<td>Electronic identification</td>
<td>“Electronic Identification”</td>
<td>Google Scholar (33500), Primo (7668)</td>
<td>2 articles</td>
</tr>
<tr>
<td>Mobile electronic identification</td>
<td>“Mobile electronic identification”, “Mobile eID”</td>
<td>Google Scholar (125), Primo (21)</td>
<td>1 article</td>
</tr>
<tr>
<td>Mobile eID app</td>
<td>“Mobile Electronic Identification Application” “Mobile eID app”</td>
<td>Google Scholar (0), Primo (0)</td>
<td>0 articles</td>
</tr>
</tbody>
</table>

### 3.5 Data Analysis

#### 3.5.1 Quantitative Data Analysis

Descriptive statistics and inferential statistics are two methods that can be used in order to analyze quantitative data. Descriptive statistics is used to describe, summarize, or display data while inferential statistics refers to drawing conclusions about a population with regards to the quantitative data gathered from a random sample (Collis & Hussey, 2014). In this research, both methods were used. Initially, descriptive statistics display data through the use of graphs and tables. Later on, the research used inferential statistics to draw conclusions about the data through the use of the statistical data software SPSS and SPSS AMOS; employing a multivariate analysis to test the hypotheses.

#### 3.5.2 Reliability and Validity

Reliability refers to the consistency of the measurements and results, i.e. the absence of difference if the same test was conducted again (Collis & Hussey, 2014). Reliability is important as it describes the consistency of the result over time and test that questions and factors accurately represent the total population (Heale & Twycross, 2018). The reliability was...
presented through the widely used Cronbach’s alpha which is a statistical test that measures internal consistency; the measure of how accurately the items on a test measure the same factor (Bonett & Wright, 2014). By looking at figure 3.4 below, the basic formula for calculating Cronbach’s alpha involves a number of items, or questions, \(n\) the variance of scores on each question \(V_i\), and the total variance of overall scores on the whole test \(V_t\). 

\[
\alpha = \frac{n}{n-1} \left(1 - \sum \frac{V_i}{V_t}\right)
\]

**Figure 3.4 Cronbach's Alpha Formula**

In this report, the Cronbach’s alpha (also called coefficient alpha) was calculated through SPSS and the result was compared to the measurement standard that serves as the base for evaluating the items which in this case is the questions related to each factor. Collis and Hussey (2014) state that a Cronbach's alpha value of \(1 > \alpha \geq 0.7\) will produce a reliable internal consistency of the model and its factors. Within this scale, a Cronbach’s alpha value of \(1 > \alpha \geq 0.8\) will produce very reliable results, indicating a good fit between the results and the actual reality, while a scenario of calculations resulting in \(0.7 > \alpha \geq 0.6\) would only be deemed reliable. Any value below 0.6 would be unacceptable, leading to that the items cannot accurately measure the model and its factors.

Validity refers to the degree of how accurately a concept is measured in a quantitative study (Collis & Hussey, 2014). To guarantee the validity of this research, rational validity was a major concern when constructing the measurements. Rational validity refers to the degree a measure represents every element of a construct (Saunders et al., 2009). So, in order to ensure the validity of the questionnaire, the selected items were all extracted from previous studies that have all been proven to be good measurements that represent every element of a construct.

### 3.5.3 Structural Equation Modeling

Structural equation modeling is a multivariate statistical analysis technique used for analyzing structural relationship (Byrne, 2016). Structural equation modeling is a powerful statistical technique that through combining multiple regression analysis and confirmatory factor analysis creates a comprehensive modeling framework. Multiple linear regression is a statistical method that is used to predict the endogenous variable through two or more exogenous variables (Byrne, 2016). Multiple linear regression attempts to fit in a linear equation to the observed data by using this general formula:

\[
Y = \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_p x_{ip} + e \quad \text{where} \quad X_1 = x_1, X_2 = x_2, \ldots, X_p = x_p
\]

Confirmatory factor analysis is the statistical technique used to accept or reject a measurement theory by measuring the representation of each variable on the number of constructs in a structural model (Pittenger, 2007). Merging the characteristics of both analysis techniques, structural equation modeling enables researchers to estimate, in a single analysis, the multiple and interrelated relationship between measured variables and latent constructs in a complex
path model. Structural equation modeling was conducted in this research in order to test the relationship between the exogenous variables and the endogenous variables. The analysis was carried out applying the structural equation modeling software SPSS AMOS. A path diagram was created with the latent variables (the theorized factors), observed variables (the question from the questionnaire), and the factor loadings that represent each hypothesis (see table 3.1). Due to some insignificant direct effects of factor loading, indicating no linear relationship from one factor to another, a refined model was constructed.

3.5.4 Multicollinearity

According to Clapham & Nicholson (2014) multicollinearity refers to the strong correlation between two explanatory variables. It is important to notice that the difference between explanatory variables and independent variables lie in the certainty of independence. While an explanatory variable is a type of independent variables it refers to this when the independence is not certain. This differs from other independent variables whereas it is for certain that it is not affected by other variables (Anderson et al., 2010). If multicollinearity exists, it will have a tremendous negative effect on the reliability of the estimates. This type of data problem arises fundamentally when there exists a high correlation between explanatory variables, however, this does not mean that lower correlation is equal to the absence of multicollinearity. Multicollinearity may also be present among explanatory variables without high correlation as it is not a phenomenon that only exists or does not exist, but it is present in varying degrees (Alin, 2010). Therefore, it is important to employ a defined measuring standard that may help researchers to identify if multicollinearity is significantly present. The definition of what level of correlation that is equal to orthogonality (no linear relationship between two variables) is quite ambiguous as there seems to be no definite answer. However, an arbitrary general rule of thumb of correlation > 0.8 seems to be the consensus among researchers (Farrar & Glauber, 1967). Through using the SPSS AMOS built-in analysis tool, a bivariate correlation analysis was conducted to assess if the data suffered from multicollinearity. This is usually presented in a matrix with each combination of independent variables in the research representing one column each. If any value exceeds the threshold of 0.8 it is considered to be suffering from multicollinearity, which indicates that reconstruction of the model and adjustment such as combining the factors are necessary in order to move forward with the research (Alin, 2010).

3.6 Model fit

Model fit is a measurement that describes how well a model represents the observations. It assesses the discrepancy between the observed values and the expected results produced by the model (Bollen & Long, 1992). This is one of the most crucial stages in structural equation modeling, but it is also one of the most complicated ones. Different from other statistical measurements and models, model fit in structural equation modeling do not rely only on one type of measurement technique, but it requires a combination of multiple indices that all possess its own bias (Hooper, Coughlan & Mullen, 2008). Due to the lack of consensus of one single index to describe model fit, it has been questioned whether it is even suitable to report model fit in SEM analysis at all, as “cherry picking” may enable researchers to use favorable
fit indices claiming that a bad fitting model is a good fitting one (Barrett, 2007). Nevertheless, researchers still recognize the importance of model fit and have therefore proposed that researchers within structural equation modeling should employ multiple indices that would produce complementary information. As different indices may produce different results for the same model, it is important to understand whether the index considers sample size, parsimony, and whether it measures absolute fit or incremental fit (Gerbing & Anderson, 1992). To measure how well the model represents the observations in this study, two types of indices that fits the features of the model has been employed. These are absolute fit indices and incremental fit indices.

3.6 Absolute Fit Indices

Absolute fit indices refer to the indices with the best fitting model having a value of zero (Barrett, 2008). This type of indices essentially measures how far away the model is from a perfect fit. Therefore, the larger the value it produces the worse the fit is, signifying that these types of indices are usually badness-of-fit indices (Barrett, 2008). Features of absolute fit indices typically involve formulas based on sample size and the discrepancies in a dataset. Unlike other indices that generates a model for comparison, absolute fit indices only measure how well the hypothesized covariances from the constructed model match the observed covariances (Bollen, 1994; Rigdon & Hoyle, 1997). Measurements within the absolute fit indices category are normally; chi-square ($\chi^2$), Root Mean Square Error of Approximation (RMSEA), Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit (AGFI), Root Mean Square Residual (RMR), and Standardized Root Mean Square Residual (SRMR).

3.6.1.1 Chi-Square: $\chi^2$

The chi-square is one of the most reported absolute indices in structural equation modeling. This is because $\chi^2$ was the original fit index applied for structural models and that many other indices are based on the $\chi^2$ (Barrett, 2007). However, $\chi^2$ is gradually getting less popularity within the research community as the index itself has several problems that make it less desirable. The problems stem from several factors that may affect the result of the $\chi^2$. These are: (1) sample size – $\chi^2$ is heavily biased towards larger sample sizes. A large sample size produces larger $\chi^2$ even with relatively small discrepancies in a dataset. On the contrary, a smaller sample size makes it easier to accept models with poor fit leading to Type II error. (2) The complexity of the model also has a significant effect on $\chi^2$, meaning that the more variables (i.e. more parameters) a model possesses the more likely the model will produce a higher $\chi^2$. (3) Highly skewed and kurtotic variables may also affect and produce a higher $\chi^2$ (Hu & Bentler, 1999; Goodboy & Kline, 2016). As the main concern of the constructed conceptual model will be of problem 1, sample size, the relative chi-square ($\chi^2$/df) (see table 3.3) has been used for evaluating the fit of the model. $\chi^2$/df is a well-used ratio for evaluating model fit because through dividing the $\chi^2$ with the degrees of freedom (df) one can weaken the sample size bias. Despite the lack of a universally agreed upon standard regarding the value of an acceptable ratio, it can be observed that several researchers have recommended the range between 2.0 to 5.0 as a general rule of thumb for acceptance (Barrett, 2007; Byrne, 1989; Marsh & Hocevar, 1985).
3.6.1.2 Root Mean Square Error of Approximation

RMSEA is an absolute fit measurement based on the non-centrality parameter and is one of the most, if not the most, reported measurement for model fit in structural equation modeling. The index has recently gained an increasingly comparable popularity to chi-square (Jackson, Gillaspy & Purc-Stephenson, 2009; Taylor, 2008). Different from other indices, RMSEA can be used both in descriptive statistics and inferential statistics. An aspect worth noticing is that RMSEA is sensitive to estimated parameters leading to that it favors parsimony models. Like most of the other indices, RMSEA does not have a universally agreed upon measurement standard. Throughout the history of RMSEA usage, many cut-off points have been recommended. In the early nineties, an RMSEA value of 0.05 to 0.1 was considered an indication of adequate fit (MacCallum, Browne & Sugawara, 1996). Since then, many other recommendations have surfaced but what can be observed is that the cut-off point has gradually reduced. According to Kenny, Kaniskan & McCoach (2014), RMSEA < 0.08 is considered good fit, 0.08 < RMSEA < 0.1 indicates adequate fit, and 0.1 < RMSEA indicates poor fit. The formula from Steiger (1980) has been applied to compute the RMSEA in this research (see table 3.3).

3.6.1.3 Goodness-of-Fit Index and Adjusted Goodness-of-Fit

The Goodness-of-Fit technique was developed by Jöreskog and Sorbom as a substitute for chi-square. As it belongs to the category of absolute indices it does not compare the generated values to a baseline model, instead, it evaluates based on how well the variances and covariances replicate the observed covariance matrix (Tabachnick and Fidell, 2010). GFI generates a value between 0 to 1 and have a positive bias towards larger sample size. In addition, when degrees of freedom is small compared to sample size, GFI has a positive bias (Sharma, Mukherjee, Kumar & Dillon, 2005). Measurements standards of GFI seems to be traditionally set at the 0.9 level, where anything above it indicates a good fit (Tanaka & Huba, 1985; Sharma et al., 2005). To deal with the potential problems related to degrees of freedom with GFI, AGFI was developed. However, like its origin base, it still suffers from the influence of sample size and it also favors parsimonious models. As with GFI, AGFI also produces a value between 0 to 1 and have a measuring standard at 0.9 (Sharma et al., 2005; Tabachnick & Fidell, 2007). Because of both GFI and AGFI being very sensitive to sample size, they have been decreasingly trusted as fit indices, even to the point where researchers have recommended to disregard them. However, it is still reported frequently; likely due to its historical value rather than the actual benefit (Sharma, et al., 2005). The formulas from Tabachnick and Fidell (2010) was used to compute the GFI and AGFI in this research (see table 3.3).

3.6.1.4 Root Means Square Residual and Standardized Root Mean Square Residuals

The RMR calculates the square root of the difference between the residuals of the sample covariance matrix and the hypothesized covariance model (Jöreskog & Sörbom, 1990). Because the range of the value generated from RMR depends on the scale of indicators from the collected dataset when there are different scales within the dataset, RMR becomes very challenging to interpret (Kline, 2011). However, as the dataset of this research have only employed the Likert-scale from 1 to 7 in every observed item, it is not likely the RMR analysis
will suffer from this problem. Nevertheless, to solve this inherent problem of RMR there is the Standardized Root Mean Square Residual (SRMR) which is considered to be more popular due to this advantage. To add, SRMR is also advantageous in the sense that it does not have a negative bias for more complex models (Hu & Bentler, 1999). Because SRMR is an absolute measure of fit, naturally, a value of 0 means a perfect fit and it ranges up to 1. A value of 0.8 or less is generally considered to indicate good fit (Hu & Bentler, 1999; Maydeu-Olivares, Shi & Rosseel, 2017). The formulas from Jöreskog & Sörbom (1990) and Bentler (1995) was used to compute the RMR and SRMR in this research (see table 3.3).

3.6.2 Incremental Fit Indices

Incremental fit indices, also sometimes referred to comparative or relative fit indices, are indices that compare the chi-square value to an independent model (Hooper et al., 2008). Incremental fit indices are similar to coefficient of determination meaning that a value of 0 indicates worse fit while a value of 1 indicates the best possible fit for a model. Indices belonging to this category includes, but not limited to, Tucker-Lewis Index (TLI), Normed Fit Index (NFI), Incremental Fit index (IFI), and Comparative Fit Index (CFI). However, due to some flaws of NFI, it is often recommended to not be reported and has hence been disregarded in this research (Bentler & Bonett 1980; Bollen, 1989; Sharma et al., 2005).

3.6.2.1 Tucker-Lewis Index

TLI, sometimes also referred to as the non-normed fit index (NNFI), was developed by Tucker and Lewis in 1973 because they wanted to solve the problem of negative bias of NFI (Bentler & Bonett, 1980). TLI is presently, together with RMSEA, one of the most reported indices and they also share a common aspect where the formulas are both based on the relative chi-square ratio ($\chi^2$/df). While TLI is not sensitive to sample size, which is a strong advantage, it is still sensitive to model complexity and favors parsimonious models (Schermelleh-Engel, Mössbrugger & Müller, 2003). This means that as the number of variables increase, the hypothesized model will be less fitting according to TLI. This is due to that it is highly dependent on the average correlation between variables within the data. The measurement standard of TLI has varied throughout its usage history ranging from 0.85 and over 0.9 being a good fit, to as much as over 0.95 to be considered a well fit (Bentler & Bonett, 1980; Sharma et al., 2005). The formula from Tucker and Lewis (1973) was employed to compute the TLI in this research (see table 3.3).

3.6.2.2 Incremental Fit Index

IFI is essentially an adjusted version of NFI (Bollen, 1989). As mentioned earlier NFI have several flaws that have made it less popular among researchers and these problems stem from sample size and degrees of freedom, consequently, IFI attempts to cover up these flaws. By subtracting degrees of freedom from the hypothesized model in the denominator, IFI manages to ease the influence of the degrees of freedom and, to some extent, sample size on the results (Hoyle, 2015). IFI is theoretically a proportion metric; meaning that it has a value ranging from 0 to 1. However, under certain conditions, it may exceed 1 or fall below 0. Although IFI is an improvement of NFI in certain aspects it still suffers from positive bias when the sample size.
is small. According to March, Balla and Hau (1996) this could arguably be a larger problem than of NFI’s negative bias because positive bias may produce a result that overestimates the fit. The formula from Bollen (1989) was used to compute the IFI in this research (see table 3.3).

3.6.2.3 Comparative Fit Index

CFI is analogous with TLI in the sense that they both are alternative indices that provides a solution for the sample size bias of NFI (Bentler, 1990). Because CFI and TLI are highly correlated, some researchers believe that only one of them should be reported. However, reporting both still can produce some value as they penalize complexity differently (Hoyle, 2015). Similar to other incremental fit indices, CFI has a conventional cut-off point at 0.9 meaning that a value above this indicates good fit (Bentler, 1990). In this research, the formula from Bentler (1990) was applied to compute the CFI (see table 3.3).
Table 3. 3 Formula List

<table>
<thead>
<tr>
<th>Fit Index</th>
<th>Equation</th>
<th>Measurement Standard</th>
<th>Bias Towards Sample Size</th>
<th>Bias Towards Parsimony Model</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative Chi- Square</td>
<td>$\chi^2/df$</td>
<td>2.0-5.0</td>
<td>Yes</td>
<td>Yes</td>
<td>Byrne (1989)</td>
</tr>
<tr>
<td>RMSEA</td>
<td>$\sqrt{(\chi^2 - df)/\sqrt{df(N - 1)}}$</td>
<td>&lt;0.08</td>
<td>Yes</td>
<td>Yes</td>
<td>Steiger (1990)</td>
</tr>
<tr>
<td>GFI</td>
<td>$1 - \frac{F[S, \Sigma(\hat{\theta})]}{F[S, \Sigma(\theta)]}$</td>
<td>&gt;0.9</td>
<td>No</td>
<td>No</td>
<td>Tabachnick &amp; Fidell (2010)</td>
</tr>
<tr>
<td>AGFI</td>
<td>$1 - \frac{(C/df)F[S, \Sigma(\hat{\theta})]}{F[S, \Sigma(\theta)]}$</td>
<td>&gt;0.9</td>
<td>No</td>
<td>Yes</td>
<td>Tabachnick &amp; Fidell (2010)</td>
</tr>
<tr>
<td>RMR</td>
<td>$\sqrt{[p^{*}-1(e'le)]}$</td>
<td>N/A</td>
<td>Yes</td>
<td>No</td>
<td>Jöreskog &amp; Sörbom (1990)</td>
</tr>
<tr>
<td>SRMR</td>
<td>$\sqrt{[p^{*}-1(e'Ve)]}$</td>
<td>&lt;0.08</td>
<td>Yes</td>
<td>No</td>
<td>Bentler (1995)</td>
</tr>
<tr>
<td>TLI</td>
<td>$\frac{\chi_0^2/df_0 - \chi_k^2/df_k}{\chi_0^2/df_0 - 1}$</td>
<td>&gt;0.9</td>
<td>No</td>
<td>Yes</td>
<td>Tucker &amp; Lewis (1973)</td>
</tr>
<tr>
<td>IFI</td>
<td>$\frac{\chi_0^2 - \chi_k^2}{\chi_0^2 - df_k}$</td>
<td>&gt;0.9</td>
<td>Yes</td>
<td>Yes</td>
<td>Bollen (1989)</td>
</tr>
<tr>
<td>CFI</td>
<td>$\frac{(\chi_0^2 - df_o) - (\chi_k^2 - df_k)}{\chi_0^2 - df_0}$</td>
<td>&gt;0.9</td>
<td>No</td>
<td>Yes</td>
<td>Bentler (1990)</td>
</tr>
</tbody>
</table>

Note: $\chi^2$, chi-square; $df$, degrees of freedom; $N$, sample size; $F$, maximum likelihood discrepancy function; $S$, sample variance/covariance matrix; $\Sigma(\hat{\theta})$, variance/covariance matrix implied by the population parameters; $\Sigma(\theta)$ is variance/covariance matrix implied by the sample-estimate parameters; $C$, number of variances and covariances, $p^*$, the number of nonduplicated elements in the covariance matrix; $e$, a vector of residuals from a covariance matrix; $I$ is an identify matrix; $W$, a weight matrix used to standardize the elements in a sample covariance matrix; $o$, baseline model; $k$, hypothesized model
4 Empirical Findings and Analysis

This chapter presents and analyses the empirical findings of the study. A descriptive statistics section is used to explain the demographic characteristics of the respondents. The model and findings’ reliability are proved in the sections: reliability analysis, model fit findings, and multicollinearity findings, while the structural equation modeling and hypotheses testing sections outline the model along with its coefficient of determinations and the result of the 13 hypotheses.

4.1 Descriptive Statistics

The demographic characteristics of the sample participating in the questionnaire, as well as the frequency of mobile eID app usage, will first be displayed and described before performing multiple regression analysis, hypotheses testing, and inferential statistics. While age, country of origin, gender, and frequency of usage will not be taken into account when performing analysis of factor correlation, it is still important to understand this in order to draw valid conclusions about the final results, as well as to pinpoint any limitation that might influence the results of the research.

4.1.1 Age

As can be seen in figure 4.1, most of the respondents (78%) were between 20 and 29 years old. 11% of the respondents were between 30 and 39, 4% between 40 and 49, 4% between 50-59, 2% younger than 20, and 1% above 60 years old. This potential age bias will be addressed later in the research.

![Age of Respondents Chart](image_url)
4.1.2 Country of Origin

By studying figure 4.2, the majority of the respondents (96%) were Swedish, a fact which is not surprising due to that the study was made targeting Sweden as the empirical site and because Sweden has implemented means of mobile eID on a greater scale compared to many other countries. The other 4% consisted of people from several other European countries as well as people from China, Thailand, The Philippines, Malaysia, and the United States of America.

![Country of Origin Chart](image)

*Figure 4.2 Country of Origin Chart*
4.1.3 Gender

In terms of gender, figure 4.3 shows that male participants amounted to 56% of the total sample size, while female amounted to 44%. This shows a rather even result indicating that it can be presumed that the result of the study is not dependent on a specific gender.

![Gender Chart](image)

Figure 4.3 Gender Chart

4.1.3 Frequency of Mobile eID App Usage

By looking at figure 4.4, out of the 396 respondents, 44.4% used mobile eID apps very frequently, 46% frequently (6=27.3%, 5=18.7%), 6.6% neither frequently nor rarely, and 3% rarely or occasionally (3=2.5%, 2=0.5%). The results imply that the majority of the respondents have already heavily implemented mobile eID apps into their lives and are familiar with the application.
4.2 Reliability Analysis

Each factor is related to a number of items (questions) which produces a measurement of reliability (Cronbach’s Alpha). Having a value over 0.7 for each of the factors indicate that all of the items were able to accurately measure the factors. As can be seen in table 4.1, five factors (intention to use, attitude, perceived usefulness, perceived ease of use, and perceived convenience) had a Cronbach’s Alpha value of $0.8 > \alpha \geq 0.7$, indicating good reliability, while two factors (perceived security and subjective norm) had a value over 0.8 indicating high reliability. This result implies that the questions asked to the participants were good means of measurements to each of the factors and that they could produce reliable results. The overall model had a Cronbach’s Alpha which amounted to 0.902 signifying both excellent reliability and that the model and its questions could appropriately measure the factors. Hence, the model served as a reliable instrument for testing the hypotheses developed in this research.
Table 4.1 Reliability Analysis

<table>
<thead>
<tr>
<th>Factors</th>
<th>Cronbach’s Alpha</th>
<th>Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention to Use</td>
<td>0.738</td>
<td>2</td>
</tr>
<tr>
<td>Attitude</td>
<td>0.727</td>
<td>4</td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>0.752</td>
<td>2</td>
</tr>
<tr>
<td>Perceived Ease of Use</td>
<td>0.787</td>
<td>3</td>
</tr>
<tr>
<td>Perceived Security</td>
<td>0.811</td>
<td>3</td>
</tr>
<tr>
<td>Subjective Norm</td>
<td>0.894</td>
<td>3</td>
</tr>
<tr>
<td>Perceived Convenience</td>
<td>0.704</td>
<td>2</td>
</tr>
<tr>
<td>Overall Model</td>
<td><strong>0.902</strong></td>
<td><strong>19</strong></td>
</tr>
</tbody>
</table>
4.3 Structural Equation Modeling

By performing structural equation modeling on the gathered data, combining multiple regression analysis and confirmatory factor analysis, the following diagram is developed (See figure 4.5). The oval-shaped constructs are the latent variables (factors), the rectangular ones represent observed variables (questions), and the circles are error terms which marks the margin of error within the model. The lines between each factor represent the hypotheses and the numbers connecting to them denote the individual linear relationship between the factors’ coefficient of determination. The extent to which the factors relate to each other is of paramount value when studying if they actually affect technology acceptance.

![Conceptual Model Results](image)

**Figure 4.5 Conceptual Model Results**

By summarizing the results from the graphical representation above into table 4.2, denoting predictor variable, predicted variable, coefficient of determination ($R^2$), and p-value, the testing of the linear relationship between the factors could easier be elaborated upon. The p-value, a determinant of probability, needs to be below a level of significance of 0.05 for the predictor variable to be able to predict another latent variable. However, if the level of significance is set to 0.01 or even 0.001, one can be even more certain that a linear relationship between the two variables exists.

When analyzing table 4.2, it can be seen that the three constructs (intention to use predicting subjective norm, intention to use predicting perceived security, and perceived usefulness predicting perceived convenience) did not reach a p-value greater than 0.05 indicating that no significant linear relationship existed between them. Apart from these constructs, the test result
shows that all predictor variables were able to predict their respective predicted variables at a level of significance equal to 0.01 or 0.001; implying that the coefficient of determination was of relevant value to show that the relationship between the factors was significant. For example, 50.4% of the variability in the factor of attitude can be explained by the perceived security, and 47.9% of the variability in the factor of perceived ease of use can be explained by the perceived convenience.

Table 4.2 Conceptual Model Results Summary

<table>
<thead>
<tr>
<th>Predicted Variable</th>
<th>Predictor Variable</th>
<th>R²</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude</td>
<td>Perceived Security</td>
<td>0.504</td>
<td>0.001</td>
</tr>
<tr>
<td>Attitude</td>
<td>Subjective Norm</td>
<td>0.335</td>
<td>0.001</td>
</tr>
<tr>
<td>Attitude</td>
<td>Perceived Usefulness</td>
<td>0.333</td>
<td>0.001</td>
</tr>
<tr>
<td>Intention to Use</td>
<td>Subjective Norm</td>
<td>-</td>
<td>0.576</td>
</tr>
<tr>
<td>Intention to Use</td>
<td>Perceived Ease of Use</td>
<td>0.262</td>
<td>0.001</td>
</tr>
<tr>
<td>Intention to Use</td>
<td>Perceived Usefulness</td>
<td>0.391</td>
<td>0.001</td>
</tr>
<tr>
<td>Intention to Use</td>
<td>Perceived Security</td>
<td>-</td>
<td>0.141</td>
</tr>
<tr>
<td>Intention to Use</td>
<td>Attitude</td>
<td>0.310</td>
<td>0.011</td>
</tr>
<tr>
<td>Perceived Ease of Use</td>
<td>Perceived Convenience</td>
<td>0.479</td>
<td>0.001</td>
</tr>
<tr>
<td>Perceived Ease of Use</td>
<td>Subjective Norm</td>
<td>0.458</td>
<td>0.001</td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>Perceived Ease of Use</td>
<td>0.307</td>
<td>0.001</td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>Subjective Norm</td>
<td>0.428</td>
<td>0.001</td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>Perceived Convenience</td>
<td>-</td>
<td>0.120</td>
</tr>
</tbody>
</table>
By excluding the constructs which showed no significant linear relationship, a refined version of the conceptual model was developed (see figure 4.6). The model was tested again in SPSS AMOS to determine new coefficients of determination as well as the p-value for each of the constructs. This was done to get a better and more accurate view of overall relatedness between factors and how it affects the acceptance of the technology.

Figure 4.6 Refined Model Results
<table>
<thead>
<tr>
<th>Predicted variable</th>
<th>Predictor variable</th>
<th>R²</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude</td>
<td>Perceived Security</td>
<td>0.498</td>
<td>0.001</td>
</tr>
<tr>
<td>Attitude</td>
<td>Subjective Norm</td>
<td>0.331</td>
<td>0.001</td>
</tr>
<tr>
<td>Attitude</td>
<td>Perceived Usefulness</td>
<td>0.337</td>
<td>0.001</td>
</tr>
<tr>
<td>Intention to Use</td>
<td>Perceived Ease of Use</td>
<td>0.271</td>
<td>0.001</td>
</tr>
<tr>
<td>Intention to Use</td>
<td>Perceived Usefulness</td>
<td>0.400</td>
<td>0.001</td>
</tr>
<tr>
<td>Intention to Use</td>
<td>Attitude</td>
<td>0.196</td>
<td>0.009</td>
</tr>
<tr>
<td>Perceived Ease of Use</td>
<td>Perceived Convenience</td>
<td>0.483</td>
<td>0.001</td>
</tr>
<tr>
<td>Perceived Ease of Use</td>
<td>Subjective Norm</td>
<td>0.455</td>
<td>0.001</td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>Perceived Ease of Use</td>
<td>0.384</td>
<td>0.001</td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>Subjective Norm</td>
<td>0.407</td>
<td>0.001</td>
</tr>
</tbody>
</table>
A graphical relationship between the latent variables, observed variables, and error terms included in the refined model can be seen in figure 4.6. After performing a refined model regression analysis, all constructs showed a strong degree of linear relatedness to each other meaning that all predictor variables were able to predict their respective predicted variable in the model (see table 4.3). The variance of attitude is described by the factors related to it with coefficients of determination equal to 0.498, 0.331, and 0.337. The coefficients of determination of 0.271, 0.400, and 0.196 that come from the relationships linked to the intention to use can explain the variability of this factor. Perceived ease of use and perceived usefulness can also, to a strong degree, be explained by its respective constructs with coefficients of determination of 0.483 and 0.455 for perceived ease of use, and 0.384 and 0.407 for perceived usefulness.

In table 4.4 below, each factor’s total effect on intention to use mobile eID apps are displayed and ranked with respect to how influential it is related to other factors. This was done by multiplying each coefficient with all its affecting factors all along the path towards the intention to use. By examining this ranking, it can be seen that perceived usefulness has the greatest total effect while perceived security has the lowest.

**Table 4.4 Refined Model Total Effect Results**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Factor</th>
<th>Calculation: direct effect + indirect effect</th>
<th>Total Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Perceived Usefulness</td>
<td>0.4+0.337 * 0.196</td>
<td>0.466</td>
</tr>
<tr>
<td>2</td>
<td>Subjective Norm</td>
<td>0.455 * 0.271 + 0.331 * 0.196 + ((0.455 * 0.384) + 0.407) * 0.337 * 0.196 + ((0.455 * 0.384) + 0.407) * 0.4</td>
<td>0.459</td>
</tr>
<tr>
<td>3</td>
<td>Perceived Ease of Use</td>
<td>0.271 + 0.384 * 0.337 * 0.196 + 0.384 * 0.4</td>
<td>0.450</td>
</tr>
<tr>
<td>4</td>
<td>Perceived Convenience</td>
<td>0.483 * 0.271 + 0.483 * 0.384 * 0.337 * 0.196 + 0.483 * 0.384 * 0.4</td>
<td>0.217</td>
</tr>
<tr>
<td>5</td>
<td>Attitude</td>
<td>0.196</td>
<td>0.196</td>
</tr>
<tr>
<td>6</td>
<td>Perceived Security</td>
<td>0.498 * 0.196</td>
<td>0.098</td>
</tr>
</tbody>
</table>
4.4 Model Fit Findings

Through using the software SPSS AMOS, various values have been generated to determine the model fit through the respective indices. The table both presents the conceptual and refined conceptual model’s results (see table 4.5). The table also displays measurement standards which are cutoffs that indicate good fit. In addition, the respective source of reference to each model fit index is also displayed in the table. Normally, the model fit would have been discussed before presenting the results from the structural equation modeling, however, in order to account for the result from the refined model, it has been placed after the structural equation modeling analysis. Values that do not show good fit has been marked in bold.

Table 4.5 Model Fit

<table>
<thead>
<tr>
<th>Model Fit Index</th>
<th>Measure Standard</th>
<th>Conceptual Model Results</th>
<th>Refined Model Results</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative Chi- Square</td>
<td>χ²/df value between 2.0-5.0 with an insignificant p-value (p&gt;0.05) indicates a reasonable fit</td>
<td>Chi-square = 462.015 Degrees of freedom = 139 p=0.000 χ²/df=3.324</td>
<td>Chi-square = 466.146 Degrees of freedom = 142 p=0.000 χ²/df=3.283</td>
<td>Barrett (2007); Byrne (1989); Marsh &amp; Hocevar (1985)</td>
</tr>
<tr>
<td>RMSEA</td>
<td>RMSEA&lt;0.08 optimal fit 0.08&lt;RMSEA&lt;0.1 adequate fit 0.1&lt;RMSEA poor fit</td>
<td>RMSEA=0.077 low 90%= 0.069 high 90%= 0.084</td>
<td>RMSEA=0.076 low 90%= 0.068 high 90%= 0.084</td>
<td>Browne &amp; Cudeck (1993); Kenny et al. (2014)</td>
</tr>
<tr>
<td>GFI</td>
<td>0.9&lt;GFI indicates good fit</td>
<td>0.894</td>
<td>0.893</td>
<td>Tanaka &amp; Huba (1985); Sharma et al. (2005)</td>
</tr>
<tr>
<td>Metric</td>
<td>Definition</td>
<td>Value</td>
<td>Value</td>
<td>Source</td>
</tr>
<tr>
<td>--------</td>
<td>------------</td>
<td>-------</td>
<td>-------</td>
<td>--------</td>
</tr>
<tr>
<td>AGFI</td>
<td>0.9&lt;AGFI indicates good fit</td>
<td><strong>0.855</strong></td>
<td><strong>0.857</strong></td>
<td>Sharma et al. (2005)</td>
</tr>
<tr>
<td>RMR</td>
<td>Small RMR means good fit</td>
<td>0.194</td>
<td>0.193</td>
<td>Browne &amp; Cudeck (1993)</td>
</tr>
<tr>
<td>SRMR</td>
<td>SRMR&lt;0.08 indicates good fit</td>
<td><strong>0.1593</strong></td>
<td><strong>0.1595</strong></td>
<td>Maydeu-Olivares et al. (2017)</td>
</tr>
<tr>
<td>IFI</td>
<td>0.9&lt;NFI indicates good fit 0.9&lt;IFI&lt;0.8 indicates adequate fit</td>
<td>0.905</td>
<td>0.905</td>
<td>Bollen (1989)</td>
</tr>
<tr>
<td>CFI</td>
<td>0.9&lt;CFI indicates good fit 0.9&lt;CFI&lt;0.8 indicates adequate fit</td>
<td>0.904</td>
<td>0.904</td>
<td>Bentler (1990)</td>
</tr>
<tr>
<td>TLI</td>
<td>0.9&lt;TLI indicates good fit 0.9&lt;TLI&lt;0.8 indicates mediocre fit</td>
<td><strong>0.882</strong></td>
<td><strong>0.884</strong></td>
<td>Bentler &amp; Bonett 1980; Sharma et al. (2005)</td>
</tr>
</tbody>
</table>
4.4.1 Absolute Fit Indices Findings

The relative chi-square test was generated through using SPSS AMOS and the result indicated a good fit in this index; $\chi^2/df = 3.283$ and $p = 0.000$ (see table 4.5). Note that the value improved after refining the model as it decreased from 3.324 to 3.283. Although the relative chi-square showed that the model had a good fit, it is important to realize, as mentioned previously, that the chi-square is biased towards larger sample sizes. As this study’s sample size is rather large (396 participants), it may have influenced the model fit to a certain degree. Nevertheless, the model still generated good fit as the result was well within the range of 2.0 to 5.0 with a significant p-value ($p > 0.05$).

Arguably the most popular index RMSEA (Jackson et al., 2009) indicated a good fit for both the conceptual and refined model; 0.077 and 0.076, which are below the measurement standard of 0.08. Despite that the RMSEA favors less complicated models (parsimony models), the rather complex hypothesized model of this study still indicated good fit. It can also be observed that the value decreased, although not much; implying that reducing the parameters does indeed improve the result of RMSEA.

The GFI measurement indicated a poor fit of the model; GFI = 0.893, which is close but not meeting the measurement standard of GFI > 0.9. As discussed before, GFI is a very sensitive measurement technique where there is positive bias towards larger sample size and low degrees of freedom compared to sample size. Although which amount that infers to a large sample size and low degrees of freedom is not clearly specified, there may have been some positive bias for the hypothesized model as the sample size is 396 and degrees of freedom is 142. AGFI, which is the adjusted GFI that ease the bias from degrees of freedom, also indicated a poor fit; AGFI = 0.857 showing even worse result than GFI. However, that may be due to AGFI favoring parsimony models. Many researchers describe GFI and AGFI as two very sensitive measurement techniques and often do not recommend them to be reported (Sharma et al., 2005). Nevertheless, according to these two measures, it appears that the model had a poor fit.

The result from AMOS showed that the RMR is 0.193 signifying a good fit for the refined conceptual model. Browne and Cudeck (1993) suggested that the lower the value the better the fit. Because the RMR is based on the residuals of the sample covariance matrix, the hypothesized model should not have suffered from interpretation difficulties (Kline, 2005). This is due to that the whole dataset was constructed so that each of the observed variables used the same scale. Although no general rule of thumb for RMR has been set, it can be said that the RMR for the refined conceptual model is relatively low. Therefore, it can be concluded that it indicated a good fit. The SRMR is the standardized version of RMR that would solve the problem arising when different scales have been used for observable variables within a dataset. In terms of SRMR, as that value was not less than the provided measurement standard of 0.08, the results indicated a poor fit for both the conceptual and refined model. Perhaps this could be due to its sensitivity towards sample size. Nevertheless, since the dataset uses the same scale, RMR still provides a good fit indication with regards to the aspect of residuals.
4.4.1 Incremental Fit Indices Findings

TLI showed that the hypothesized model has a value of 0.884 which is not quite at the measurement standard of 0.9 for a good fit. The advantage of TLI is the fact that it does not get affected by sample size and has therefore been one of the more reported indices. However, it also favors parsimony models and can have hence been affected by the number of parameters that the hypothesized model has. Like RMSEA after refinement of the conceptual model, by reducing parameters, the TLI value did in fact increase. Although a 0.9 cutoff point was selected for the measurement standard, as discussed previously, the cutoff point of TLI has been constantly changing and no universally agreed upon measurement standard has been established. So, as the value is higher than 0.85, which was the lowest recommended cutoff point for good fit, it can be concluded that according to TLI, the model has at least a mediocre or even good fit.

IFI generated a value of 0.905 which exceed the measurement standards of 0.9 indicating good model fit. Despite IFI favoring smaller sample sizes, when the sample size of this study is arguably the opposite, it has generated a good fit. CFI, which like IFI was developed to cover up the flaws of NFI, also generated a value of 0.904 implying good fit of the model.

According to Barrett (2007), while the process of calculating model fit is considered one of the most, if not the most, important step of structural equation modeling, most of the indices have too many biases that make it hard to judge if the indices are even useful. He even proposed that only the absolute index chi-square should be used. Sharma et al. (2005) also argued that most of the indices have its flaws, specifically that GFI and AGFI should not be reported. In general, most of the indices in this research indicated that the conceptual model has a good fit. Although GFI and AGFI showed that the model was slightly below the recommended value, based on the previously discussed arguments by Sharma et al. and Barrett, it is negligible. As the most reported and supported indices (relative chi-square, RMSEA, and TLI) showed that the model had a good fit, it may already provide enough evidence to conclude that the model can represent the observations. However, in addition to these indices showing good fit, RMR, CFI, and IFI which accounts for other aspects also indicated good fitness; further adding credibility to the overall fitness of the model. By neglecting GFI and AGFI, as well as taking what was previously discussed about TLI into account, it may be stated that only SRMR showed poor fit. However, as all of the other indices generated good support for the model, it seems to outweigh the negative outcome of SRMR. Hence, it can be concluded that the model has a good fit.

4.5 Multicollinearity Findings

A bivariate correlation analysis in SPSS AMOS was conducted to be able to check for signs of multicollinearity between exogenous variables within the refined model of this report. Table 4.6 includes the exogenous variables to the lower left as well as to the upper right. The intersect between two exogenous variables display the value of correlation that is related to that specific relationship. A correlation value above 0.8 would be deemed too high, indicating signs of that
multicollinearity exist between the two variables. However, a correlation value below 0.8 would be considered acceptable and that no signs of multicollinearity would exist. By studying table 4.6, the three exogenous variables perceived convenience, subjective norm, and perceived security of this research did not show an intersect value that exceeds the threshold level of 0.8, and hence it can be concluded that no bivariate correlation between the variables exists and that the research do not suffer from any signs of multicollinearity. This means that the refined model could make reliable estimates and that no reconstruction or adjustment of the refined model, or its factors, were needed.

Table 4.6 Multicollinearity Test Results

<table>
<thead>
<tr>
<th></th>
<th>Perceived Convenience</th>
<th>Subjective Norm</th>
<th>Perceived Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Convenience</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Subjective Norm</td>
<td>0.420</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Perceived Security</td>
<td>0.389</td>
<td>0.474</td>
<td>1</td>
</tr>
</tbody>
</table>

4.6 Hypotheses Testing

The hypotheses testing for the conceptual model was done using SPSS AMOS, checking for p-values and coefficients of determination of the various relationships between the factors studied in this research. On a total of 13 hypotheses, 3 were not supported (perceived security predicting intention to use, subjective norm predicting intention to use, and perceived convenience predicting perceived usefulness); implying that the majority of the hypotheses that were conducted were true and therefore accepted. The following is a detailed description of each hypothesis and an overall summary is shown in table 4.7.

Hypothesis 1: The attitude towards using a mobile electronic identification application has a positive effect on the intention to use a mobile electronic identification application.

The weight of the regression coefficient for the predictor factor of attitude towards using a mobile eID app in the prediction of the factor of intention to use it was significantly different from zero at a 0.01 significance level. This means that hypothesis 1 was accepted and that
attitude has a positive effect on the intention to use. Therefore, it can be said that 19.6% (See table 4.7) of the variability of intention to use a mobile eID app can be explained by the attitude towards it.

**Hypothesis 2: Perceived ease of use of a mobile electronic identification application has a positive effect on the perceived usefulness of a mobile electronic identification application.**

The weight of the regression coefficient for the predictor factor of perceived ease of use in the prediction of the factor of perceived usefulness was significantly different from zero at a 0.001 significance level. Hence, hypothesis 2 was accepted and it can be concluded that perceived ease of use has a positive effect on perceived usefulness. To describe in more details, 38.4% of the variability of perceived usefulness of a mobile eID app can be explained by the perceived ease of use of it.

**Hypothesis 3: Perceived ease of use of a mobile electronic identification application has a positive effect on the intention to use a mobile electronic identification application.**

The weight of the regression coefficient for the predictor factor of perceived ease of use in the prediction of the factor of the intention to use was significantly different from zero at a 0.001 significance level. Thus, hypothesis 3 was affirmed to be true. Perceived ease of use has indeed a positive effect on the intention to use as 27.1% of the variability in intention to use a mobile eID app can be explained by the perceived ease of use of it.

**Hypothesis 4: Perceived usefulness of a mobile electronic identification application has a positive effect on the attitude towards using a mobile electronic identification application.**

The weight of the regression coefficient for the predictor factor of perceived usefulness in the prediction of the factor of attitude was significantly different from zero at a 0.001 significance level. Hypothesis 4 was thereby accepted, and perceived usefulness has a positive effect on the attitude in terms of mobile eID app usage. To add, 33.7% of the variability in the attitude towards using a mobile eID app can be explained by the perceived usefulness of it.

**Hypothesis 5: Perceived usefulness of a mobile electronic identification application has a positive effect on the intention to use a mobile electronic identification application.**

The weight of the regression coefficient for the predictor factor of perceived usefulness in the prediction of the factor of intention to use was significantly different from zero at a 0.001 significance level. The hypothesis 5 was therefore true, perceived usefulness has indeed a positive effect on intention to use which can be explained more thoroughly by saying that 40% of the variability in the intention to use a mobile eID app can be explained by the perceived usefulness of it.

**Hypothesis 6: Perceived security of a mobile electronic identification application has a positive effect on the attitude towards using a mobile electronic identification application.**
The weight of the regression coefficient for the predictor factor of perceived security in the prediction of the factor of attitude was significantly different from zero at a 0.001 significance level. This means that hypothesis 6 was true and that perceived security has a positive effect on attitude. Hence it can be concluded that 49.8% of the variability in the attitude towards using a mobile eID app can be explained by the perceived security of it.

Hypothesis 7: Perceived security of a mobile electronic identification application has a positive effect on the intention to use a mobile electronic identification application.

The weight of the regression coefficient for the predictor factor of perceived security in the prediction of the factor of intention to use was not significantly different from zero at a 0.05 significance level. Hence, hypothesis 7 was rejected and it can be concluded that perceived security of a mobile eID app does not have a positive effect on the intention to use it.

Hypothesis 8: Subjective norm has a positive effect on the perceived ease of use of a mobile electronic identification application.

The weight of the regression coefficient for the predictor factor of subjective norm in the prediction of the factor of perceived ease of use was significantly different from zero at a 0.001 significance level. This means that hypothesis 8 was accepted, the subjective norm has a positive effect on the perceived ease of use, and that 45.5% of the variability in the perceived ease of use of a mobile eID app can be explained by the subjective norm of it.

Hypothesis 9: Subjective norm has a positive effect on the perceived usefulness of a mobile electronic identification application.

The weight of the regression coefficient for the predictor factor of subjective norm in the prediction of the factor of perceived usefulness was significantly different from zero at a 0.001 significance level. Hence, hypothesis 9 was accepted and it can be confirmed that subjective norm has indeed a positive effect on the perceived usefulness. Therefore, 40.7% of the variability in perceived usefulness of a mobile eID app can be explained by the subjective norm of it.

Hypothesis 10: Subjective norm has a positive effect on the attitude towards using a mobile electronic identification application.

The weight of the regression coefficient for the predictor factor of subjective norm in the prediction of the factor of attitude was significantly different from zero at a 0.001 significance level. Thus, hypothesis 10 was accepted and subjective norm is stated to have a positive effect on attitude. As the hypothesis was accepted, 33.1% of the variability in attitude toward using a mobile eID app can be explained by the subjective norm of it.
Hypothesis 11: Subjective norm has a positive effect on the intention to use a mobile electronic identification application.

The weight of the regression coefficient for the predictor factor of subjective norm in the prediction of the factor of intention to use was not significantly different from zero at a 0.05 significance level. Hence, it can be concluded that hypothesis 11 was rejected and that there was no linear relationship between the two latent variables of subjective norm and the intention to use a mobile eID app.

Hypothesis 12: Perceived convenience of a mobile electronic identification application has a positive effect on the perceived ease of use of a mobile electronic identification application.

The weight of the regression coefficient for the predictor factor of perceived convenience in prediction of the factor of perceived ease of use was significantly different from zero at a 0.001 significance level. Therefore, hypothesis 12 was accepted and it can be confirmed that perceived convenience has a positive effect on the perceived ease of use. In addition to this, it can be said that 48.3% of the variability in perceived ease of use of a mobile eID app can be explained by the perceived convenience of it.

Hypothesis 13: Perceived convenience of a mobile electronic identification application has a positive effect on the perceived usefulness of a mobile electronic identification application.

The weight of the regression coefficient for the predictor factor of perceived convenience in the prediction of the factor of perceived usefulness was not significantly different from zero at a 0.05 significance level. Hence, the last hypothesis was rejected and therefore it can be said that perceived convenience of a mobile eID app does not have a positive effect on the perceived usefulness of it.
<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Predicted Variable</th>
<th>Predictor Variable</th>
<th>$R^2$</th>
<th>Level of Significance</th>
<th>p-value</th>
<th>Hypothesis Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intention to Use</td>
<td>Attitude</td>
<td>0.196</td>
<td>p &lt; 0.01</td>
<td>= 0.009</td>
<td>Supported</td>
</tr>
<tr>
<td>2</td>
<td>Perceived Usefulness</td>
<td>Perceived Ease of Use</td>
<td>0.384</td>
<td>p &lt; 0.001</td>
<td>&lt; 0.001</td>
<td>Supported</td>
</tr>
<tr>
<td>3</td>
<td>Intention to Use</td>
<td>Perceived Ease of Use</td>
<td>0.271</td>
<td>p &lt; 0.001</td>
<td>&lt; 0.001</td>
<td>Supported</td>
</tr>
<tr>
<td>4</td>
<td>Attitude</td>
<td>Perceived Usefulness</td>
<td>0.337</td>
<td>p &lt; 0.001</td>
<td>&lt; 0.001</td>
<td>Supported</td>
</tr>
<tr>
<td>5</td>
<td>Intention to Use</td>
<td>Perceived Usefulness</td>
<td>0.400</td>
<td>p &lt; 0.001</td>
<td>&lt; 0.001</td>
<td>Supported</td>
</tr>
<tr>
<td>6</td>
<td>Attitude</td>
<td>Perceived Security</td>
<td>0.498</td>
<td>p &lt; 0.001</td>
<td>&lt; 0.001</td>
<td>Supported</td>
</tr>
<tr>
<td>7</td>
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<td>Perceived Security</td>
<td>-</td>
<td>p &lt; 0.05</td>
<td>= 0.141</td>
<td>Not supported</td>
</tr>
<tr>
<td>8</td>
<td>Perceived Ease of Use</td>
<td>Subjective Norm</td>
<td>0.455</td>
<td>p &lt; 0.001</td>
<td>&lt; 0.001</td>
<td>Supported</td>
</tr>
<tr>
<td>9</td>
<td>Perceived Usefulness</td>
<td>Subjective Norm</td>
<td>0.407</td>
<td>p &lt; 0.001</td>
<td>&lt; 0.001</td>
<td>Supported</td>
</tr>
<tr>
<td>10</td>
<td>Attitude</td>
<td>Subjective Norm</td>
<td>0.331</td>
<td>p &lt; 0.001</td>
<td>&lt; 0.001</td>
<td>Supported</td>
</tr>
<tr>
<td>11</td>
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<td>Subjective Norm</td>
<td>-</td>
<td>p &lt; 0.05</td>
<td>= 0.576</td>
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</tr>
<tr>
<td>12</td>
<td>Perceived Ease of Use</td>
<td>Perceived Convenience</td>
<td>0.483</td>
<td>p &lt; 0.001</td>
<td>&lt; 0.001</td>
<td>Supported</td>
</tr>
<tr>
<td>13</td>
<td>Perceived Usefulness</td>
<td>Perceived Convenience</td>
<td>-</td>
<td>p &lt; 0.05</td>
<td>= 0.120</td>
<td>Not supported</td>
</tr>
</tbody>
</table>
5 Conclusion

This chapter concludes the study by summarizing the results and analysis as well as answering the research question.

This research aimed to find and outline the factors influencing the user acceptance of mobile eID apps in Sweden. Through performing a quantitative study, using the well-studied technology acceptance model and extending it in order to better fit the specific topic of this research, the factors studied in this report were analyzed and tested if, and to what extent, they affect the user acceptance of mobile eID apps in Sweden. Based on this quantitative analysis and hypotheses testing, the answer to the following research question is presented:

What factors influence user acceptance of mobile electronic identification applications in Sweden?

The result of the hypotheses testing showed that the factors that influence the user acceptance of mobile eID apps in Sweden are the following (in ranked order): perceived usefulness of a mobile eID app, subjective norm, perceived ease of use of a mobile eID app, perceived convenience of a mobile eID app, attitude towards using a mobile eID app, and perceived security of a mobile eID app. Perceived usefulness, subjective norm, and perceived ease of use are the most influential factors which means that the people value that the mobile eID app is rather free of efforts, that using a mobile eID app enhance the performance of mobile electronic identification, and that they are greatly influenced by the social context in their lives when accepting mobile eID app usage. Perceived convenience, attitude, and perceived security does also, to at least some extent, influence the user acceptance of mobile eID apps. This indicates that the convenience related to that the app can be used almost whenever or wherever the user wants, as well as it is possessing qualities of adding personal value and low risk to the user, also affect the acceptance of mobile eID app usage.

Out of all the 13 hypotheses that were tested, only 3 were rejected because they were proved to not have any substantial effect on their predicted latent variable. These are perceived security predicting intention to use, subjective norm predicting intention to use, and perceived convenience predicting perceived usefulness. These rejected relationships contrast previous research studying mobile service acceptance (Pikkarainen et al., 2004; Bhatti, 2007; Lee et al., 2012; Kim et al., 2010). However, even if these positive linear relationships do not exist, all factors are still proved to be indirectly linked to the user acceptance of mobile eID apps in Sweden due to that the predicting variables have positive linear relationships with other factors in the model.
6 Discussion

This chapter provides a discussion of the theories and constructs proposed by previous research; linking them to the result and hypotheses findings of this research. Moreover, the research methodology and model, theoretical contribution, managerial implications, and strengths and weaknesses of the research will be discussed. To end this section, some suggestions for future research are proposed.

6.1 Discussion of Hypotheses

The hypotheses testing led to that 3 hypotheses were rejected while 10 were accepted resulting in an acceptance rate of 77% and that only relationships between some latent variables is excluded and not the factors as such. Thus, it can be said that the factors of attitude, perceived ease of use, perceived usefulness, perceived security, perceived convenience, and subjective norm all possess characteristics that influence mobile eID acceptance either directly, indirectly, or both directly and indirectly as can be seen figure 4.6. However, even if the testing resulted in a high acceptance rate, some discussion on why the other 23% of the hypotheses were rejected, even though they had been tested before in previously related subjects, needs to be done.

Hypothesis 7 testing perceived security in predicting intention to use could not be supported; implying that perceived security, relating to that low risk is preferable, is something that the potential user does not directly relate to why it intends to use the specific application. This construct was initially proposed by Pikkarainen et al. (2004) testing online banking user acceptance. So why would this construct not be applicable for mobile eID apps? What is needed to take into account when studying the relationship between these two latent variables, is that perceived security does not have a direct effect on intention to use, but instead have to go through the attitude towards mobile eID usage (hypothesis 6) to have an effect on the intention to use; indicating that perceived security have an indirect effect on the intention to use. This is in line with both Schiertz et al.’s (2010) and Park and Kim’s (2013) research on user mobile payment and cloud acceptance showing that the users’ level of confidence that a technology is secure should be seen as an attribute of attitude towards the intention to use a mobile application. Hence, in the case of mobile eID acceptance, the application needs to add positive personal value before affecting the intention to use it. Therefore, hypothesis 7 cannot be supported.

In the context of mobile commerce and financial services, subjective norm has a positive linear relationship to the intention to use (Bhatti, 2007; Lee et al., 2012). However, in this research, hypothesis 11 testing this relationship was rejected. This infers that a potential user does not consider what other people think and do when intending to use mobile eID apps. Yet, in the same way as perceived security, subjective norm also has an indirect effect on intention to use as it affects perceived ease of use, perceived usefulness, and attitude that in turn all affect the intention to use. Thus, it can be stated that the influence of what other people think and do affect to what extent the potential user thinks the application is free of effort, the enhancement
of performance of verifying one’s identity, as well as the attitude towards using the application before affecting the intention to use.

Lastly, hypothesis 13, perceived convenience predicting perceived usefulness, could not be supported. Therefore, it can be concluded that the extent to which the application can enhance the performance at the given task cannot be explained by how accessible the application is regarding time and place. This goes against what was initially proven correct by Kim et al. (2010) studying mobile payment acceptance. However, it still has an indirect effect as it first affects the perceived ease of use which influences the perceived usefulness. To explain this relationship, consider a real-life scenario where a person thinks that using a mobile eID app is absolutely not free of effort. Even if the application is accessible whenever and wherever the user wants, the person would probably not think the application is useful as performing the identification process would include hard and tedious work. As to why this relationship would exist in regard to mobile payment applications could be due to that such service rely even more on the transaction being done right away compared to mobile eID apps. Take the example of a person buying groceries, even if the process would be tedious, the transaction cannot be postponed as it is needed to be done when standing at the sales counter.

6.2 Discussion of Questionnaire and Sampling

Because of the limited time, resources, and accessibility, this study used a convenience sampling method when gathering data. Even if this method of sampling might not correctly represent the whole population as the sample was selected according to the availability and accessibility to the researchers, it was regarded as a suitable method for researchers facing limitations such as the ones presented for the researchers in this study (Saunders et al., 2009). The drawback for using this way of sampling led to that some potential bias in terms of age of the respondents were apparent. 78% of the respondents were between the age of 20 to 29 indicating that a systematic error is introduced into the sampling by it including a majority of people in the twenties. This can to some extent, influence the result of the research as the perception of technology acceptance can be different depending on what age group the respondents adhere to. Testing the model but on different age demographics could verify the possible existence and degree of this bias. However, due to the researchers’ constraints related to time and resources, this was not done. Hence, the potential bias is something that is needed to take into account when observing the result of this study and when developing a personal view on what it concludes. This together with a potential bias regarding country of origin (see section 4.1.2) contributed to that only descriptive statistics were used to analyze the demographic characteristics of the sample instead of including it in the structural equation modeling.

As mobile electronic identification is a rather new phenomenon which was introduced not too long ago, the amount of applications related to this mean of validating one’s identity are limited. By asking several of the respondents what specific application were used, it seems that the application of Mobilt BankID were the only one used. This might also present itself as a bias in the result due to that the factors that affect mobile eID app acceptance may primarily be
related to only this specific application and not the phenomenon as such. Adding a question to the questionnaire asking what specific application that was used could have hinted the presence of this bias and the results could have been interpreted accordingly.

According to the saturation formula presented in section 3.4.1.1, at least 384 participants were needed in order for the sample to be able to adequately represent the population. In this research, data from 396 respondents were gathered which proves that the result can indeed represent the population and that the result is reliable at least in terms of necessary sample size. This was important not only in terms of providing validity to the results but also because that SPSS AMOS required at least around 200 data points in each category for it to be able to analyze the data properly. However, even if the data gathered was sufficient enough to perform structural equation modeling testing multiple linear regression and confirmatory factor analysis for the 7 factors in this research, it was still insufficient for including the demographic characteristics of the sample as the data for each subset category needed to be more than 200 data points each. This would be an interesting addition to the result of what factors that affect mobile eID acceptance as it would also account for the difference in age, country of origin, and gender. Regarding the factors and questions used in the questionnaire, all had been well-studied and applied in previous research. The factors and its related questions were chosen since they were proven significant for several other mobile service acceptances; adding reliability to this research studying just another mobile service application, as well as assuring the relationship between the questions and its respective factors.

6.3 Discussion of Research Model
In this research, the TAM was used as the basis for the conceptual model. The choice to implement this specific model instead of UTAUT was grounded in that it was the most used, that it included attitude as a factor of influence, that it explains variances in usage intentions, as well as that it has been recognized to be a consistent tool of measurement and conciseness. In addition, several well-studied factors of influence within mobile service application research were included to better fit the specific subject of this research. If the UTAUT model would have been applied instead, the result would probably had differed to some extent. This is due to that the UTAUT model includes the demographic factors and linking them to the different factor loadings. This could have been a great addition to the research as it categorizes the sample in order to better understand the relationship between the personal details of the respondents and the factor-to-factor connections. However, as the mean of being able to answer the research question was using SPSS AMOS, the researchers would not have been able to analyze this relationship due to the insufficient amount of data points gathered. Therefore, it further adds evidence to that TAM served as a better model of choice compared to UTAUT for this specific research.

6.4 Discussion of Theoretical Contribution
By answering the proposed gap by Axelsson & Melin (2012), this study contributed to the existing literature of mobile eID acceptance by exploring and identifying the factors of
influence on mobile eID acceptance; adding to the understanding of the theoretical basis for mobile eID. These are attitude, perceived ease of use, perceived usefulness, perceived security, perceived convenience, and subjective norm. In addition to this, the research has several other theoretical contributions.

First, even though TAM2 and UTAUT excluded attitude as a concept in an attempt to improve the original TAM, this research proves and confirms, as proposed by the original TAM, that attitude, along with perceived ease of use and perceived usefulness, are still important determinants of technology acceptance. Second, to follow the proposition stated by Davis et al. (1989) of extending the model with several other factors to better fit the area of research was also proven a good idea as most hypotheses were supported and all the factors proved to have some relationship to the acceptance of mobile eID apps. This further adds to the credibility of TAM and to the original author's statements rather than later standardized models. By incorporating these new factors, this study contributes to the underlying theory of TAM by establishing a conceptual model. Third, the model itself can be used and applied when performing future investigations; providing a foundation for technology acceptance researchers studying other mobile service applications. To add, researchers and academics can also relate to the drivers of mobile eID acceptance when expanding the research field of mobile eID and mobile eID apps, as well as fields associated to other applications handling important transactions and validation; drawing value from the design and outcome of this research. By doing this, deeper understanding about this phenomenon, or other technologies, can be developed; adding to the understanding of users’ perceptions, acceptance, behaviors, interpretations, or other similar functions and abilities.

6.5 Discussion of Managerial Implications

Managerially, the findings of this research relate to implications within service management by presenting significant information that can help in the development and improvement of mobile eID services. This could be essential in order to keep the existing pool of users as well as to attract new users to use this application. The total effect of the factor analysis indicated that perceived usefulness, subjective norm, and perceived ease of use is of paramount importance to the users. This implies that managers and marketers working with mobile eID apps should focus on these influencing factors when performing service management. This can be done by highlighting and improving the performance enhancement and the “free-of-effort to use” characteristic of the application; adding to the chance of creating an encouraging attitude towards using the application within a social context which positively affects subjective norm. To explain how this can be done in more details, the scope of usage of the application can be expanded upon by applying the service to even more contexts that include the need for identification verification (e.g. logging into internet websites, paying online, and handling important documents) and the interface of the application may be improved by making it simpler to use as well as reducing the time needed for performing the identification process. Even if not as significant as the previously discussed factors, perceived convenience, attitude, and perceived security also influence mobile eID usage. This implies that managerial emphasis should be put on the applications’ accessibility, qualities that influence a positive
attitude, and security to fully meet the existing and potential users’ requirements. The accessibility might be hard for the mobile eID app managers and developers to improve due to them having little influence on internet providers. However, as it is already highly accessible as long as the user has an internet connection, from a marketer's perspective, the good accessibility of the application is something that they can highlight. The attitude can be enhanced by improving the other factors mentioned, trying to perfect the overall user experience and the product that derives from using it. The perceived security, being the least influential factor, is also needed to be a focus of improvement. This can be done by, for example, improving the application’s source code, encryption code, and servers; decreasing the vulnerability and the chance that important information becomes available for those with malicious intent.

6.6 Strengths and Weaknesses of the Research

The strengths of this research relate to the success in finding the factors that are influencing the acceptance of mobile eID apps. By performing successful statistical analysis, using a robust model based on the frequently used and well accepted TAM together with a good model fit, the hypotheses were able to be tested and the result can be seen as reliable. In addition to this, due to the study’s quantitative nature and the relatively high sample size, the findings presented can also be generalized; reflecting the quality of the study. Another strength is that the refined model can be applied to various researches studying mobile service application acceptance; providing a good starting point for future exploration. Also, by specifically focusing on the country of Sweden, companies dealing with mobile eID apps in Sweden and neighboring countries with similar cultures can effectively use the result of this report and implement it in their operations.

The weaknesses of the report lie mainly in the sampling part of it. As the respondents’ country of origin were mainly Sweden, and that the 20 to 29 age group stood for 78 percent of the total sample, it can be stated that some possible biases were apparent. This may be due to the convenient sampling utilized in this research. This aspect could have been improved by asking a third-party specialized in finding relevant respondents for researchers to do the sampling, or by performing the face-to-face method more; making sure that the respondents’ demographic characteristics were more varied. Even though the sample size was sufficient enough for performing the hypotheses testing of this report, if larger, the demographic characteristics could have been included in the structural equation modeling analysis. To only focus on one country can also present itself as a weakness due to that it might be difficult for people in countries that are far away from Sweden geographically, culturally, and politically to be able to be sure that the specific factors of influence in this report are the most influential in their respective countries.

6.7 Suggestion for Future Research

This research provides a model for acceptance of mobile eID apps in Sweden. Due to differences in cultural, political, economic, and social aspects, the result would probably differ
if the research was carried out in another country. Hence, it is suggested that researchers implement a similar study but focusing on a different empirical site, testing the same factors but in different countries. Another suggestion would be to implement another model, for example the UTAUT model, to test the demographic characteristics of the sample. To do this as well as to be able to show reliable and valid results, a large sample size is needed, and the respondents’ demographic characteristics need to be varied. If this is done, the research will be able to illustrate how gender, age, and country of origin affect the influential factors on acceptance of the application. The factors that were proposed and proven to have an impact on mobile eID acceptance could also be extended upon in future research; testing other individual factors (e.g. trust, compatibility, and mobility) and hypotheses that also could influence user acceptance. If done, one could get an even more accurate view of the influential and non-influential factors of acceptance. It is also suggested that future research can explore the relationship between the concept of having an online personal identity and the adoption of mobile eID apps to see how it affects the perception of oneself when performing activities in an online environment. This could further help academics, managers, and marketers to understand user behavior and to better develop and improve the product. Lastly, to better understand user perception regarding mobile eID, a qualitative study on the underlying reason to why perceived convenience could not predict perceived usefulness and to why perceived security and subjective norm could not predict intention to use is suggested.
7 References


Davis, F. (1986). A technology acceptance model for empirically testing new end-user information systems: Theory and results (Ph.D). Massachusetts Institute of Technology, Sloan School of Management.


King, W., & He, J. (2006). A meta-analysis of the technology acceptance model. *Information & Management, 43*(6), 740-755. [http://dx.doi.org/10.1016/j.im.2006.05.003](http://dx.doi.org/10.1016/j.im.2006.05.003)


8 Appendix

8.1 Questionnaire Questions

Do you use a Mobile eID app? (e.g. Mobilt BankID) *
Använder du en mobil eID app? (t.ex. Mobilt BankID)

- Yes
- No

Country of Origin *
Ursprungsland

Your answer

Age *
Ålder

- <20
- 20-29
- 30-39
- 40-49
- 50-59
- >60

Gender *
Kön

Choose ▼
Frequency of Mobile eID app usage *
Användningsfrekvens av mobil eID-app

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I am currently using the Mobile eID app to verify my identity *
Jag använder för närvarande mobil eID-appen för att bekräfta min identitet

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Assuming that I have access to the Mobile eID app I intend to use it *
Förutsatt att jag tillgång till mobil eID-appen har jag för avsikt att använda den

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Using the Mobile eID app is a good idea *
Att använda Mobil eID-appen är en bra idé

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Using the Mobile eID app is interesting *
Att använda Mobil eID-appen är intressant

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Using the Mobile eID app is wise *
Att använda Mobil eID-appen är klokt

1 2 3 4 5 6 7
Strongly Disagree

Using the Mobile eID app is beneficial *
Att använda mobil eID-appen är förmånligt

1 2 3 4 5 6 7
Strongly Disagree

The Mobile eID app is a useful method for verifying my identity *
Mobil eID-appen är en användbar metod för att bekräfta min identitet

1 2 3 4 5 6 7
Strongly Disagree

Using the Mobile eID app makes verifying my identity easier *
Att använda mobil eID-appen gör det lättare att bekräfta min identitet

1 2 3 4 5 6 7
Strongly Disagree

The interaction with the Mobile eID app is clear and understandable *
Användningen av mobil eID-appen är tydlig och förståelig

1 2 3 4 5 6 7
Strongly Disagree
It is easy to perform the steps required to use the Mobile eID app *
Det är enkelt att utföra de steg som krävs för att använda mobil eID-appen

1 2 3 4 5 6 7

Strongly Disagree
Strongly Agree

Learning to use the Mobile eID app will be or has been easy *
Att lär sig att använda mobil eID-appen kommer att vara eller har varit lätt

1 2 3 4 5 6 7

Strongly Disagree
Strongly Agree

The risk of an unauthorized third party overseeing the identification process is low *
Risken för att en obehörig tredje part övervakar identifieringsprocessen är låg

1 2 3 4 5 6 7

Strongly Disagree
Strongly Agree

I would find the Mobile eID app to be secure when verifying my identity *
Jag tycker att mobil eID-appen är säker för att bekräfta min identitet

1 2 3 4 5 6 7

Strongly Disagree
Strongly Agree
I believe my information or data will not be manipulated by inappropriate parties when using the Mobile eID app *
Jag tror att min information eller data inte kommer att manipuleras av olämpliga parter när jag använder mobil eID-appen

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People close to me would recommend using the Mobile eID app *
Människor som är nära mig skulle rekommendera att använda mobil eID-appen

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People close to me would find using the Mobile eID app beneficial *
Människor som är nära mig skulle tycka att användningen av mobil eID-appen är förmånlig

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People close to me would find using the Mobile eID app a good idea *
Människor som är nära mig skulle finna användningen av mobil eID-appen en bra idé

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8.2 Frequency Tables of Questionnaire Answers

Frequency of Mobile eID app usage
396 responses

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<thead>
<tr>
<th>Frequency</th>
<th>Count</th>
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<td>1</td>
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<td>6</td>
<td>110</td>
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<td>7</td>
<td>175</td>
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</table>
Assuming that I have access to the Mobile eID app I intend to use it
396 responses

Using the Mobile eID app is a good idea
396 responses
Using the Mobile eID app is interesting

Using the Mobile eID app is wise
Using the Mobile eID app is beneficial
396 responses

The Mobile eID app is a useful method for verifying my identity
396 responses
Using the Mobile eID app makes verifying my identity easier

396 responses

The interaction with the Mobile eID app is clear and understandable

396 responses
It is easy to perform the steps required to use the Mobile eID app
396 responses

Learning to use the Mobile eID app will be or has been easy
396 responses
The risk of an unauthorized third party overseeing the identification process is low
396 responses

I would find the Mobile eID app to be secure when verifying my identity
396 responses
I believe my information or data will not be manipulated by inappropriate parties when using the Mobile eID app

396 responses

People close to me would recommend using the Mobile eID app

396 responses
People close to me would find using the Mobile eID app beneficial

396 responses

People close to me would find using the Mobile eID app a good idea

396 responses
The Mobile eID app is convenient because I can use it at any time
396 responses

The Mobile eID app is convenient because I can use it in any situation
396 responses