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THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN NEW AGE OF MARKETING: AN ANALYSIS ON AI MOBILE BANKING APPS

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Foreword

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Abstract

Mobile banking technology has been named as a technologic and innovational breakthrough in the field of banking. The increasing amount of data in banking and usage rate of mobile banking services via smartphones created a need for a high speed and reliable service. Artificial Intelligence (AI) technologies are being implemented into the mobile banking application structures to improve the general service provided. Mobile banking has been an important and slowly progressing field in the research world. In this study the research is based on AI mobile banking apps which will be released in the very near future. However, since the AI technologies have not yet been released by banks for the time being, there are no previous studies conducted on this precise topic to our knowledge. Therefore, this study aims to fill that gap. The study proposes an introductory research on AI mobile banking apps and their effects on mobile banking adoption using an updated version of the TAM model and TAM2 model. Privacy and Security constructs have been added to the proposed model aiming to find out the factors effecting mobile banking adoption and usage behavior regarding the app. A survey was conducted where the participants were given a demo of the AI mobile banking chatbot interface and screenshot images from certain application pages. The model was tested by using the data which was collected through a google forms survey and analyzed in IBM SPSS. The results showed that the output quality, perceived ease of use and perceived usefulness constructs had the highest effects in the model. This study contains future managerial implications and further research suggestions regarding the use and possible effects of AI mobile banking apps.

Keywords: Artificial Intelligence, Marketing, Mobile Banking Apps, Technology Acceptance Model

Özet

Mobil bankacılık teknolojisi, bankacılık alanında teknolojik ve yenilikçi bir atılım olarak tanımlanmıştır. Bankacılıkta artan veri miktarı ve mobil bankacılık hizmetlerinin akıllı telefonlarla kullanım oranı, yüksek hızlı ve güvenilir bir hizmete ihtiyaç oluşturmuştur. Yapay Zekâ teknolojileri, sağlanan genel hizmeti geliştirmek için mobil bankacılık uygulama yapılarına uyarlanmaktadır. Mobil bankacılık, araştırma dünyasında önemli bir konu olmasına rağmen yavaş ilerleyen bir araştırma alanı olmuştur. Bu çalışma, yakın gelecekte piyasaya sürülecek olan yapay zekâ ara yüzüne sahip mobil bankacılık uygulamalarını incelemektedir. Ancak, bu mobil bankacılık uygulamaları, henüz bankalar tarafından kullanıma sunulmadığı için, bu alanda bilgimiz dahilinde daha önce yapılmış olan bir çalışma bulunmamaktadır. Bu nedenle, bu tez konuya ilişkin önemli bir araştırma boşluğunu doldurmayı hedeflemektedir. Bu araştırma, TAM modeli ve TAM2 modelinin güncellenmiş bir versiyonunu kullanarak, yapay zekâ mobil bankacılık uygulamalarının mobil bankacılığın benimsenmesi üzerindeki etkilerini ve bu sistemler tanıtmayı amaçlamaktadır. Mobil bankacılıkta benimsenme ve uygulamanın kullanım davranışını etkileyen faktörleri araştırmak amacıyla, önerilen modele gizlilik ve güvenlik yapıları eklenerek güncellenmiştir. Katılımcılara, yapay zekâ mobil bankacılık uygulamasına ait bir chatbot tanıtım ara yüzü ve uygulamanın belirli sayfalarından ekran görüntüleri içeren bir anket verildi. Önerilen araştırma modeli, bir Google form anketi aracılığıyla toplanan verilerin IBM SPSS programında analizi ile test edilmiştir. Sonuçlar, çıktı kalitesi, algılanan kullanım kolaylığı ve algılanan kullanışlılık yapılarının modelde en yüksek etkiye sahip olduğunu göstermiştir. Bu çalışma, yapay zekâ mobil bankacılık uygulamalarının kullanımı ve bankacılık sektörüne olası etkilerinden bahsetmektedir. Sektöre ilişkin önerilere ve konuya ilişkin ileri akademik araştırma önerilerine yer verilmektedir.

Anahtar Kelimeler: Yapay Zeka, Pazarlama, Mobil Bankacılık Uygulamaları, Teknoloji Kabul Modeli

INTRODUCTION

During the last century an unprecedented change in the digital world has caused big shifts in the economic and financial field. With a continuously growing middle class, more and more people became active users on social networks, and new generations who grew up with technology around them, the personal and business environment changed drastically. (Stoicescu,2015)

With the latest technological innovations and discoveries, the marketing system has become something more than simply introducing newer models of existing products or services and their accompanying upgrades. The end products have switched from being sold in boxes, to ground breaking ideas in the form of computerized virtual experiences. With this shift from tangible solutions to intangible ubiquitous concepts, the traditional marketing system has been forced to change into a digitalized modern marketing notion, in order to keep up with the fast pace of the ever-changing liquefied technological advancement movement. The concept of solely digitalized marketing approaches such as E-Commerce and Social Media Marketing emerged with this movement. After these developments it became well established that consumers had become more "connected" than they ever had been. This was mainly due to the popularity of social media, as well as the rapid propagation of smartphones. (Stephen,2017)

As the society adapted to the digital age, a gravitation towards singularity, personalization and self-serving systems surfaced. One of the biggest technological key discovery that initiated the sudden shift to digitalized marketing, has been the introduction of Artificial Intelligence. AI has not only changed the consistent evolutionary pattern of science and technology world but the future of society, by becoming one of the most important breakthroughs of the 21st century.

To keep up with the highly increasing amount of demand towards digital solutions and technologies, a system with a high intelligence and profoundly fast data processing capabilities was necessary. As a solution to that the AI systems were slowly introduced into the business world and started being used as a part of the

new age innovative marketing tools. AI systems gradually expanded in to areas like medicine, education and later on, marketing.

With the rising number of users of applications and certain technologies, the notion of data storage became more vital in the process of enhancing personalized customer experience. But the unexpected load of data and high rate of users was creating a mass of information lumps that the normal daily work life couldn't handle. At that point, the AI systems were introduced to aid with cleaning and sorting the data output, which was now called as "big data".

AI systems could handle processing big data sets belonging to millions of customers of a firm and still be able to create extremely rapid personalized and verified recommendations for each individual customer. With regard to the previously mentioned emerging developments, it can be said that the importance of keeping up with the data and AI trends has become highly vital, to ensure continuous success in marketing. Andrew T. Stephen (2017) mentioned about the current viewpoint of marketers on data and its use in marketing by stating that: "Marketers enjoy having access to more and richer data due to the rise of the connected, always on consumer. This is fueling better customer insights and the infusion of data into all facets of marketing and brand management." Thus, this thesis aims to become a sort of guide towards the steps of potential future adoption of AI technologies and infrastructure usage in the mobile banking sector.

1.1. The Research Problem and the Limitations of the Previous Research

The recent dated research on mobile banking is fairly new and very little research has been conducted on the topic in the last decade. The research topic is focused on a type of technological tool (a mobile app) that is constantly and drastically evolving (sometimes even in a time frame such short as a few days) which is why it is important to conduct a research which is solely focused on how fast the system is evolving and using only the most recent and updated sources available. Since the AI systems are very new to the subject there hasn't been any articles or theses addressing the effects or possible changes of the AI technology on the mobile banking app sector, the main aim of this thesis is to address that gap and try to conduct the first research on the field to our knowledge. The main limitation for this thesis is the lack of resources and prior research on the area AI mobile banking apps and their adoption rates. The number of previous research conducted on mobile banking adoption was a calculated at a total of 55 in the timeline between January 2005–March 2014 (Shaikh& Karjaluoto, 2015).

By proposing a simple yet powerful research question like; What AI technology is based on and what are the possible usage and effects of it in the area of Mobile Banking applications as well the possible forecast of reactions which might be received from the customers, this thesis is aiming to offer valuable insights for marketing executives who are working in the implementation of new technological interfaces for their firms. As well as, firms which are seeking for a short guide map on how AI mobile banking application services evolving and certain future insights on the area. As for the academics, this thesis aims to create a new subdivision to the topic of the TAM 2 model Mobile Banking Application research by implementing a newly introduced technological addition of Artificial Intelligence systems, into the study.

1.2. Significance and Aim of the Study

The significance of the study is that it aims to become the first research on the area of AI mobile banking application and factors affecting the adoption rates by using a modernized version of the TAM 2 model (Venkatesh & Davis 2000). The thesis is multidisciplinary in the sense that, it's based on diverse fields such as marketing, finance, computer science and information technologies.

1.3. Organization of the Study

The variables in the model are mostly aligned with the TAM 2 model (Venkatesh & Davis 2000) but there are a several additions which are vital in the process of an added new AI technology which was not a part of the equation at the time the original model was created. In process of deciding which variables to add to the model, several important theories in similar context was researched. Technology Acceptance Model (TAM) (Davis,1989), Universal Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003).

2.LITERATURE REVIEW

2.1 Definition of Artificial Intelligence

The technological revolution has brought together a large number of devices and systems to help solve difficulties that are come across in many daily life activities. A lot of these devices and systems are focused on solving problems where the human mind or strength is considerably vague when compared or there is a need of upgrades and powerups to the current system. The effect of the digital (information) and industrial revolutions has been undeniably significant on essentially all aspects of life, society, firms as well as employment. (Makridakis, 2017)

Artificial Intelligence can be named as one of the greatest system inventions regarding the mentioned technological revolution. It is a mysterious case in the sense that the concept itself was coined in the early 1950's but the functions of the Artificial Intelligence systems and subcategories have taken a long time to enter the daily life systems, and to this day there is still slow yet large steps being taken to appropriate AI systems or AI powered structures into areas like economics, marketing, healthcare and banking. It is vital to first understand how the term Artificial Intelligence was first coined and what the basic principle of AI is. That is why in this section, the paper will be focusing on the historical evolution of AI, certain tools of AI and the possible usage of AI systems today, then it will focus on how it is slowly starting to be used in mobile banking services and the advantages of the system. Later on, in the next section mobile banking services will be discussed.

Even though there had been some research regarding intelligence and its applications on electronic tools prior to the 1950's, there was no clear research that was proposing even the possibility of computational intelligence existing. It was for the first time actualized as a concept when Alan Turing published an influential paper titled "Computing Machinery and Intelligence" in 1950 questioning the probability of programming an electronic computer to behave intelligently by asking "Can machines think?". (Haton, 2006, Turing, 1950) As an addition to this paper Alan Turing later on developed a test called the "Turing test" which was designed to determine whether a machine could be determined as intelligent. (Perez, Deligianni, Ravi, & Yang, 2018)

Shortly after Alan Turing's test and paper was published in 1950's, at the 1956 "The Dartmouth Conference" the expression "Artificial Intelligence" was coined for the first time as the title of the field. (Perez, Deligianni, Ravi, & Yang, 2018)

> *"Professor J. McCarthy at Stanford University, Professor M. L. Minsky at the Massachusetts Institute of Technology, and Professors H. Simon and A. Newell at Carnegie Mellon University (all four of whom were awarded the Turing Award), along with C. E. Shannon (also known as "the father of information theory") at Bell Labs, N. Rochester at IBM, and other scholars*

took part in the process of establishing the AI concept in "The Dartmouth Conference". (Pan, 2016)

Following these advancements, in 1969 the first International Joint Conference on Computer Science was held in the state of Washington and the term "Artificial Intelligence" (AI) was officially introduced in to the system. (Kornienko, Kornienko, Fofanov, & Chubik, 2015)

Creating a complete timeline of AI dating from 1950's till today would be highly difficult to include in this thesis thus, only a brief timeline of AI innovations will be listed to form an idea on how the AI technology progressed throughout the years.

Table 1. AI revolution timetable

AI revolution timetable	
1990	Neural net device reads handwritten digits
1993	Robot Polly navigates using vision
1997	Deep Blue defeats the world chess champion
1998	Robotic toy Furby learns how to speak
2005	Robot ASIMO serves restaurant customers
2009	Google's first self-driving car
2011	Watson computer beats Jeopardy's
2016	AlphaGo defeats GO champions

Source: Makridakis, S. (2017).

By drawing a conclusion from Table 1 it can be said that, the evolution of the AI systems first starts with the system learning how to read and comprehend the datasets, then learn about senses and navigation, take the form of a robotic device and serve the public (for ex: in the form of a toy or a robot). Also, becoming a master at mathematical based games such as go and chess and eventually evolving into a self-driving car is included in the capabilities of AI throughout the years. At this point it is crucial to ask the question of what AI really is and to understand the systematics lying underneath to this multipurpose use technological system.

In the previous researches there have been a variety of definitions belonging to various research topics, some which are focused on the scientific explanations and some which are focusing on the general outlines. In this thesis due to its research topic belonging to marketing, only few general outline descriptions and definitions belonging to similar research areas will be assessed.

After coining the term Artificial intelligence in the 1956 Dartmouth Conference, the previously mentioned team of professors and scholars defined Artificial Intelligence as: the ability of machines to comprehend, think, and learn in a comparable way to human beings, indicating a possibility of using computers in order to simulate human intelligence. (Pan, 2016)

In a report titled “A Brief Introduction to Artificial Intelligence”, a definition of AI was included which suggested that; Artificial Intelligence is working with designing and implementation of computer systems which are capable of solving problems that are highly complex or are a part of natural tasks which require the ability of humans and usually aren’t able to be solved with classic algorithm-based methods. (Haton, 2006)

According to the "Dictionary of Cybernetics": Artificial Intelligence is "an artificial system that simulates solution of problems by human during his life." (Kornienko, Kornienko, Fofanov, & Chubik, 2015) A very recently published report focusing on the history and research on AI and robotics formed a very thorough and detailed explanation of the AI concept by stating; Artificial Intelligence is a study focusing on human intelligence and actions that are reproduced synthetically, where the design brings a level of rationality, which eventually may outsmart the human intelligence, to aid with specific and detailed tasks. The term AI is generally used to refer to the field of science which proposes to supply machines with the capability of operating in actions such as, reasoning, planning, learning, logic and perception. It surrounds the whole concept of a machine that is intelligent both in terms of operational and social outcomes. (Perez, Deligianni, Ravi, & Yang, 2018)

A more scientifically focused definition explains it as; “The core of the artificial intelligence focuses on the development of valuable, automated solutions (intelligent agents or systems) to problems which would require the intervention of intelligence if it were done by humans” (Negnevitsky, 2004). A more holistic

definition was included in an article published by (Martínez-López & Casillas, 2013) in which they mentioned “intelligent systems”, focused on the daily use and aims of it by stating that: Intelligent systems have distinct capabilities and stabilities to assist strategic natured decision-making cases faced by firms, where there is a need of good strategic intelligence.

(Kornienko, Kornienko, Fofanov, & Chubik, 2015) define Artificial Intelligence from a strategic application point of view by mentioning that: AI is known to be a system that mimics the solution of complex problems faced by the humans in a duration of a lifetime. But while defining AI they also mentioned about key issues in the analysis and application of AI by claiming that: The construction of symbols and operations, through which intellectual solutions are implemented, as well as seeking for strategic reference points for the mentioned solutions, which are caused by certain structures of symbols and operations are considered as a part of the main set of issues in the analysis and application process of AI.

After several literature definitions and a historical overview, it is important to point out several subcategories such as aim, importance, usage, abilities and advantages of AI. This literature review part will continue to introduce the mentioned categories in the given order.

The aim of Artificial Intelligence is to uncover adaptive mechanisms with the usage of intelligence, which will function in a changing environment. For example; the capability of excluding unlikely solutions and adapting it accordingly. (Hil'ovská & Koncz, 2012) In an environment where the technological systems and the surroundings are a part of a constant change, one of the most important aims of AI is creating certain adaptive solutions according the pace of the continuum. (Makridakis, 2017) mentioned that AI aims to reinforce, deepen and serve as a substitute for nearly the entire set of tasks carried out by humans. Today artificial intelligence has a vital role in various fields of daily life and is focusing its aim on creating a computer system that has an intelligence similar to human beings. (Kornienko, Kornienko, Fofanov, & Chubik, 2015) AI’s current achievements and multidisciplinary nature has caught the attention of both the public eye and the scientific society as well as slowly started proving its importance. As for the importance of AI today, it is widely accepted that AI has an importance since it

strengthens human abilities as well as their productivity, and this importance is reflected through the expeditious increase in the number of investments on AI in many companies and organizations. Some sectors which are investing on AI can be listed as; healthcare, banking, energy, marketing, financial services, management consultancy, manufacturing, advertising and government administration. (Perez, Deligianni, Ravi, & Yang, 2018)

After the first part of the research it can be said that the aim and importance of AI is nearly undeniable, but in order to support that claim, it is of great importance to explain the variety of fields AI is used in, what abilities it has and the advantages it brings to the society.

Artificial intelligence is dealing with conundrums of categorization, forecast and optimization blended cases, which can be identified as intelligence in decision making, where the problems cannot be solved with simple solutions. Fields where this type of problem is typical are economics and banking, since they require a precise and meticulous decision making in a continually shifting market, AI's usage is both ideal and carries importance in reaching a successful solution. (Hil'ovská & Koncz, 2012) The unique importance of the Artificial intelligence technologies comes from their ability to enhance, deepen and stand-in for nearly all duties that are being completed by humans (Makridakis, 2017). As for the abilities of the AI systems in a mix perspective of academics and business it can be said that, AI has a broad variety of knowledge about domains of application. The problem of obtaining knowledge and its representation as an output are key points in AI development. In the last few years AI technologies have been entering fields like economics and banking, an example of the AI system integration in those fields can be "decision support systems". These systems are interactive computerized systematics which aim to support and enhance the decision-making process in complicated situations where a quick and critical decision is required by the maker of the decision such as; assessing risks or managing resources (Haton, 2006). The importance of AI also lies in its ability to both uncover undisclosed information in a large quantity of data and produce fast and trustworthy solutions. Studies have also shown evidence that supports that the AI methods are suitable for several economic implementations due to their capabilities in processing nonlinear

relationships, in learning, evolving and making decisions at an expert level (Hil'ovská & Koncz, 2012).

According to (Martínez-López & Casillas, 2013); AI creates new opportunities for accelerating the analytical methods and systems that firms use in order to solve a number of marketing issues they have come across. Well planned and designed artificial intelligence systems are expected to outperform normal statistic-based tools of support in the sense that they can solve more complex, quality focused marketing problems and decision-making schemes.

In the last decades there has been a fast shift towards creating a vast amount of data through modern information systems, the world wide web in order to carry out evidence-based marketing. Technologic subcategories of AI such as data mining, predictive modeling, data analytics and big data progressing very quickly and have started to be used as robust apparatus in the modern marketing world. The most recent and advanced form of artificial intelligence creates several automated processes and applications which have the capability to change the course of the everyday business life, therefore there is deemed to be a large potential of economic outcome and advancement (Stalidis, Karapistolis, & Vafeiadis, 2015). With the forthcoming new artificial intelligence 2.0, gathering a more valid insight and practical administration towards interaction with sophisticated comprehensive systems such as; economic management and financial risks (Pan, 2016).

In the next part mobile banking, which is one of the biggest and newest addition to the field of AI system integration will be discussed.

2.2 Definition of Mobile Banking Applications

Banks are organizations that are running in the financial business territory and are concerned with actions like giving out loans, deposits management and investments in capital markets, as well as others. Since the banking business is vital for the existence of the economy, it carries significant importance for researchers from a variety of area of expertise, for instance marketing, finance and information technologies (Moro, Cortez, & Rita, 2015). The rising development of the Internet has created an information technology-based transformation in the financial

services field which has thoroughly changed how the banking products and services are being delivered to the customers (Hanafizadeh, Keating, & Khedmatgozar, 2014). The expeditious confluence of the technology and the banking fields are a crucial point in question for the future of the banking industry (Morgan, 2017).

In this section the recent history of banks and banking services, introduction of tech banking, mobile banking apps and the digital revolution in banking services will be discussed. In order to understand how the mobile banking apps were developed and what purpose they serve, it is vital to analyze their definitions, usage and importance as the paper has done previously in the AI section.

Banks have been service points for customers throughout history and slowly evolved by adapting several specialized services according to the technological developments and the shifting customer needs. Shu&Strassmann, (2005) claim that the banking industry has been productive in innovation regarding informatic systems and technologies. The globalization of business and technological systems has created an importance on the need to understanding the mobile banking usage as well as the essential determinants that have an effect on the mobile banking usage (Baptista&Oliviera,2016). The main factors which are affecting the mobile banking usage and adoption will be discussed thoroughly in the proposed research model section of this thesis. There is a need to comprehend the mobile banking adoption through researching the factors that are influencing the customer's intentions toward using mobile banking services. By doing this, it may act as a guide in strategic planning and help the decision-making process in banks while creating or implementing a new type of mobile banking services to a variety of differentiated customers (Aboelmaged & Gebba, 2013). As for the banking professionals, understanding the customer's motivations in mobile banking usage can help them develop strategies for improving the adoption of new banking technologies (Hanafizadeh, Keating, & Khedmatgozar, 2014). In the last years, there has been considerable changes that have been occurring in the fields of delivery and consumption of financial services. The banking sector is one of the leaders in the adoption and utilization of the internet and mobile technologies on their customer markets. Therefore, the structure of the bank's service delivery has gone through unexpected changes throughout the history. The advancement of banking services

through numerous electronic mediums has allowed an environment where it is possible to create new types of added value for the consumers (Laukkanen, 2007). With the introduction of mobile phones and other carry-on technological devices, the notion of the bank as a location shifted into an all access almost virtual concept. As mentioned previously a vast amount of data such as the customer information, transaction data, credit reports, billing etc. is being created and stored, but this has created a need of processing that data in a comprehensible output rapidly, with the least number of mistakes. The expansion of smart mobile phone users halfway through the 2000's assisted in the progress of the advancement of mobile finance categories like mobile banking and payment which are an extension the larger concept; e-finance. The introduction of the wireless technology, the internet and its combination with the expansion of smartphone usage has created a pathway for the rapid development of mobile financial services (Kousaridas, Parissis, & Apostolopoulos, 2008). Following this introduction, banks created a platform on the mobile devices of the customers where they can not only access their bank account credentials but carry out monetary based transactions like paying bills and transferring money. The effects of the web based technological advancements have noticeably been seen in the industry of banking. Banks rapidly took up the modern technology innovations which created new communication mediums (Moro, Cortez, & Rita, 2015). The innovational implementation of these technologies has provided benefit to nearly all segments of the banking business value chain due to its nature of time sensitivity and information intensity (Lee & Shin, 2018) In one of the previous researches, evidence regarding the relationship between the technological its effects on the productivity in banking was found. (Berger,2003) With mobile banking emerging, the payment systems and the systems of processing the monetary input changed accordingly. Mobile payment technologies were introduced, which became a modernized alternate to currency, banking checks and credit cards and were adapted quickly by the public (Liébana-Cabanillas, Marinkovic, Luna, & Kalinic, 2017). These advancements in the information technologies had an extensive effect and significance on the banking sector by creating easy to use new payment tools which expanded the elasticity of the services (Bidarra, Leiva, & Cabanillas, 2013). Even though the mobile banking services

have been regarded as revolutionary in regard to remote banking services, the customers have become hesitant to use the services due to several mobile banking usage affecting factors including security concerns (Muñoz-Leiva, Climent-Climent, & Liébana-Cabanillas, 2017; Bidarra, Leiva & Cabanillas, 2013). Technological immaturity, early adoption and fear of users are some of the issues that have put a limitation on the progress of mobile payment and banking system adoption (Kousaridas, Parissis, & Apostolopoulos, 2008). This is one of the most prominent issues related with mobile banking applications today, thus is included in the proposed model and will be discussed in detail, further in the thesis.

In recent studies, mobile banking is claimed to be a type of financial service through an electronic process where the customers combine the use mobile of mobile devices with the mobile connection methods to carry out financial transactions. (Anderson, 2010) Before banks focused their attention to the mobile version of their banking services, they introduced an online version of their main banking services to the customers which was named as internet banking since the customers were accessing the services through the internet. After the emergence of technologies such as 3G internet on the go, portable phones with simplified applications belonging to institutions it was certain that there had to be a major change towards the mobile applications. That was when the banks joined the mobile app trends and created a virtual portal, a substitute of the real bank that can give service 24 hours days a week. This cleared out a major complication of the banking service; the working hours. Prior to the internet and mobile banking applications, the customer had to arrive at the bank inside the working hours in order to get service. The internet banking channel is constructed to reduce the incoming number of customers in to the banks, decrease the operational costs an allow customers to complete all of their banking transactions, with one exception being, actual cash withdrawal (Marafon, Basso, Espartel, Barcellos, & Rech, 2018). Through the internet banking, the customer could access the banking services if they had access to a computer, but there were still some limitations. Cost-saving in mind, banks provided offers and incentives to customers to get them to use the internet banking services (Marafon, Basso, Espartel, Barcellos, & Rech, 2018). With the introduction of mobile banking applications, the banks were virtually available in

the pockets of the consumers at all times. According to Tam & Oliveria (2017); Mobile banking is a service/product that is using portable technologies as a tool of service and is extended out to the customers of a bank, by the bank. Mobile banking can also be described as; providing the customer a banking channel through the use of mobile devices that allows them to access their financial data, communication and banking transactions such balance checks, fund transfers and other banking services at any time and from virtually any location (Ensor et al., 2012) One of the most notable features of mobile banking systems are their abilities to be available for use at any time and without regard for geographic location, which allows immediate access/actions and saves time in the service use. The convenience of the service, ease of access regardless of time and place and the private nature of the mobile banking are some of the advantages that increase the usage of this type of technology-based banking solution (Laukkanen, 2007). Mobile banking caries crucial importance for both the customers of the banks and the bank itself. Several advantages of mobile banking for both the banks and the customers can be listed as; increasing the amount of services and content available, currency transfers, bill payments, trades, loans, automatic check payments, virtual advising, personalized savings plans etc. (Baptista & Oliveira, 2016). M-banking shortens the amount of time spent with banking activities, reduces the costs by providing customers the ability to review their transactions, pay their bills, transfer money, check their remaining balances, and access to other banking services through a single point of service, without the need to visit a bank branch or call the bank's customer service center which is much more expensive when compared (Kim et al., 2009; Hoehle et al., 2012). As for the advantages for the financial industry mobile banking creates, cost savings, attracts new customers, helps maintain old customers as well (Hoehle & Huff, 2012) Other benefits of mobile banking are; decreased operational costs, briefer turnaround times (TAT), instant live organizational data access, easy communication base within the institution, a beneficial interaction with current and future customers and supplying new value-added services like admittance to professional information in the field of financial management. (Nielsen, 2002; Sathye, 1999) The mobile banking tool is also used by the banks to cross and up sell their more sophisticated products and services, e.g. school loans and credit

cards etc. The mobile banking channel aids banks in the process of improving the efficiency of the service operations, cost effectiveness and customer satisfaction (Tam & Oliveira, 2017). Mobile banking has a place at the center of the customer relationship, day by day it is turning into a point of difference and becoming a possible source of income for growing banking institutions (Ensor &Wannemacher, 2015). Mobile banking services are also able to the boost the volume of data processing as well as enhancing the performance of the operations in the bank (Aboelmaged & Gebba, 2013).

After mentioning the attributes, usage and importance of mobile banking it is important to focus on the technological infrastructure behind the system and the possible futuristic progress route it might follow in the near future. Considering the recent, advancements in the field of information technology, essentially the entire banking services and processes have become computerized therefore are creating vast amounts of data. (Moro, Cortez, & Rita, 2015). As the amount of data created and digitally stored is rapidly increasing, retrieving and analyzing relevant sets of information is becoming a harder task (Harris,1992). Banking institutions have large databases where critical customer data is stored, can be retrieved and extracted for decision making purposes regarding the banking transaction behavioral patterns of the customers. In banking branches, most of the data analysis solutions are brought in through the banking computer service staff and banking consultants depending on the category of the complications they've come across. A big advantage that the mobile technologies have over the traditional bank branches is that; they are bringing all solutions and services together and combining them into one unified single access point. By doing so, the technological structure helps reduce costs from eliminating processes from identification, assembly and processing of colossal amount of critical data (Ogwueleka, Misra, Colomo-Palacios, & Fernandez, 2015). Technologies like data mining/analytics, predictive modeling and big data have quickly progressed in the data extraction field and have already become authoritative tools in modern day marketing and banking fields (Stalidis, Karapistolis, & Vafeiadis, 2015). These technological tools belong to subcategories of the previously introduced artificial intelligence systems. They can store, extract and process the vast amount of data buildup that the banking

institutions are facing, multiply the working speed while decreasing the work costs and provide high quality, reliable banking solutions to the customer all through a single service point. At this point of the thesis, the ideation of a predictive model of mobile banking app with an AI infrastructure will be introduced with its possible advantages and contributions it will bring to the mobile banking field. AI technologies like data mining and big data have already been used in fintech; financial technologies in the last few years. Data mining is a mechanism that can extract valid, previously undetected and understandable information out of massive databases and apply the outcomes of the data on important decision-making processes (Simoudis,1996). It can help in the process of finding connections between assets and creating forecast models established from a variety of data input. Appropriating historical data, short term exchange rates (Buryan, P., Taušek, J., 2008); interest rates (Liberopoulou, 2006); and stock prices (Shaaf, 2000) can be forecasted (Hil'ovská & Koncz, 2012).

If the AI systems are integrated into the mobile banking apps, there will be cost saving, a large boost in the quality and speed of the banking services and new services which are personalized, and customer focused will be introduced. AI can be used for helping with the evaluation of the systematics as a whole and bringing out unified resolutions for ubiquitary complications therefore, increasing effectiveness, capability and customer satisfaction (Harris,1992). According to Tam & Oliveria (2017), performing banking services at a top-level can improve time saving features and effort also, by adding the AI mobile banking apps into the system the customers are given flexibility to choose whichever channel they need at that time. If there aren't solutions like the proposed model, problems like system unavailability can damage the image of the bank and decrease the customer satisfaction level of the service provided. By enhancing the quality of the mobile banking interfaces, previous users will keep using the services and new potential adopters will be attracted, and consequently improve the personal performance in return (Tam & Oliveria 2017). To sum up, it can be said that the implementation of AI technologies into the currently available banking infrastructure is much more intelligible rather than choosing to get help from a completely disconnected versions of stand-alone artificial intelligence mechanisms (Harris,1992).

In the next part, the factors affecting mobile banking adoption and the proposed model will be thoroughly discussed.

2.3 Definition of the Technology Acceptance Model (TAM)

In previous mobile banking researches, several reputable models have been used such as; "Innovation Diffusion Theory (Rogers, 1983), Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1980), Theory of Planned Behavior (TPB) (Taylor & Todd, 1995), Decomposed Theory of Planned Behavior, (Taylor & Todd, 1995), Technology Acceptance Model (TAM) (Davis, Bogozzi &Warshaw, 1989), Technology Acceptance Model 2 (TAM2) (Venkatesh & Davis, 2000), Technology Acceptance Model 3 (TAM3) (Venkatesh & Bala 2008) and Unified Theory of Acceptance and Usage of Technology (UTAUT) (Venkatesh, Morris, Davis & Davis, 2003; Zhou, Lu, & Wang, 2010). One of the most used models in research of mobile banking adoption has been the Technology Acceptance Model. It carries importance in the sense that the factors of the model are applicable directly to mobile banking usage behavior. Recently there have been some studies using the UTAUT model as well and it is slowly becoming reputable in the studies of M-banking.

The model of this thesis is formed from the combination of TAM (Davis, Bagozzi &Warshaw, 1989), and TAM2 (Venkatesh & Davis, 2000) models, with the additions of Privacy and Security embedded into the model. The aim of the TAM model is to help analyze certain key factors affecting the user's behavior towards using the technological tool in the research.

2.4 Proposed Research Model

In this thesis model two newly introduced factors which weren't available before were added; security and privacy. These variables were added after the implementation of AI concept in to the mobile banking apps. The variables of the model can be listed as; Output Quality, Result Demonstrability, Personal

Innovativeness, Percieved Usefulness, Percieved Ease of Use, Intention to Use, Security, Privacy, Usage Behavior.

Technology Acceptance Model (TAM):

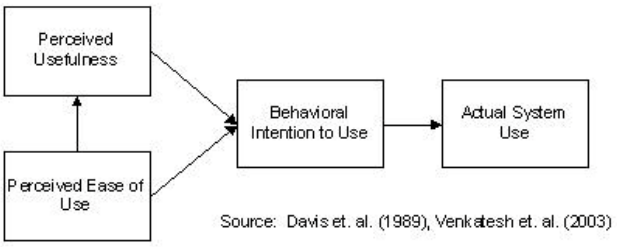

Fig. 1 Technology Acceptance Model

Technology Acceptance Model 2 (TAM2):

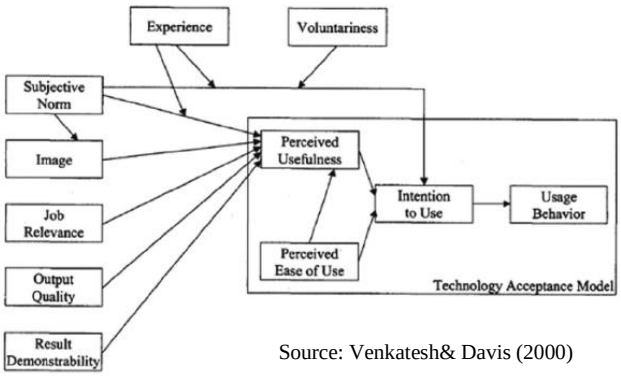

Fig.2 Technology Acceptance Model 2

Proposed Model:

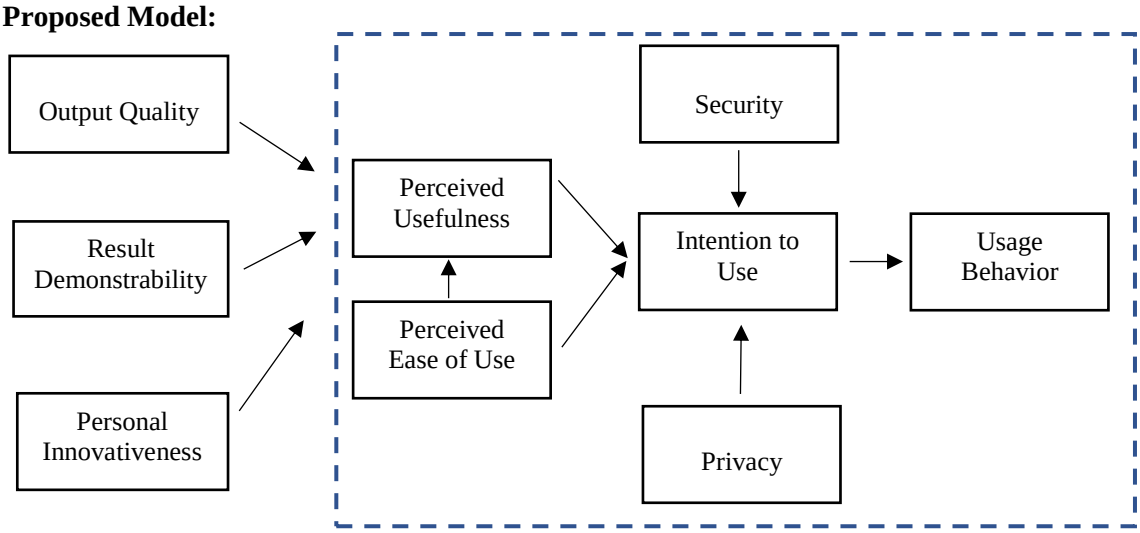

Fig. 3 Research Model

Hypothesis Table:

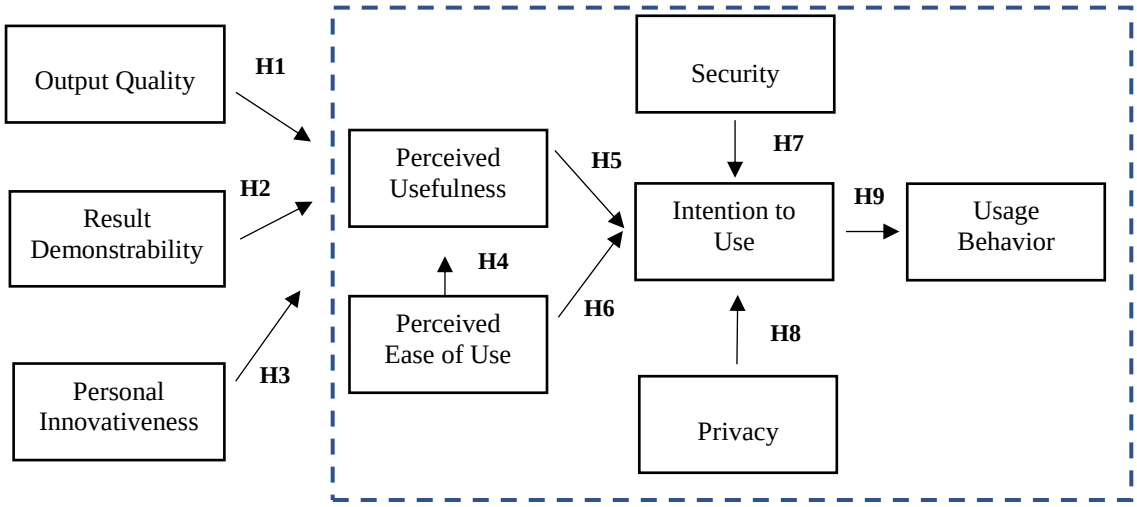

Fig. 4 Hypothesis Table

Hypotheses:

H1. Output quality of AI Mobile Banking Applications positively influence the perceived usefulness.

H2. Result Demonstrability positively influences perceived usefulness of AI Mobile Banking Applications.

H3. Personal Innovativeness positively influences perceived usefulness of AI Mobile Banking Applications.

H4. Perceived Ease of Use has a positive effect on perceived usefulness of AI Mobile Banking Applications.

H5. Perceived Usefulness positively influences intention to use of AI Mobile Banking Applications.

H6. Perceived Ease of Use positively influences intention to use of AI Mobile Banking Applications.

H7. Security has a negative effect on intention to use of AI Mobile Banking Applications.

H8. Privacy has a negative effect on intention to use of AI Mobile Banking Applications.

H9: Intention to Use has a positive effect on Usage Behavior of AI Mobile Banking Applications.

2.4.1 Output Quality

The output quality is based on the user's perception of how efficiently the system working is while completing the tasks given by the user. It goes beyond focusing on which tasks the system can complete, whether they are relevant and matching the job description, but rather questions how well the quality of the output (the quality of the results coming out of the app) is. In the case of AI mobile banking apps, the output quality is determined by how fast, efficient and accurate the system is operating, as well as the accuracy and verifiability of financial solutions or recommendations the system is proposing as an "output" to the consumer. From an empirical approach, Davis et al. (1993) had previously demonstrated the existence of a relationship between output quality and perceived usefulness. Venkatesh & Davis (2000) claim that if the user was given a chance to choose from a variety of relevant services, the decision would be based on selecting the one that can deliver the topmost output quality. In light of this information, the hypothesis below has been proposed;

H1. Output quality of AI Mobile Banking Applications positively influence the perceived usefulness.

2.4.2 Perceived Usefulness

Perceived Usefulness has also become a widely researched construct since its introduction in the first TAM. It is important in the sense that, it plays a key role in convincing the user to actually believe (perceive) that the services are useful and continue their act of mobile banking adoption. Davis et al. (1992) defines perceived usefulness as, the user perceptions on the output of the experience. Later in another study, Davis (1993) claims that, it is the user's idea that using a new technology will improve their performance. Hernandez et al. (2011) and Tan & Teo (2000) have suggested that in the process of determining the adaptation to innovations, usefulness plays a key role. In several studies a positive relationship between perceived usefulness and intention/attitude to use has been discussed (Karahanna et al. (2000), Pavlou (2002), and Taylor & Todd (1995). With respect to previous studies, the hypothesis below has been proposed.

H5. Perceived Usefulness positively influences intention to use of AI Mobile Banking Applications.

2.4.3 Result Demonstrability

Result Demonstrability has been defined as the "tangibility of the results of using the innovation" (Moore & Benbasat, 1991). The successful systems might have a challenging time keeping the mobile banking adoption rates, if they are not able to physically prove the attributes/benefits their app is proposing and the attributes/benefits are not matching the customer's specific use aim of the app. Venkatesh & Davis (2000) claim that, result demonstrability has a direct effect on perceived usefulness and if an app can produce productive, relevant yet ambiguous results expected by the users, it is not probable for the users to comprehend how useful the actual system is. In previous studies, Agarwal & Prasad (1997) has found empirical data showing that there is a high correlation level between result demonstrability and usage intention. Therefore, focusing on result demonstrability carries significant importance in the sense that, it directly influences the perceived

usefulness of an app, viewed from the perspective of users. The hypothesis below has been proposed in regard;

H2. Result Demonstrability positively influences perceived usefulness of AI Mobile Banking Applications.

2.4.4 Perceived Ease of Use

Ease of use is described as the user's notion of perception which claims that the act of using a system is effort free and merely simple to use (Davis, 1989). Venkatesh & David (2000) suggest that; the performance of the system increases as the system usage is easy and effortless. There has been extensive use of perceived ease of use in studies and empirical data has been formulated which suggests that perceived ease of use is highly linked to intention, through its effect on perceived usefulness (Davis et al.,1989; Venkatesh,1999). It has recently been discovered that in mobile banking, ease of use is significantly in relation with intention to use (Amin et. al, 2008). Another study claimed that, perceived ease of use didn't have a positive correlation with online banking usage (Pikkarainen et al., 2004). Since there were many models basing their hypotheses on the question of the effects of ease of use, it can be said that including it in this model was also vital in the process of conducting research on factors affecting mobile banking adoption rates. If the app is easier to use, the user has an elevated level of perceived usefulness towards the results received from the app. If the app is easier to use and simplifies the tasks for the customers, their intention to use the app will increase. Perceived ease of use features such as; looking through and analyzing data, making transactions can create an advantageous and fascinating personal experience (Aboelmaged & Gebba, 2013; Chen et al., 2002; Heijden et al., 2003; Kleijnen et al., 2004; Robinson et al., 2005)

Therefore, two hypotheses were proposed below regarding the information mentioned;

H4. Perceived Ease of Use has a positive effect on perceived usefulness of AI Mobile Banking Applications.

H6. Perceived Ease of Use positively influences intention to use of AI Mobile Banking Applications.

2.4.5 Personal Innovativeness

According to Agarwal & Karahanna (2000), personal innovativeness in the IT field symbolizes a user characteristic trait that shows an enthusiasm towards trying out the newest technological advancements. Since the users are familiar and likely to understand using the technologies easier, personal innovativeness has a positive effect on shaping the perceived usefulness of the user. Malaquias & Hwang (2016) mention that with information from previous researches it can be said that, personal innovativeness has positive relationships with intention to adopt a mobile credit card (Tan, Ooi, Chong, & Hwe, 2014) and intention to adopt mobile banking technologies. By using personal innovativeness as an identifier for users who are likely to adopt a new technological advancement prior to other users (Agarwal & Prasad, 1998), a more specific and direct targeting can be planned. When used in the mobile banking field, personal innovativeness can help reduce the level of uncertainty (Montezemi & Saremi, 2015) regarding the app etc. and positively contribute to the ease of use (Lu,Yao, & Yu, 2005) and trust (McKnight et al., 2002). Personal innovativeness has been proven to have a positive effect on the adoption of internet banking systems (Yiu et al., 2007) and a positive correlation with the adoption of IT systems (Hwang, 2014). With the presented data in mind, the hypothesis below has been proposed;

H3. Personal Innovativeness positively influences perceived usefulness of AI Mobile Banking Applications.

2.4.6 Security

This addition in the model is vital for AI mobile banking apps and the effects of it on the user adoption rate. Security risk can be defined as, the possibility of a loss of data, resulting from unauthorized individuals accessing classified information (Lee, 2009). Mobile banking services, especially the AI mobile banking apps have highly important data processing infrastructures, thus maintaining the highest level of security is vital. Any unauthorized access or loss of the mobile bank user's data can negatively affect privacy and security trusts and cause concerns. Previous research has found out that online purchases had been negatively affected because of the user's security concerns (Miyazaki & Fernandez, 2001; Laroche et al., 2005; Zhou et al. 2007; Kansal, 2014) The perceived usefulness and perceived ease of use is negatively affected if the user has an elevated level of security concerns (Kansal, 2016). For security, the hypothesis below has been proposed;

H7. Security has a negative effect on intention to use of AI Mobile Banking Applications.

2.4.7 Privacy

Privacy can be defined as the amount of control a person has over their personal data, in the process of their interaction with mobile banking apps (Hong & Thong 2013). Privacy concerns of the users can be triggered and increased if the user does not have control of their personal data. Smart phone users generally act out on their privacy concerns during their interactions with online products and services (Sutanto et al. 2013). The increasing level of privacy concern causes the satisfaction and trust levels to decrease substantially, which may negatively affect the intention to use and further adoption of mobile banking systems (Wang et al. 2006; Zhou 2012). According to this, it can be said that privacy concerns most likely have the ability to negatively impact the user's level of satisfaction from the mobile banking app (Albashrawi & Motiwalla, 2017). Since privacy has a considerably important

effect on intention to use, it was added to the model. The hypothesis below was proposed regarding privacy;

H8. Privacy has a negative effect on intention to use of AI Mobile Banking Applications.

2.4.8 Intention to Use & Usage Behavior

Intention to use and usage behavior are constructs that are highly correlating in the field of mobile banking. These constructs play a vital role in the research since they can provide information about the factors that are affecting the mobile banking adoption rate. Previous studies have found differential results regarding the effects of intention to use. Pham & Ho, (2015) claim that perceived usefulness has a positive and important effect on intention to use, whereas (Li, Liu, & Heikkilä, 2014) claims the opposite. This is important in the sense that, the user's perception of usefulness has the ability to directly affect the intention to use due to the fact that AI mobile banking applications are fairly new to the mobile banking sector. If the user deems the app to be useful, then they will have an intention to use the app and more over continue their usage behavior. Muñoz-Leiva, Climent-Climent, & Liébana-Cabanillas (2017) state that, attitude assists the progress of mobile banking actions and aims to lessen the barriers against the adoption of innovation (Pavlou, 2002; Liébana-Cabanillas et al., 2014) as well as, facilitate and approve the intended use of the proposed mobile application (Saghafi,Moghaddam, & Aslani, 2016).

Ajzen (1991) mentions that, as the attitude of a user is more positive, the intention to use will be stronger and consequently increasing the level of a corresponding usage behavior. Intention to use is directly connected to the level of the user's attitude towards using a mobile banking app. If the attitude is positive, then there is an intention to use and as a result it develops the actual system usage behavior. Therefore, the hypothesis below is proposed in regard;

H9: Intention to Use has a positive effect on Usage Behavior of AI Mobile Banking Applications.

3. METHODOLOGY

3.1 Research Design and Data Collection

"All items that were used to measure the variables were sourced from previous studies and adapted to the mobile banking context." (Maduku, 2017) The items were first formed into an English questionnaire, then translated into Turkish and prepared as a duplicate of the original English questionnaire. A case-specific interactive AI mobile banking chatbot design was included in the questionnaire as well as live action screenshots from currently active AI mobile banking application examples. The questionnaires were prepared through Google Forms and published in various channels such as; Bilgi University Blackboard interface, Facebook student groups, LinkedIn, E-mails and WhatsApp. After the questionnaire was formulated, it was tested among two hundred and forty-eight users with previous mobile banking usage experience. The list of the items and their corresponding sources are listed in Appendix A. Each of the items were measured with a five-point Likert scale, which provided a scale from "strongly disagree" (1) to "strongly agree" (5). The data was analyzed by using IBM SPSS v.20. Factor analysis, Regression Analysis, Reliability and Frequency tests were conducted. Screenshots from the survey are given below.

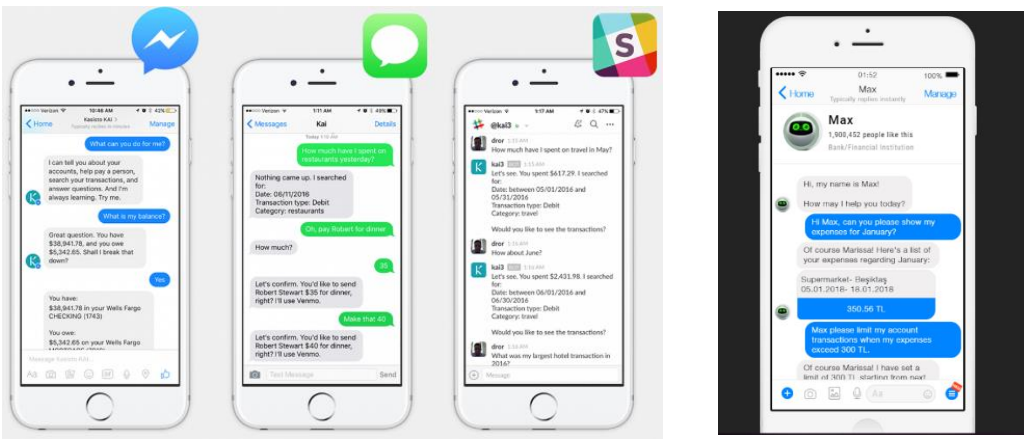

Fig.5 Screenshots from the survey

3.2 Data Analysis

Table 2. Questionnaire

Construct	Measurements	References
Mobile Banking	→ **MB1-** I have information about Artificial Intelligence systems.	Leiva et al. (2016)
	→ **MB2-** I am using Artificial Intelligence systems.	
	→ **MB3-** I am familiar with Mobile Banking Apps.	
	→ **MB4-** I am using Mobile Banking Apps actively.	
Personal Innovativeness	→ **PI 1 -** I like to experiment with new information technologies.	Meuter et al. (2003)
	→ **PI 2 -** I hesitate to use technology because I fear of making mistakes I cannot correct.	
	→ **PI 3 -** I have avoided technology because it is unfamiliar to me.	Jackson et al. (2013)
	→ **PI 4 -** I am able to keep up with important technological advances.	
	→ **PI 5 -** I have difficulty understanding most of the technological systems.	
Ease of Use	→ **EU 1 -** I found the app easy to use.	Venkatesh&Davis (2000)
	→ **EU 2 -** It is easy for me to learn how to perform tasks using the AI banking app.	
	→ **EU 3 -** The system interraction was clear and understandable.	Davis (1989)
	→ **EU 4 -** The AI system made the process very easy.	
	→ **EU 5 -** The tool is easy to use in general.	
Perceived Usefulness	→ **PU 1 -** The AI interface is very useful for the banking app services.	Davis et al. (1989)
	→ **PU 2 -** The AI interface is very beneficial for banking functions.	
	→ **PU 3 -** The AI system enables me to complete my banking services faster.	
	→ **PU 4 -** The AI system enhances my effectiveness in banking services.	Gefen et al. (2003)
	→ **PU 5 -** The AI system makes it easier to complete the banking services.	
Security	→ **SC 1 –** I think that the bank will maintain the terms and commitments made in relation to their AI mobile app.	Leiva et al. (2016)
	→ **SC 2 –** I think that the AI system in the mobile banking app is reliable.	
	→ **SC 3 –** In general I trust an AI banking app.	
	→ **SC 4 –** I felt safe using an AI system for my banking transactions.	
Privacy	→ **PV 1 -** I am concerned that when I give personal information to the app, the bank would use the information for other purposes.	Leiva et al. (2016)
	→ **PV 2 -** There is a significant risk regarding my banking transactions done through the app.	
	→ **PV 3 -** Other parties may gather information about my online transactions if I use this banking app.	
	→ **PV 4 -** I believe that making queries and/or banking transactions through the app is a risky choice.	
Output Quality	→ **OQ 1 -** The quality of the service I get from the AI banking app is high.	Venkatesh&Davis (2000)
	→ **OQ 2 -** My experience with the AI banking app was better than I expected.	
	→ **OQ 3 -** The service provided by the AI banking app was better than I expected.	S.J Hong et al. (2006)
	→ **OQ 4-** Overall, most of my expectations from using the AI banking app were confirmed.	
Result Demonstrability	→ **RD 1 –** I have no difficulty telling others about the results of using the AI banking app.	Venkatesh&Davis (2000)
	→ **RD 2 –** The results of using AI banking system are apparent to me.	
Intention to Use	→ **IU 1 –** I would use the AI banking app for all my banking services.	Gefen et al. (2003)
	→ **IU 2 –** I am willing to provide the AI banking app with the information itneeds to better serve my needs.	
	→ **IU 3 –** I will continue using the AI banking apps in the future.	Jackson et al. (2013)
Usage Behavior	→ **UB 1 –** I am able to use the AI banking app in my daily life.	S.J Hong et al. (2006)
	→ **UB 2 –** I will increase my use of the AI banking app in the future.	

3.2.1 Demographic Variables

3.2.1.1 Gender

The sample of the survey respondents consisted of female and male divisions, 65.3 % of the respondents were female and 34.7 % were male. 65.3% percent accounts to 162 (n) female individual respondents and 34.7% accounts to 86 (n) male individual respondents totaling to 248 respondents in general.

Table 3. Frequency distribution of Gender

Gender		
	Frequency	**Percent**
Female	162	65.3
Male	86	34.7
Total	248	100

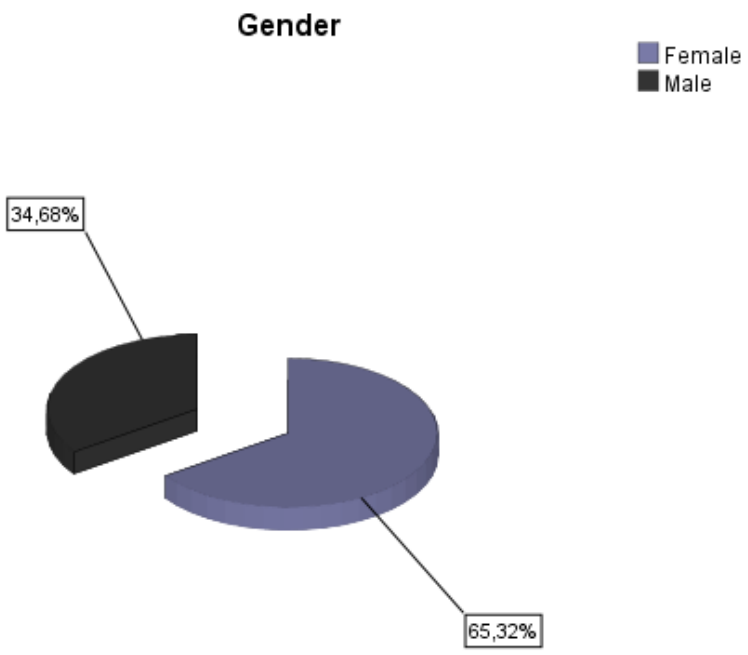

Figure 6. Gender frequency pie chart

3.2.1.2 Age

The sample of the survey respondents consisted of categories such as; 18-25, 26-35, 36-45,46-65, 65 and up. 18-25 age category had 54 (n) respondents and 21.8%. 26-35 age category had 79 (n) respondents and 31.9 %. 36-45 age category had 39 (n) respondents and 15.7%. 46-65 age category had 74 (n) respondents and 29.8%. 65 and up age category had 2 (n) respondents and 0.8%, all of the category results totaled up to 248 (n) respondents and 100%.

Table 4. Frequency distribution of Age Groups

Age Groups		
	Frequency	**Percent**
18-25	54	21.8
26-35	79	31.9
36-45	39	15.7
46-65	74	29.8
65 and up	2	0.8
Total	248	100

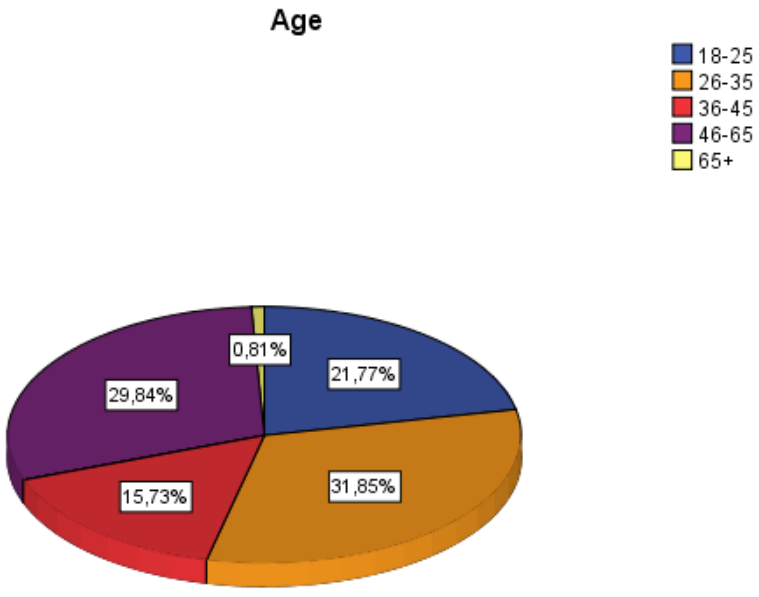

Figure 7. Age Groups frequency pie chart

3.2.1.3 Educational Status

The sample of the survey respondents consisted of categories such as; Primary School, Middle School, Technical-Vocational Training, Bachelor's Degree, Master's Degree, PhD. The Primary School category was not included in the table since there were no responses in the category. Middle School category had 1 (n) respondent and 0.4%. High School category had 10 (n) respondents and 4.0 %. Technical-Vocational Training category had 5 (n) respondents and 2.0%. Bachelor's Degree category had 127 (n) respondents and 51.2%. Master's Degree category had 88 (n) respondents and 35.5%. PhD category had 17 (n) respondents and 6.9%.

Table 5. Frequency distribution of Educational Status

Educational Status		
	Frequency	**Percent**
Middle School	1	0.4
High School	10	4.0
Technical- Vocational Training	5	2.0
Bachelor's Degree	127	51.2
Master's Degree	88	35.5
PhD	17	6.9
Total	248	100

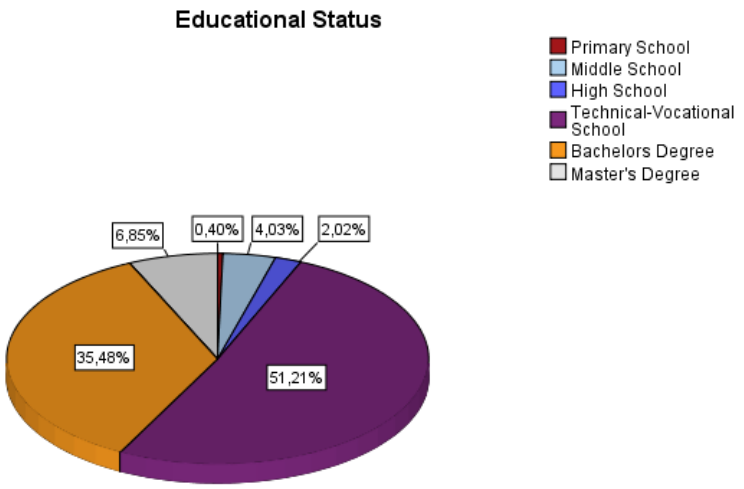

Figure 8. Educational Status frequency pie chart

3.2.1.4 Occupational Status

The sample of the survey respondents consisted of categories such as; 18-25, 26-35, 36-45,46-65, 65 and up. 18-25 age category had 54 (n) respondents and 21.8%. 26-35 age category had 79 (n) respondents and 31.9 %. 36-45 age category had 39 (n) respondents and 15.7%. 46-65 age category had 74 (n) respondents and 29.8%. 65 and up age category had 2 (n) respondents and 0.8%, all the category results totaled up to 248 (n) respondents and 100%.

Table 6. Frequency distribution of Occupational Status

Occupational Status		
	Frequency	**Percent**
Student	43	17.3
Academician	21	8.5
Private Sector Employee	90	36.3
Self Employed	20	8.1
Retired	29	11.7
Unemployed	6	2.4
Public Official	39	15.7
Total	248	100

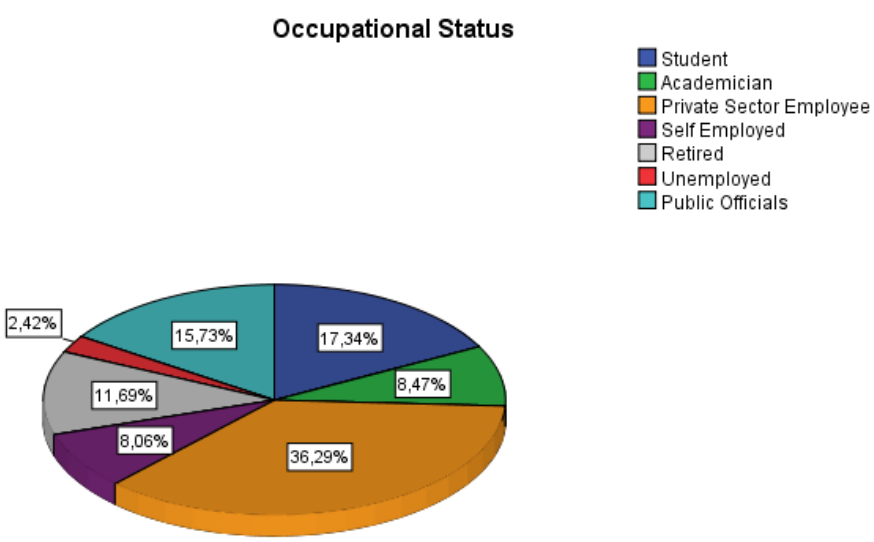

Figure 9. Occupational Status frequency pie chart

3.3 Factor Analysis

The aim of the factor analysis is to find out specific batches of variables called factors, which are eminently interconnected. (Hair et al. 2006). In the encyclopedia of education factor analysis is explained as: “Factor analysis aims to explain the correlations among a set of observed variables in terms of a smaller set of latent variables, or factors.” (Bartholomew, 2010) Performing a factor analysis can help analyze any possible relationships between subjectively developed content and empirical data findings as well as helping figure out whether the previously found data results on previous studies can be achieved with a new set of data. In this study, a factor analysis is performed to learn about how many dimensions the survey respondents have recognized in the given constructs and whether they have recognized them in the same way as in the original data. In this case, the scale was developed also to examine if the proposed constructs in the study are confirming the validity of the theoretically supported content.

“At the beginning of each factor test, the measure of sampling adequacy is calculated to see if the data is appropriate to apply the factor analysis to” (Durmuş et al., 2011). Statistics that can represent this adequacy are called Keiser- Meyer-Olkin (KMO) and Bartlett’s test of sphericity. KMO shows that the data used in the analysis is a homogenous collection of variables and that there are correlations between variables. According to Hair et al., 2006, the lower limit for KMO that is generally agreed upon is 0.50. Bartlett’s test on the other hand gives the statistical significance of the intercorrelation between variable (Hair et al., 2006), and the upper limit for the value of p in Social Sciences that is generally agreed upon is 0.05. The KMO and Bartlett’s tests in this study have been found to be satisfactory for all ten constructs in the study since their values are over 0.50 and the data tables for each factor analysis are evaluated in the consecutive sections.

3.3.1 Factor and Reliability Analysis for Mobile Banking

"Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett test of sphericity tests were performed to test the appropriateness of data for conducting factor analysis" (Sharma, 1996). Result of the tests (KMO=0.650, χ^2Bartlett test (6) =656.746, p=0.000) were satisfactory. The diagonals of the anti-image correlation matrix were all over 0.50, supporting the inclusion of each item in the factor analysis.

Principal component analysis and varimax rotation were applied to the data sets. Factors with eigenvalues over one were retained (Hair et. al., 1998). As a result of the analysis one dimension was found. Findings of the factor analysis showed a total variance of 69.04%. To test the internal consistency of the factors, Cronbach's coefficient alpha reliability was calculated, and the result was **α**= 0.848.

Table 7. Factor Analysis result for Mobile Banking

Relationships between constructs	**Factor Item**	**Factor Loading**	**Cronbach's α**	**% of Variance**
Mobile Banking	I have information about Artificial Intelligence systems.	0.813	0.848	69.004
	I am using Artificial Intelligence systems.	0.747		
	I am familiar with Mobile Banking Apps.	0.889		
	I am using Mobile Banking Apps actively.	0.867		

3.3.2 Factor and Reliability Analysis for Personal Innovativeness

"Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett test of sphericity tests were performed to test the appropriateness of data for conducting factor analysis" (Sharma, 1996). Result of the tests (KMO=0.660, χ^2Bartlett test (3) =213.660, p=0.000) were satisfactory. The diagonals of the anti-image correlation matrix were all over 0.50, supporting the inclusion of each item in the factor analysis. In this specific case since the *PI1 and *PI4 items had a Cronbach's α below the recommended 0.70 the items were taken out. The factor loading of the item questions showed similarity therefore were considered as a repetition and excluded.

Principal component analysis and varimax rotation were applied to the data sets. Factors with eigenvalues over one were retained (Hair et. al., 1998). As a result of the analysis one dimension was found. Findings of the factor analysis showed a total variance of 69.62%. To test the internal consistency of the factors, Cronbach's coefficient alpha reliability was calculated, and the result was **α=** 0.769.

Table 8. Factor Analysis result for Personal Innovativeness

Relationships between constructs	**Factor Item**	**Factor Loading**	**Cronbach's α**	**% of Variance**
Personal Innovativeness	I like to experiment with new information technologies. *	**Excluded*	0.769	69.062
	I hesitate to use technology because I fear of making mistakes I cannot correct.	0.807		
	I have avoided technology because it is unfamiliar to me.	0.885		
	I am able to keep up with important technological advances. *	**Excluded*		
	I have difficulty understanding most of the technological systems.	0.798		

3.3.3 Factor and Reliability Analysis for Perceived Ease of Use

"Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett test of sphericity tests were performed to test the appropriateness of data for conducting factor analysis" (Sharma, 1996). Result of the tests (KMO=0.896, χ^2Bartlett test (10) =1233.634, p=0.000) were satisfactory. The diagonals of the anti-image correlation matrix were all over 0.50, supporting the inclusion of each item in the factor analysis.

Principal component analysis and varimax rotation were applied to the data sets. Factors with eigenvalues over one were retained (Hair et. al., 1998). As a result of the analysis one dimension was found. Findings of the factor analysis showed a total variance of 83.57%. To test the internal consistency of the factors, Cronbach's coefficient alpha reliability was calculated, and the result was **α=** 0.950.

Table 9. Factor Analysis result for Perceived Ease of Use

Relationships between constructs	Factor Item	Factor Loading	Cronbach's α	% of Variance
Perceived Ease of Use	I found the app easy to use.	0.902	0.950	83.567
	It is easy for me to learn how to perform tasks using the AI banking app.	0.919		
	The system interaction was clear and understandable.	0.934		
	The AI system made the process very easy.	0.917		
	The tool is easy to use in general.	0.898		

3.3.4 Factor and Reliability Analysis for Perceived Usefulness

"Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett test of sphericity tests were performed to test the appropriateness of data for conducting factor analysis" (Sharma, 1996). Result of the tests (KMO=0.887, χ^2Bartlett test (10) =1522.456, p=0.000) were satisfactory. The diagonals of the anti-image correlation matrix were all over 0.50, supporting the inclusion of each item in the factor analysis.

Principal component analysis and varimax rotation were applied to the data sets. Factors with eigenvalues over one were retained (Hair et. al., 1998). As a result of the analysis one dimension was found. Findings of the factor analysis showed a total variance of 87.31%. To test the internal consistency of the factors, Cronbach's coefficient alpha reliability was calculated, and the result was **α**= 0.963.

Table 10. Factor Analysis result for Perceived Usefulness

Relationships between constructs	**Factor Item**	**Factor Loading**	**Cronbach's α**	**% of Variance**
Perceived Usefulness	The AI interface is very useful for the banking app services.	0.941	0.963	87.315
	The AI system enables me to complete my banking services faster.	0.950		
	The AI system enhances my effectiveness in banking services.	0.940		
	The AI system makes it easier to complete the banking services.	0.909		

3.3.5 Factor and Reliability Analysis for Security

"Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett test of sphericity tests were performed to test the appropriateness of data for conducting factor analysis" (Sharma, 1996). Result of the tests (KMO=0.794, χ^2Bartlett test (6) =720.525, p=0.000) were satisfactory. The diagonals of the anti-image correlation matrix were all over 0.50, supporting the inclusion of each item in the factor analysis.

Principal component analysis and varimax rotation were applied to the data sets. Factors with eigenvalues over one were retained (Hair et. al., 1998). As a result of the analysis one dimension was found. Findings of the factor analysis showed a total variance of 76.40%. To test the internal consistency of the factors, Cronbach's coefficient alpha reliability was calculated, and the result was **α**= 0.895.

Table 11. Factor Analysis result for Security

Relationships between constructs	**Factor Item**	**Factor Loading**	**Cronbach's α**	**% of Variance**
Security	I think that the bank will maintain the terms and commitments made in relation to their AI mobile app.	0.812	0.895	76.407
	I think that the AI system in the mobile banking app is reliable.	0.935		
	In general, I trust an AI banking app.	0.929		
	I felt safe using an AI system for my banking transactions.	0.812		

3.3.6 Factor and Reliability Analysis for Privacy

"Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett test of sphericity tests were performed to test the appropriateness of data for conducting factor analysis" (Sharma, 1996). Result of the tests (KMO=0.774, χ^2Bartlett test (6) =476.017, p=0.000) were satisfactory. The diagonals of the anti-image correlation matrix were all over 0.50, supporting the inclusion of each item in the factor analysis.

Principal component analysis and varimax rotation were applied to the data sets. Factors with eigenvalues over one were retained (Hair et. al., 1998). As a result of the analysis one dimension was found. Findings of the factor analysis showed a total variance of 71.02%. To test the internal consistency of the factors, Cronbach's coefficient alpha reliability was calculated, and the result was **α=** 0.861.

Table 12. Factor Analysis result for Privacy

Relationships between constructs	Factor Item	Factor Loading	Cronbach's α	% of Variance
Privacy	I am concerned that when I give personal information to AI Mobile Banking App, the bank would use the information for other purposes.	0.801	0.861	71.026
	There is a significant risk regarding my banking transactions done through the app.	0.871		
	Other parties may gather information about my online transactions if I use this banking app.	0.868		
	I believe that making queries and/or banking transactions through the app is a risky choice.	0.830		

3.3.7 Factor and Reliability for Output Quality

"Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett test of sphericity tests were performed to test the appropriateness of data for conducting factor analysis" (Sharma, 1996). Result of the tests (KMO=0.862, χ^2Bartlett test (6) =1038.092, p=0.000) were satisfactory. The diagonals of the anti-image correlation matrix were all over 0.50, supporting the inclusion of each item in the factor analysis.

Principal component analysis and varimax rotation were applied to the data sets. Factors with eigenvalues over one were retained (Hair et. al., 1998). As a result of the analysis one dimension was found. Findings of the factor analysis showed a total variance of 87.10%. To test the internal consistency of the factors, Cronbach's coefficient alpha reliability was calculated, and the result was **α=** 0.950.

Table 13. Factor Analysis result for Output Quality

Relationships between constructs	**Factor Item**	**Factor Loading**	**Cronbach's α**	**% of Variance**
Output Quality	The quality of the service I get from the AI banking app is high.	0.913	0.950	87.106
	My experience with the AI banking app was better than I expected.	0.946		
	The service provided by the AI banking app was better than I expected.	0.959		
	Overall, most of my expectations from using the AI banking app were confirmed.	0.914		

3.3.8 Factor and Reliability for Result Demonstrability

"Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett test of sphericity tests were performed to test the appropriateness of data for conducting factor analysis" (Sharma, 1996). Result of the tests (KMO=0.500, χ^2Bartlett test (1) =218.959, p=0.000) were satisfactory. The diagonals of the anti-image correlation matrix were all over 0.50, supporting the inclusion of each item in the factor analysis.

Principal component analysis and varimax rotation were applied to the data sets. Factors with eigenvalues over one were retained (Hair et. al., 1998). As a result of the analysis one dimension was found. Findings of the factor analysis showed a total variance of 88.41%. To test the internal consistency of the factors, Cronbach's coefficient alpha reliability was calculated, and the result was **α=** 0.869.

Table 14. Factor Analysis result for Result Demonstrability

Relationships between constructs	**Factor Item**	**Factor Loading**	**Cronbach's α**	**% of Variance**
Result Demonstrability	I have no difficulty telling others about the results of using the AI banking app.	0.940	0.869	88.410
	The results of using AI banking system are apparent to me.	0.940		

3.3.9 Factor and Reliability Intention to Use

"Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett test of sphericity tests were performed to test the appropriateness of data for conducting factor analysis" (Sharma, 1996). Result of the tests (KMO=0.741, χ^2Bartlett test (3) =369.573, p=0.000) were satisfactory. The diagonals of the anti-image correlation matrix were all over 0.50, supporting the inclusion of each item in the factor analysis.

Principal component analysis and varimax rotation were applied to the data sets. Factors with eigenvalues over one were retained (Hair et. al., 1998). As a result of the analysis one dimension was found. Findings of the factor analysis showed a total variance of 79.68%. To test the internal consistency of the factors, Cronbach's coefficient alpha reliability was calculated, and the result was **α=** 0.871.

Table 15. Factor Analysis result for Intention to Use

Relationships between constructs	**Factor Item**	**Factor Loading**	**Cronbach's α**	**% of Variance**
Intention to Use	I would use the AI banking app for all my banking services.	0.898	0.871	79.679
	I am willing to provide the AI banking app with the information it needs to better serve my needs.	0.886		
	I will continue using the AI banking apps in the future.	0.894		

3.3.10 Factor and Reliability Usage Behavior

"Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett test of sphericity tests were performed to test the appropriateness of data for conducting factor analysis" (Sharma, 1996). Result of the tests (KMO=0.500, χ^2Bartlett test (1) =177.209, p=0.000) were satisfactory. The diagonals of the anti-image correlation matrix were all over 0.50, supporting the inclusion of each item in the factor analysis.

Principal component analysis and varimax rotation were applied to the data sets. Factors with eigenvalues over one were retained (Hair et. al., 1998). As a result of the analysis one dimension was found. Findings of the factor analysis showed a total variance of 85.85%. To test the internal consistency of the factors, Cronbach's coefficient alpha reliability was calculated, and the result was **α**= 0.835.

Table 16. Factor Analysis result for Usage Behavior

Relationships between constructs	**Factor Item**	**Factor Loading**	**Cronbach's α**	**% of Variance**
Usage Behavior	I am able to use the AI banking app in my daily life.	0.927	0.835	85.852
	I will increase my use of the AI banking app in the future.	0.927		

3.4 Multiple Regression Analysis

Series of multiple regression analysis were conducted to test the model to find the explanatory data of the selected components.

3.4.1 Multiple Regression Analysis for Perceived Usefulness

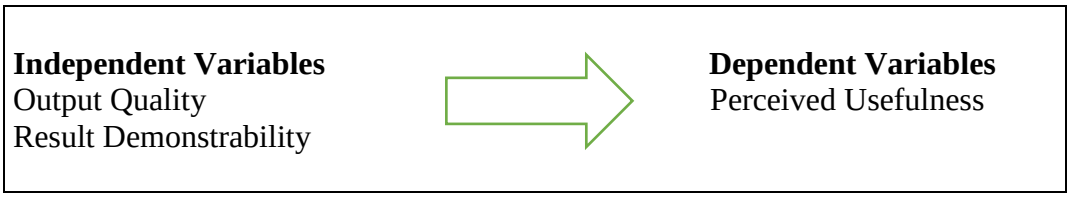

Figure 10: Multiple Regression for Perceived Usefulness

Dependent variable: Perceived Usefulness			
Independent variables:	**Beta**	**t-value**	**p-value**
Output Quality	0.616	10.216	0.000
Result Demonstrability	0.206	3.418	0.001

Table 17. Multiple Regression for Perceived Usefulness

The dependent variable in the first multiple regression analysis was Perceived Usefulness and the independent variables were Output Quality and Result Demonstrability. Perceived Usefulness was explained by Output Quality with results of (ß=0.616, t=10.216, p= 0,000) and Result Demonstrability with results of (ß=0.206, t=3.418, p= 0,001).

The overall explanation of the model showed a %61 rate with results of: (**R**= 0.783, $\mathbf{R^2}$=0.613 **F**=193.884, **p**=0.000) and thus is found to have a strong result due to regression results. (**R**=0.783> 0,700)

3.4.2 Multiple Regression Analysis for Intention to Use

To find the relationship between Intention to Use, Ease of Use and Perceived Usefulness a Multiple Regression Analysis was performed.

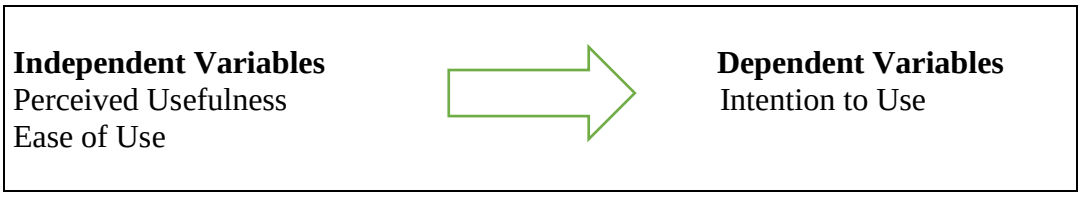

Figure 11: Multiple Regression for Intention to Use

Dependent variable: Intention to Use			
Independent variables:	**Beta**	**t-value**	**p-value**
Perceived Usefulness	0.467	6.253	0.000
Ease of Use	0.210	2.811	0.005

Table 18. Multiple Regression for Intention to Use

The dependent variable in the first multiple regression analysis was Intention to Use and the independent variables were Perceived Usefulness and Ease of Use. Intention to Use was explained by Perceived Usefulness with results of (ß=0.467, t=6.253, p= 0,000) and Ease of Use with results of (ß=0.210, t=2.811, p= 0.005). The overall explanation of the model showed a %41 rate with results of: (**R**= 0.641, $\mathbf{R^2}$=0.411 **F**=85.434, **p**=0.000) and thus is found to have a weaker result compared to other regressions due to results being smaller than the recommended sample size. (**R**=0.641< 0.700)

3.5 Simple Linear Regression Analysis

3.5.1 Simple Linear Regression between Perceived Usefulness and Ease of Use

To find the relationship between Perceived Usefulness and Ease of Use, a Simple Linear Regression Analysis was performed.

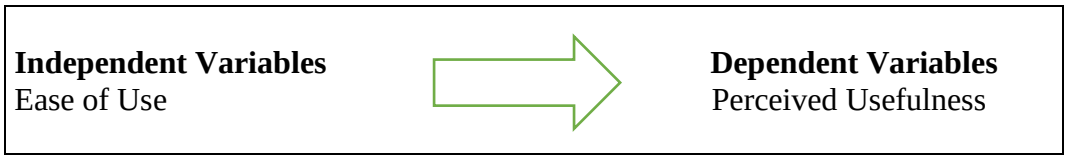

Figure 12: Simple Linear Regression for Perceived Usefulness

Dependent variable: Perceived Usefulness			
Independent variables:	**Beta**	**t-value**	**p-value**
Ease of Use	0.755	18.043	0.000

Table 19. Simple Linear Regression for Perceived Usefulness

As shown in Table 19 Ease of Use has a positive contribution on Perceived Usefulness. Perceived Usefulness was explained by Ease of Use with results of (ß=0.755, t=18.043, p= 0,000). The overall explanatory power of model was 57% (**R**= 0.755 $\mathbf{R^2}$=0.570 **F**=325.538 **p**=0.000) and thus is found to have a strong result due to regression results. (**R**=0.783> 0.700)

3.5.2 Simple Linear Regressions between Intention to Use and Security

To find the relationship between Intention to Use and Security, a Simple Linear Regression Analysis was performed.

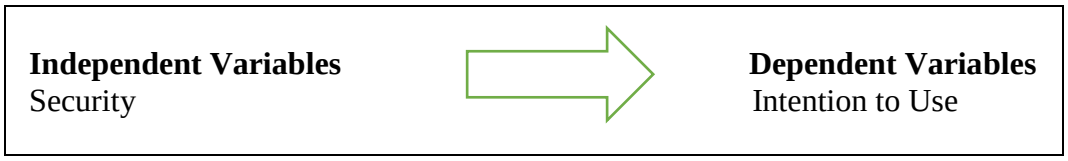

Figure 13: Simple Linear Regression for Intention to Use

Dependent variable: Intention to Use			
Independent variables:	**Beta**	**t-value**	**p-value**
Security	0.776	15.565	0.000

Table 20. Simple Linear Regression for Intention to Use

As shown in Table 20 Security has a negative contribution on Intention to Use. Intention to Use was explained by Security with results of (ß=0.776, t=15.565, p= 0,000). The overall explanatory power of model was 49% (**R**= 0.704 $\mathbf{R^2}$=0.496 **F**=242.258 **p**=0.000)and thus is found to have a strong result due to regression results. (**R**=0.704> 0.700)

3.5.3 Simple Linear Regressions between Usage Behavior and Intention to Use

To find the relationship between Usage Behavior and Intention to Use, a Simple Linear Regression Analysis was performed.

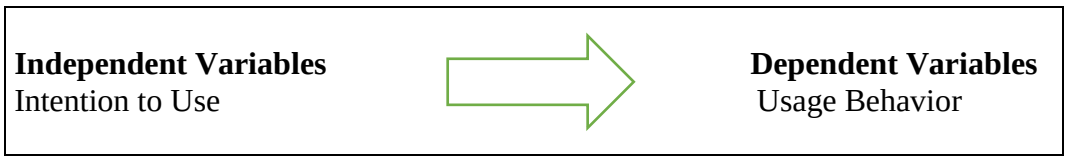

Figure 14: Simple Linear Regression for Usage Behavior

Dependent variable: Usage Behavior			
Independent variables:	**Beta**	**t-value**	**p-value**
Intention to Use	0.755	18.082	0.000

Table 21. Simple Linear Regression for Usage Behavior

As shown in Table 21 Intention to use has a positive contribution on Usage Behavior. Usage Behavior was explained by Intention to Use with results of (ß=0.755, t=18.082, p= 0,000). The overall explanatory power of model was 57% (**R**= 0.755 $\mathbf{R^2}$=0.571 **F**=326.941 **p**=0.000)and thus is found to have a strong result due to regression results. (**R**=0.755> 0.700)

3.6 Summary of Hypotheses Results

Hypothesis	Result
H1: Output quality of AI Mobile Banking Applications positively influence the perceived usefulness.	**Accepted**
H2: Result Demonstrability positively influences perceived usefulness of AI Mobile Banking Applications.	**Accepted**
H3: Personal Innovativeness positively influences perceived usefulness of AI Mobile Banking Applications.	**Not Supported**
H4: Perceived Ease of Use has a positive effect on perceived usefulness of AI Mobile Banking Applications.	**Accepted**
H5: Perceived Usefulness positively influences intention to use of AI Mobile Banking Applications.	**Accepted**
H6: Perceived Ease of Use positively influences intention to use of AI Mobile Banking Applications.	**Accepted**
H7: Security has a negative effect on intention to use of AI Mobile Banking Applications.	**Accepted**
H8: Privacy has a negative effect on intention to use of AI Mobile Banking Applications.	**Not Supported**
H9: Intention to Use has a positive effect on Usage Behavior of AI Mobile Banking Applications.	**Accepted**

Table 22. Hypotheses Results

Regression Table

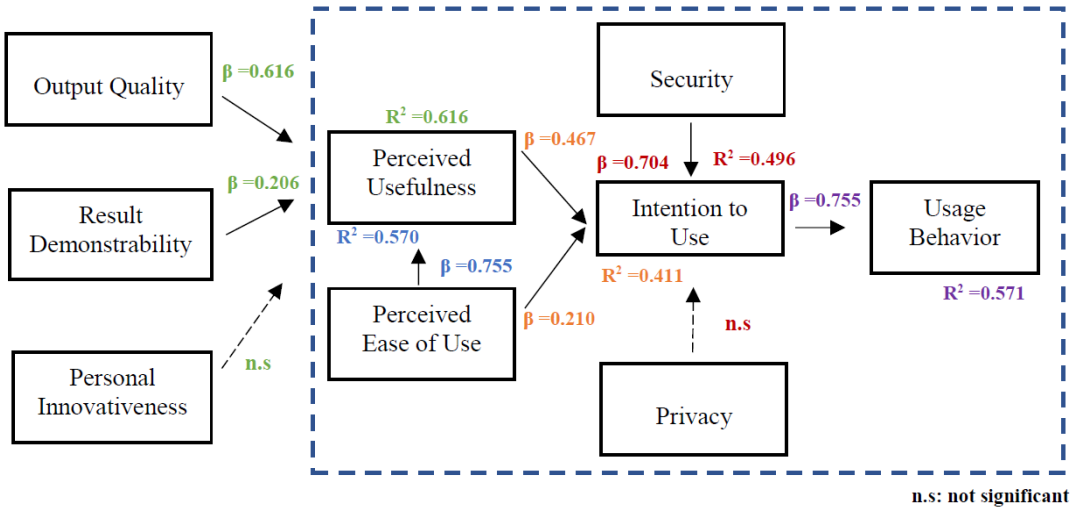

Figure 15. Renewed Model after Regression Analysis

4. CONCLUSION

4.1. Summary of Findings

The main aim of the thesis has been to research and find whether the implementation of AI systems into mobile banking applications will have an effect on the mobile banking adoption process. The model has been based on the combination of the TAM and TAM2 models with the additions of Security and Privacy. 9 hypotheses were formulated to find the possible level of relationships between the constructs belonging to the proposed model. Nearly all hypotheses have been found statistically and empirically verified (Muñoz-Leiva, Climent-Climent, & Liébana-Cabanillas, 2017).

After the SPSS analysis has been completed and the data has been analyzed, it can be said that the proposed model has served its purpose and nearly all the hypotheses that were submitted has been accepted with statistical data. Hypotheses regarding Personal Innovativeness and Privacy have not been supported due lower loadings and results. Personal Innovativeness did not have a powerful positive effect on Perceived Usefulness as proposed. Even if the level of Personal Innovativeness is

high and accepted, it is not affecting Perceived Usefulness as influential as the other hypotheses. Also, even though Privacy was expected to have a very strong negative effect on Intention to Use, the survey results showed that Security had a much more substantial effect on Intention to Use. As the problems in the notion of security arise with the constant changes in the technological world, providing a secure service has become vital. These results are confirming that the AI mobile banking apps are prone to be adopted by the customers at a higher if the security measures are taken seriously. With all the factors affecting Intention to Use in a unified whole, it is one of the most important hypotheses in the model. It is directly influencing the usage behavior and has a strong effect which can be seen from the data results. In order for the customers to have a large amount of Perceived Usefulness regarding the app, the Output Quality and the Result Demonstrability must be accomplished at highest levels as well.

4.2 Limitations and Future Research

In conclusion, there have been some limitations discovered at the end of the research that can help create new research areas if they are solved. The first limitation was regarding the survey content. The participants were shown a predictive virtual demo of an AI mobile banking app chatbot system and answered questions regarding the system interaction they witnessed in the demo. Unfortunately, since there were no live functioning AI mobile banking apps at the time when the survey was conducted. If there were any examples of apps that could be downloaded on the participant's smart phones, the customer mobile banking adoption behavior could be monitored in a more extended approach. As Muñoz-Leiva, Climent-Climent, & Liébana-Cabanillas (2017) have mentioned in their research limitations, for future research regarding the AI mobile banking app, the data output can be widened by offering the participants a real interaction with the original active version of the app, underlining the differences between the customer's intention to use and usage behavior, collecting the expectations of the participants prior to usage and the outcome effects it has on the participant after the realized usage of the mobile banking app. Moreover, from the methodological

perspective the sample size and geographical conditions were very limited. Since the survey was only conducted in Turkey and to a small sample size of 248, the findings only represent a very focused and specialized group. Future researches are advised to use a larger sample size with several different demographic group sets. Since the research is regarding the continued usage behavior of the customers and their habits of using the AI mobile banking apps, it is important to conduct another survey after the users have become accustomed to the app and have used it over a time period. By doing this, the feedback from the participants can also contribute to the formation of new models and techniques by using their experiences, wants and needs.

One of the biggest limitations was the scarcity of the research materials focused on specifically AI mobile banking apps. Since there were no direct sources, conducting the literature review and linking the study to previous research was challenging. Since the AI mobile banking apps that are being proposed in the thesis will activated and available for the customer's use in the near future, the future research topics can focus on the types of the AI mobile banking apps, the new AI mobile banking app access tools such as; smart watches and other innovative devices with the ability to download and use the mentioned apps.

4.3 Managerial Implications

Banks have become aware that the smartphones have become a connecting bridge between them and the end user. In order to be at service to the customers and ensure the highest level of service, an app that can provide nearly all banking services in one single point of service is vital. By creating an app which has a deep learning algorithm base, the bank can provide the customer with the feeling of receiving a fully personalized and special service from their smart phones, just like they would experience if they were visiting a customer banking specialist at any bank branch. Creating apps that can form personalized forecasts according to needs, interests or spending patterns are crucial in the sense that, they can drastically shape the role of the AI mobile banking apps in the customer's daily routine. The app becomes a sort of personal financial assistant which can offer specific campaigns only targeted for

the customer using the app, analyze their data and grant access to more features according to expenditure data as well as keep track of any investment or trading opportunity where the key point is to track any sudden changes in the market.

Creating different segmented versions of AI mobile banking applications can provide banks with a strong marketing campaign as well as a very specifically targeted point of service for the clients. As the technological advancements are rapidly evolving and even starting to shape the currencies in the sense that, they are also becoming digitalized such as the bitcoin currency example. It is important for banks to keep up with the blockchain trend and even bring in certain capabilities of the blockchain and cryptocurrency concepts into the AI mobile banking apps to create an even more intriguing app which will definitely increase the customer's mobile banking adoption rates, due to the fact that the mobile banking app will serve not only as a bill payment, loan/credit check system but a more digitalized financial marketplace where the customer can exchange cryptocurrencies through their mobile banking apps and the special integration it has with the digital wallets and similar tools.

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