

T.C.
BAHÇEŞEHİR UNIVERSITY
GRADUATE SCHOOL OF EDUCATION
THE DEPARTMENT OF BUSINESS ADMINISTRATION

İ. B. ERKEK

THE NEW ERA IN
DIGITALIZATION OF FINANCIAL SERVICES:
CUSTOMERS' ADOPTION TO
ARTIFICIAL INTELLIGENCE BASED BANKING APPLICATIONS

BAU 2023

PHD THESIS
İSMAİL BURAK ERKEK

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İSTANBUL 2023



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ABSTRACT

The New Era in Digitalization of Financial Services: Customers' Adoption to
Artificial Intelligence Based Banking Applications

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Business Administration PhD Program

Thesis Advisor: Prof. İpek Altınbaşak Farina

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The latest research aimed to understand indicative factors of consumers' adoption to Artificial Intelligence (AI) based services. Nevertheless, following the pandemic, subsequent social risks, geopolitical conflicts and supply chain crisis, marketing discipline has evolved. The emerging disruptive technologies facilitated this change. The thesis investigates the determinant factors of customers' attitude and intention to use AI based banking services in Turkey and European Union countries, in the post-pandemic period. Within this research, features of banks' virtual assistants, characteristics of bank customers and perception of banks by their customers are claimed to have an influence on adoption to those virtual assistants. The thesis has another purpose of elaborating the national, generational, socio-demographic differentiation with regards to virtual assistant adoption. Research model built on Technology Acceptance Model (TAM) (Davis, 1989) with several integrations from Diffusion of Innovation theory (DOI) (Rogers, 1995) and Unified Theory of Acceptance & Use of Technology model (UTAUT) (Venkatesh, Morris, Davis, Davis, 2003) and perceived risks were evaluated, via the survey filled by 430 Turkish and EU

citizens. Based on analysis results, it is revealed that, usefulness, proactivity and performance of virtual assistants positively influence attitude and attitude positively influences intention to use virtual assistants. On the other hand, EU citizens have a more positive intention to use virtual assistants, compared to Turkish customers and customers which command virtual assistants by voice has less adoption compared to other customers. With the contribution of this thesis, a TAM model with UTAUT and DOI covering all dimensions of virtual assistants and their users, was elaborated.

Key words: Technology Adoption, Digital Banking, Artificial Intelligence, Virtual Assistant, Covid-19 Pandemic

ÖZ

Finansal Hizmetlerin Dijitalleşmesinde Yeni Dönem: Müşterilerin Yapay Zeka Temelli Bankacılık Hizmetlerine Adaptasyonu

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Son araştırmalar, tüketicilerin yapay zeka temelli hizmetlere adaptasyonuna etki eden faktörleri anlamayı hedeflemektedir. Ancak, pandemi, çevresel ve sosyal riskler, jeopolitik çatışmalar ve bunlara bağlı oluşan tedarik zinciri krizinin ardından, dijital pazarlama dinamiklerinde de değişimler gerçekleşmiştir. Yeni dijital çağda ortaya çıkan yıkıcı teknolojiler ve yasal gelişmeler bu değişimi hızlandırmıştır. Bu tezde, Türkiye ve Avrupa Birliği ülkelerindeki önde gelen bankaların müşterilerinin, pandemi sonrası dönemde yapay zeka temelli bankacılık hizmetlerine yönelik tutumuna ve kullanma niyetine etki eden faktörler araştırılmaktadır. Araştırmada, bankaların sanal asistanlarının ve müşterilerinin özelliklerinin ve bankaların müşterileri tarafından algılanışının, müşterilerin sanal asistanlara karşı tutum ve yönelimini etkilediği ileri sürülmektedir. Ayrıca bu tez, tüketicilerin uyruk, nesil, sosyo-demografik özelliklerindeki farklılıklarının Sanal Asistanlara yönelimlerine etkisini açıklamayı amaçlamaktadır. Teknoloji Kabul Modeli (TKM) temelinde oluşturulan araştırma modeli, Yenilik Yayılımı Teorisi (YYT) ve Teknoloji Kabul, Kullanım Birleşik Kuramı Modeli (TKKBK) ve algılanan risklerle birlikte, 430 Türk

ve AB vatandaşı tarafından doldurulan bir anket aracılığıyla değerlendirilmiştir. Nitel ve nicel analizlerin sonuçlarına göre, sanal asistanların kullanışlılığı, proaktifliği ve performansının tutumu, tutumun da sanal asistanları kullanma niyetini olumlu yönde etkilediği ortaya konulmuştur. Öte yandan, AB vatandaşlarının T.C. Vatandaşlarına göre sanal asistanları kullanmaya daha olumlu bir yönelimlerinin olduğu ve sanal asistanlarını sesle yönlendiren müşterilerin, diğer yöntemlerle yönlendiren müşterilere kıyasla daha az sanal asistanları benimsediği görülmektedir. Bu tez ile, sanal asistanların ve kullanıcılarının tüm boyutlarını ele alan TKKBK ve YYT' yi de içeren ayrıntılı bir TKM modeli sunulmaktadır. Ayrıca, bu tez, pazar aktörleri için sanal asistanların anlama kapasiteleri ve proaktiflikleri konularında çeşitli analiz, fırsat ve öneriler sunmaktadır.

Anahtar Sözcükler: Teknolojiye Adaptasyon, Dijital Bankacılık, Yapay Zeka, Sanal Asistan, Covid-19 Pandemi

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LIST OF SYMBOLS/ ABBREVIATIONS

AI	Artificial Intelligence
BRSA	Banking Regulation and Supervision Agency
CMB	Capital Markets Board
DOI	Diffusion of Innovation theory
KMO	Kaiser-Meyer-Olkin
SOR	Stimulus, Organism, Response theory
TAM	Technology Acceptance Model
UTAUT	Unified Theory of Acceptance and Use of Technology model

Chapter 1

Introduction

Disruptive technologies and new digital solutions provide various payable opportunities to businesses in different industries. Digital transformation of consumers' behavior guided the institutions to discover their motivation for choosing do it yourself services, mobile applications and consequently, revised their core marketing strategies.

Following the pandemic, subsequent environmental and social risks, geopolitical conflicts and consequent supply chain crisis, marketing dynamics have evolved. E-commerce platforms and mobile applications have been welcomed by non tech-savvy consumers in different socio-demographic groups. The emerging technologies in the new digital era and regulatory developments facilitated this change, in the financial services industry.

Besides, the rivalry environment in the banking industry become more complicated with the inclusion of e-commerce platforms, payment institutions, solely digital banks, as well as open banking initiatives, which may create both opportunities and threats to banks. In order to struggle against those challenges, the Banks in advanced and developing geographies invest and rely mostly on cost-efficient solutions, including cloud and artificial intelligence based technologies and deliver advanced analytics services. Although those solutions potentially understand and respond to the financial needs and health of customers, traditional consumer behavior may insist on refusing the new services.

1.1 Statement of the Problem

The rise of artificial intelligence and advancements in technology have greatly impacted the banking industry, leading to the emergence of AI-based services that aim to improve customer experience and robotize banking operations. However, it is

crucial to focus deeper into customers' perceptions and behaviors to ensure the successful adoption and implementation of these services.

One of the main challenges addressed by this research is identifying the factors that influence customers' attitudes and intentions towards AI-based banking applications, which will reflect their perceptions. Functional attributes such as usability, performance, confidentiality, proactivity play a significant role in shaping customers' perceptions of these services. Understanding how these attributes impact customers' attitudes and intentions will provide valuable insights for banks and financial institutions to design and develop user-friendly and efficient AI-based banking applications. Moreover, personal traits including innovativeness, self-efficacy and familiarity with technology may also influence clients' acceptance and adoption of these services. By exploring the relationship between functional attributes, personal traits and adoption, this research aims to shed light on the complex interaction of factors that drive customers' attitude and intention towards AI-based banking services.

Another important aspect addressed by this research is the examination of national, generational, socio-economic and socio-demographic differences in the adoption of AI-based banking services. It is crucial to understand how these factors impact customers' acceptance and usage of these services in different contexts. The banking industry operates in diverse markets with various cultural, generational, and socio-demographic characteristics. By analyzing these differences, the research aims to identify specific factors that may facilitate the adoption of AI-based banking services in different countries and among different customer segments. This knowledge can feed banks' marketing strategies and customization efforts to fulfill their unique needs and preferences.

1.2 Purpose of the Study

Overall, this research aims to address the problem of understanding customers' motives and behaviors regarding adoption to AI-based banking services, specifically Virtual Assistants, in the post-pandemic era, both in Turkey and European Union

countries (mainly Spain & Netherlands). By exploring the factors that influence customers' attitude and intention, as well as the impact of contextual factors, the research aims to contribute to the existing knowledge in the field and provide valuable insights for banks and financial institutions to effectively implement and market AI-based banking services.

The objectives of the thesis will be to discover,

- The impact of functional attributes (e.g. understanding capacity, complexity, proactivity, design, confidentiality) of artificial intelligence based banking applications and personal traits (e.g., innovativeness, self-efficacy, familiarity) of bank customers on attitude and intention to use those AI based banking applications, in the post-pandemic era,
- The national, generational, e-commerce usage and socio-demographic differences in acceptance of artificial intelligence based banking services.

1.3 Research Questions

As the primary purpose of this study is to investigate and understand the motivations behind customers' adoption to artificial intelligence based banking services, specifically virtual assistants, the primary research questions that will guide the thesis are as follows:

1. What is the impact of functional attributes, such as proactivity, design, confidentiality of AI-based banking applications on customers' attitudes and intentions to use those applications? Additionally, how do personal traits, such as personal innovativeness, self-efficacy and familiarity with technology, influence customers' intentions and attitudes towards virtual assistants? This research question aims to reveal the factors that contribute to customers' acceptance and adoption of AI-based banking services by examining the relationship between functional attributes and personal traits and their impact on attitude and intention.

2. Are there any significant national, generational, e-commerce usage, and socio-demographic differences in the adoption of AI-based banking services? This research question seeks to investigate whether there are variations in the acceptance and usage of AI-based banking services based on factors such as nationality, generation, e-commerce habits, e-lifestyle and socio-demographic characteristics. By analyzing the mentioned differences, the study aims to provide insights into the specific factors that may influence the adoption of AI-based banking services in different contexts.

By addressing those research questions, the study aims to contribute to the existing literature on AI-based banking services and provide valuable insights for both practitioners and policymakers in the banking industry. The findings of this research can inform the development of effective digital banking marketing strategies and help banks better understand their customers' needs and preferences in the post-pandemic era.

1.4 Significance of the Study (Expected Contributions)

In order to understand the impact of emerging and disruptive intelligent technologies (such as ChatGPT) on the digital marketing discipline in the post-pandemic era, it is planned with this thesis to evaluate the indicators influencing acceptance of AI based banking solutions.

Based on a theoretical perspective, the study will define the motivating factors that have an impact on virtual assistant adoption of consumers in different nationality, e-lifestyle, income, culture and generations. Besides the thesis will contribute to build an enriched Technology Acceptance Model, covering both functional and customer based aspects of artificial intelligence based banking services.

Considering the business life perspective, it is expected from the thesis to discover existing problems and bring new ideas and recommendations for intelligent customer solutions on the agenda of financial institutions, especially in Turkey, where there is a geo-political instability, currency depreciation, high inflation rates and

uncertainties for long term investments of companies. Financial institutions will still grow in do it yourself banking services, consequently advanced analytics solutions. But, as the customers' adoption to AI based solutions in Turkish Banking industry, including virtual assistants and chatbots are limited and have not been studied in scientific study yet, this research will shed light on the future of AI usage and strategies, in the financial services sector.



Chapter 2

Literature Review

2.1 Digitalization of Banking Services

2.1.1 Global digital evolution. WeAreSocial's 2023 world-wide research reveals that two third of the global population, which translates to approximately 5.44 billion individuals, own smart or non-smart phone, tablet or other mobile devices. Of these mobile users, around 5.16 billion (64.4%) are considered to have internet connection. Accordingly, in Turkey, 71.38 of 85.59 million (83.4%) have active internet connection, with 94.3% of these connections are made via mobile devices. (Figure-1 illustrates the internet & mobile usage figures in Turkey and several other geographies.) (Wearesocial, 2023; Burak, İpek, 2021)

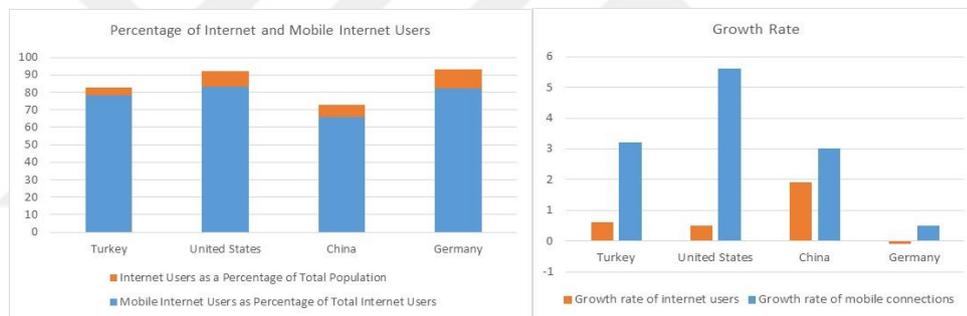


Figure 1. Internet & mobile usage ratios in different geographies (Wearesocial, 2023)

Online shopping experienced a significant (44%) annual surge during 2020 due to the Covid-19 pandemic and subsequent lockdown measures (Deloitte, TÜBİSAD, 2021). As per the latest figures, around 64% of consumers in Turkey, engage e-commerce transactions (Datareportal, 2023). Looking ahead, it was projected that the total amount of goods purchased via e-commerce platforms would reach \$20.87 billion in 2022. Furthermore, within a short period of time, digital payments on e-commerce web sites in Turkey witnessed an 18% increase. (Datareportal, 2023)

2.1.2 Digitalization of banking services & branchless banking. In accordance with the world-wide digital transformation, financial institutions also increased their

capital and operational expenditures on digital customer solutions, considering their high return on investment and the economies of scale, within the companies' tight budgets. Traditional core banking channels have been migrated to do it yourself services, based on digital banking, advanced analytics, virtual/ intelligent assistants, biometric recognition systems, robotic process automation and many different disruptive innovations. The digital banking apps and services build on artificial intelligence solutions including intelligent assistants and chat-bots have been prioritized and treated as the primary banking channels within the context of Omni channel service strategy. This transformation has challenged onsite banking services. (Cortinas et al, 2010). Due to the growth in mobile banking customers various financial institutions in different geographies, including United States, EU countries and Turkey reduced their branches (Figure 2) (French, Leyshon, Meek, 2013; BBC, 2016; Federal Deposit Insurance Cooperation, 2019; Webrazzi Insights, 2020; Strategy&, 2021; The Banks Association of Turkey, 2023).

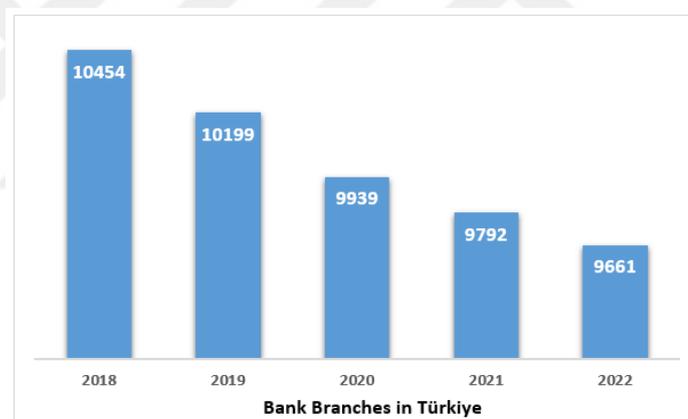
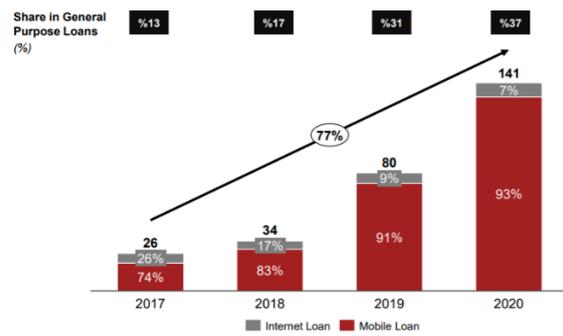
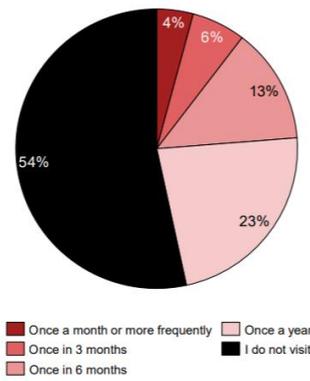


Figure 2. Overall number of bank branches in Turkey (The Banks Association of Turkey, 2023)

In-line with the decrease in number of branches, customers' branch visits are also becoming very limited in today's financial ecosystem. ~55% of the customers of Banks in Turkey, have never visited the branches after they were on-boarded. Besides, it is also observed that, 37% of whole retail loans are being lent via digital banking platforms in 2020 (Figure 3) (Strategy&, 2021).



Branch Visit Frequency

Volume of Retail Loans Lent in Digital Channels (TRY bn)

Figure 3. Branch visit frequency & Digital share in general purpose loans (Strategy&, 2021)

On the other hand, due to the digitalization of banking services, adoption to digital banking and artificial technologies, operational expenses of the financial institutions have been minimized compared to their revenues and assets (Figure 4) (McKinsey, 2021).

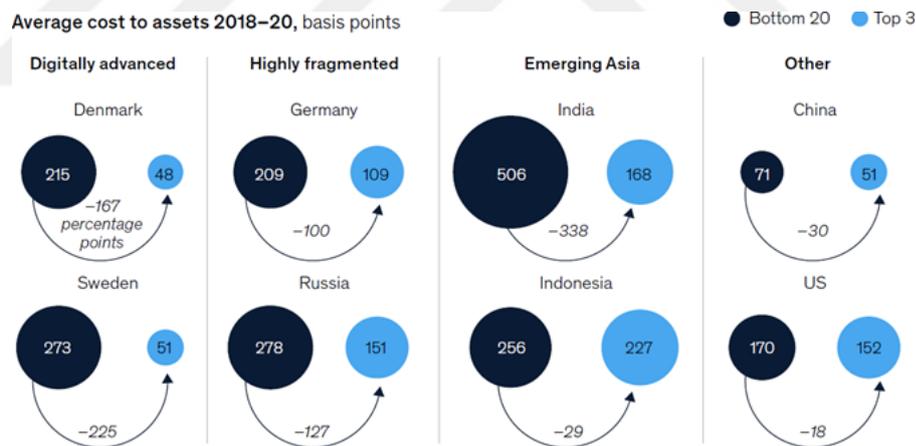


Figure 4. Average costs to assets in Banks 2018-2020 (McKinsey, 2021)

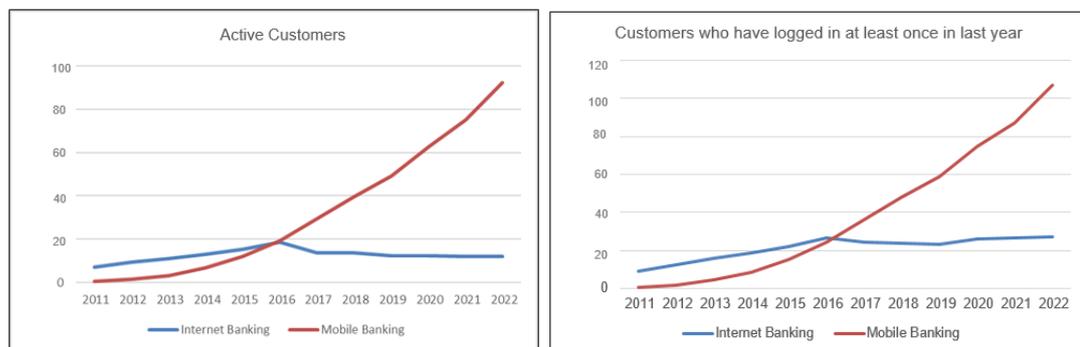
2.1.3 Mobile banking. Although mobile and internet banking are both do it yourself services, they are based and build on different configuration and access methodologies. A mobile application refers to the provision of banking services via mobile devices, while Internet Branches encompass the delivery of services via personal computers.

Thus, Internet banking can be seen as a predecessor of mobile banking apps (Laukkanen, Passanen, 2008).

More than 25 years passed since the first examples of internet branches have been implemented in the Turkish and European financial industry. During that period, Banks in Turkish economy never give up investing on those innovations, as well as aligning with the continuous legislation published by local authorities, including BRSA and Presidency of Turkish Republic. BRSA published a legislation in 2010 that defines the rules of operating the banking services under this channel and its security principles (BRSA, 2007). After 10 years, the mentioned regulation has been updated considering recent fraudial risks, digital customer expectations and alignment with other related legislation.

Notably, in response to the pandemic, financial institutions were permitted to remotely verify and accept new customers, through digital channels (BRSA, 2020). As mobilization gained momentum, the local authority began licensing solely digital banks, exclusively engaged in providing do it yourself services (BRSA, 2021).

In line with the mobilization of customers, rapidly changing regulatory environment and organizational expectations on economies of scale within tight budgets, mobile customer base grew exponentially, in the recent years (Mbama, Cajetan, 2018). Surprisingly, on the contrary internet banking client base has reduced. (The Banks Association of Turkey, 2023), (Figure 5).



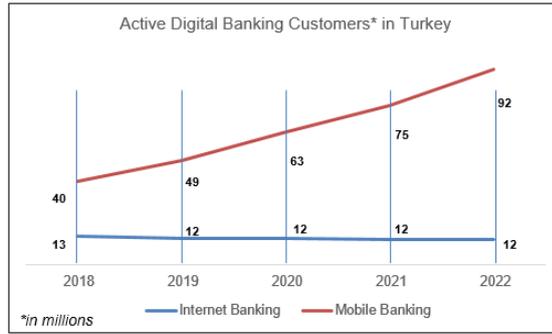


Figure 5. Digital banking statistics of period between 2011 – 2022 for Turkey (The Banks Association of Turkey, 2023)

Customers signed to the application has reached to around 145 million at 2022-year end. And the number of mobile active customers grew by 4,4 million quarterly (The Banks Association of Turkey, 2023).

2.2 Artificial Intelligence in Banking

2.2.1 Artificial intelligence based banking. From the theoretical approach, Artificial Intelligence (AI) is defined as the disruptive innovation which is going to replace people jobs in future (Huang, Rust, 2018). Companies' communications made by their agents have been replaced by artificially intelligent interfaces (Singh, Brady, Arnold, Brown, 2017). AI based banking is used throughout the Banks, both externally by the customers via Virtual, Digital or Personal assistants or chat-bots and internally by the organization itself, for credit, risk, operations, customer relationship management purposes. With the AI utilization strategy of the Banks, it is aimed to dispose around \$450 billion, in 2023 (Butt, Lee, 2022).

Since the mid of 2010s', the banking industry has been searching for AI solutions and interfaces for their customers in order to fulfill their individual expectations. AI based solutions are usually delivered in digital channels, as Instant Messaging Chatbots, Digital, Virtual & Intelligent Assistants, Video Authentication and Voice Recognition. Virtual assistants or chat-bots are artificial intelligence solutions which enable individuals make oral or verbal or reciprocal conversations with computers via a natural language and based on a natural language processing technology (Dale, 2016).

The intelligent assistants, Siri (Apple), Alexa (Amazon), Cortana (Microsoft), and Google Assistant (Google) were the first of their kind. They have been launched starting from 2011 and have various features delivered to consumers via smart devices, as well as pros and cons, given in Table 1 (Ha, Chen, Uy, Capistrano, 2021).

Table 1

Features of Outstanding Virtual Assistants with Non-Banking Purposes

	Year Invented	Features	Drawbacks in the Past	# of Languages Supported
Siri	2011	Delivers various services by voice (e.g. setting an alarm, informing on weather forecast, playing a song) via Apple devices.	Understanding capacity was limited.	20
Alexa	2014	Enables vocal interaction, playing music, podcasts, reading books, providing traffic status and news via Amazon Echo devices.	Usage limited to Amazon Echo devices	8
Cortana	2015	Sets alarm, reminder, shares the current location, receives information on traffic or news.	No outstanding drawback	8
Google Assistant	2016	Controls intelligent Google home devices, enables listening podcasts and news	Lack of two way conversation ability.	9

Following invention and several renewals of popular intelligent voice assistants of Google, Apple, Amazon and other big brands, OpenAI introduced a popular virtual assistant in November, 2022, called, **Chat GPT**. Chat GPT is described as an AI language model build to understand and generate human-like responses to a wide range of questions and prompts, on various topics. It is different from its predecessors, in terms of its detailed answers and responses across many domains of knowledge (Chat GPT, 2023). It's able to remember what the user said earlier in the conversation but has very limited knowledge of world and events after 2021.

As a language model, Chat GTP has a wide range of features that enable itself to understand and generate natural language text (Chat GPT, 2023). Some of its key features include:

- **Natural Language Processing:** Similar to other chat-bots, it is able to process and understand natural language text, respond to questions and statements posed.
- **Contextual Understanding:** It can understand the context of a conversation or text.

- Language Generation: It is able to generate grammatically correct sentences and paragraphs in response to questions.
- Language Translation: Similar to Google Translate, it is able to translate text from one language to another.
- Question Answering: It is able to answer questions accurately based on its knowledge and understanding of various topics.
- Text Completion: It can complete sentences or paragraphs based on the context and input shared with it.
- Sentiment Analysis: It can analyze the sentiment of a text, consequently determine whether it is positive, negative, or neutral.
- Summarization: It is able to summarize long text to provide a summary.
- Conversation Management: It can maintain a conversation and respond appropriately based on the input shared with it.

As the inheritor of the disruptive virtual assistants including Siri, Alexa, Google Assistant, Cortana, the financial virtual assistants: Erica (Bank of America-2016), Coin (JPMorgan Chase-2016), Gina (CaixaBank-2017), Citibot (Citi Bank-2018) are the leading ones in the financial services industry (Rosman, 2018; Acquire, 2020). In the following years, intelligent advisory services, sales of complex products (consumer loans, mortgage, investment etc.) and complicated inquiries to chat-bots have been initiated in digital channels. As a modern AI advisory service example, customers are able to link their banking accounts to Moneylink (a digital bank) application, and the application receives data from linked bank accounts and uses Artificial Intelligence and Machine Learning algorithms to offer customized, online and financial health improvement advices (Strategy&, 2021).

Virtual assistants and chatbots are mostly positioned in mobile banking applications. In Turkey, 73% of financial institutions offer their artificial intelligence based services in their mobile banking apps or web sites. The remaining banks prefer to position them in WhatsApp and social media platforms (CBOT, 2021). But the

industry is still searching for other platforms where AI based solutions will be available.

Based on the analysis made in 2019 by one of the biggest banks in Turkey, Ratio of Customers who used Intelligent Voice Assistants, at least once is %37 and Mobile Banking Customers who has tendency of using those Voice Assistants is %50. The percent of Mobile customers who continue to use Voice Assistants frequently after the first experience is calculated as %50. And the total number of monthly active customers who use virtual assistants in local banking industry is 2,3 million (The Banks Association of Turkey, 2019.) With the aid of robo-agents, world-wide financial assets at an amount of \$ 800.000 m are being managed, and this volume is increasing with a yearly ratio of %30 (Statista, 2019).

In the recent years, according to the “Chatbot Usage in the Turkish Banking Sector 2021 Report” of CBOT, %39 of mobile banking customers has used virtual chatbots, 60% of financial institutions either provide virtual assistant services or are about to deliver those Artificial Intelligence based services in line with their corporate strategies (Figure 6). %36 of financial institutions serves Voice-based assistants to enable their customers control their mobile banking apps efficiently by only their voice (CBOT, 2021). Although, it seems chatbots are welcomed by all stakeholders of the financial services industry, there is still a big room for improvement. Banking customers make inquiries and ask questions to virtual assistants or chatbots on product categories, exchange and interest rates, commissions, debt calculations, security processes and social issues. Although those technologies are able to fulfill consumers’ financial needs and offer the best services based on those needs (Lipton, Shrier, Pentland, 2016), a minor portion of the consumers are using those tools to perform financial services and transactions.

Top management of the most of companies are not aware of the criticality of Artificial Intelligence usage for their organizations. More than %60 of the C-level managers do not have an AI utilization strategy although they accept this technology as a strategic advantage in competition (Butt, Lee, 2022).

In this sense, customers' adoption to virtual agents was not so fast (Jung, Dorner, Weinhardt, Pasmaz, 2018). Within the early phases of those AI based agents, a limited part of the consumers was choosing and adapting those intelligent apps, instead of old platforms (Laukkanen, Pasanen, 2008). In the mature stages of those services, the Banks aimed to enhance the customer portfolio who will be using virtual agents although they were not using in the past (Ryu, 2018). That's why it's needed to define the accelerators of Artificial Intelligence banking services adoption including virtual agents, robo-advisors and chatbots.

On the other hand, the regulatory environment regarding banking services creates some opportunities for the players to further use AI based technologies. Especially, the new regulation of BRSA on digital onboarding and solely digital (branchless) banks, lets the Banks in Turkey to enhance their digitalization and consequently AI strategies. Thus, investments on artificial technologies are predicted to be increased in the near future. It is expected that robos and virtual assistants delivered by the global financial institutions, will increase till the end of 2023 by 3.150% (Juniper Research, 2019). As the financial services industry in Turkey is assumed as the master in implementation of innovative technologies, the Banks has already moved rapidly for those artificial solutions. But considering the postpandemic and the rivalry environment, those currently used virtual assistants and robots are expected to go beyond the current status.

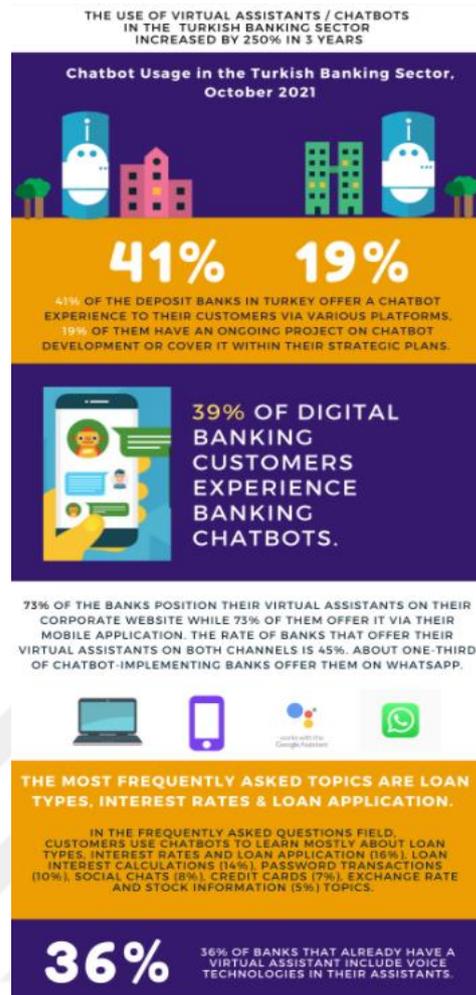


Figure 6. Chatbot Usage in the Turkish Banking Sector 2021 Report (CBOT, 2021)

2.2.2 Bank customers’ artificial intelligence based banking service usage statistics. Considering the above mentioned growth potential and recent advancement of artificial intelligence based banking services and the digital and regulatory environment that fosters their use, it is worth to evaluate the latest transactional statistics regarding Bank customers’ usage of AI based banking services. AI usage statistics of the Bank customers in Turkey, and the characteristics of the clients using those services have been analyzed.

Among the artificial intelligence services delivered to customers, usage of Virtual Assistants has been evaluated. The clients mostly prefer virtual assistants for doing investment, limit, account, card and debt query transactions. The percentage of

outstanding transactions and queries performed with the virtual assistant is given in Table 2.

Table 2

Distribution of Transactions & Queries performed via Banks' Virtual Assistants

INTENT	Ratio of transactions in Q1 2022
Investment Transactions	8,87%
Limit Transactions	7,01%
Query of Credit Categories	5,60%
Query of Account Info	6,11%
Debt Query	4,58%
Connection to Customer Agent	4,26%
Cancellations	3,07%
Observation – Account & Card Activities	3,16%
Card Type	2,28%
Loan	2,25%
Not understood.	2,33%
Others	50,48%
Total	100,00%

The virtual assistants served to the consumers in the financial services industry are either commanded by text or voice, or by tapping. The virtual assistants that have been commanded by text are also called as chat-bots. Among the alternative commanding categories, text is the most widely used, whereas voice is the least frequently used one. The virtual assistant usage preferences of the customers, through year 2021, including text, tap or voice based systems are given in Table 3. As it can be observed, text usage is increasing, while voice recognition systems are less likely preferred, in the recent months. The other details of those customers' preferences are given in Table 4.

Table 3

Banks' Virtual Assistant Users' Usage Preferences in Last One Year

Virtual Ass. Usage Preferences	2021 01	2021 02	2021 03	2021 04	2021 05	2021 06	2021 07	2021 08	2021 09	2021 10	2021 11
Text	73%	69%	76%	69%	74%	70%	75%	78%	80%	81%	83%
Tap	44%	49%	46%	50%	51%	57%	53%	56%	54%	54%	54%
Voice	21%	17%	17%	16%	15%	14%	14%	14%	13%	12%	12%

Table 4

Banks' Virtual Assistant Users' Usage Preferences in Detail

Text	Tap	Voice	Explanation	Year 2021 Usage
0	0	1	Commanded only with Voice	6,57%
0	1	0	Commanded only with Tapping	15,14%
0	1	1	Commanded with both Voice and Tapping	2,89%
1	0	0	Commanded only with Text	39,02%
1	0	1	Commanded with both Voice and Text	2,34%
1	1	0	Commanded with both Text and Tapping	31,02%
1	1	1	Commanded with all Text, Tapping and Voice	3,01%

As mentioned in the literature review, the usage frequency of AI based Banking services, including virtual assistants are still not high. Only one fifth of the active Bank customers have used virtual assistants once in a year. The virtual assistant usage frequencies of the customers are given in Table 5. The clients using virtual assistants monthly is only 2,35% level.

Table 5

Usage Frequency of Banks' Virtual Assistant Users

Usage Frequency	Unique Customers using Virtual Assistant
Once a Year	51,15%
Twice or 5 Times in a year (Quarterly)	39,32%
5 or 10 Times in a year (Bimonthly)	6,14%
10 or 20 Times in a year (Monthly)	2,35%
20 or 50 Times in a year (Weekly)	0,90%
50 or 100 Times in a year (Biweekly)	0,12%
Daily	0,02%

On the other hand, the characteristics and demographics of Bank customers using those services have been analyzed, as well. Compared to distribution of whole Bank customers, the customers using virtual assistants are younger and mostly between 18-35. The customers above 55 do not much prefer to use virtual assistants or similar Artificial Intelligence based banking services, as given in Table 6.

Table 6

Generational Distribution of Banks' Virtual Assistant Users

Age - Range	Ratio of Bank Customers	Ratio of Customers Using Virtual Assistants
Below 18	0,57%	0,32%
18 – 25	12,78%	21,04%
26 – 35	26,46%	32,20%
36 - 45	25,59%	25,40%
46 – 55	17,89%	13,93%
56 - 65	10,78%	5,34%
66 - 75	4,56%	1,48%
Above 75	1,38%	0,28%
Grand Total	100,00%	100,00%

Considering the educational status, the customers using virtual assistants are a little more educated than an average Bank customer. Among the customers using virtual assistants, there are proportionally less people who have graduated from primary and secondary school and more people from undergrad and academy. The details are given in Table 7.

Table 7

Educational Status of Banks' Virtual Assistant Users

Educational Status	Ratio of Bank Customers	Ratio of Customers Using Virtual Assistants
Primary School	11,71%	9,50%
Secondary School	8,80%	7,71%

Table 7 (cont.d)

Educational Status	Ratio of Bank Customers	Ratio of Customers Using Virtual Assistants
High School	48,27%	48,61%
Undergrad	23,22%	24,98%
Academy	6,56%	7,80%
Grad	1,44%	1,41%
Total	100%	100%

If the customers are assessed as per their monthly income, income of customers using virtual assistants are much higher than the monthly income of an average customer, as given in Table 8. There are proportionally three times more customers in high segments using virtual assistants.

Table 8

Socio-Economic Distribution of Banks' Virtual Assistant Users

Monthly Income	Ratio of All Bank Customers	Ratio of customers using Virtual Assistants
Less than 4250 TL per month	0,18%	0,19%
In between 4250-10000	56,05%	43,67%
Between 10000-20000	32,45%	29,36%
Between 20000-40000	7,74%	20,54%
Between 40000-80000	2,40%	6,43%
Greater than 80000	1,19%	2,65%

Furthermore, the customers using virtual assistants can be evaluated as per their gender and marital status. Considering those criteria, it can be observed that, AI addicted clients are much male and single. The details of the analysis are given in Table 9, 10.

Table 9

Gender Distribution of Banks' Virtual Assistant Users

Gender	Ratio of Bank Customers	Ratio of Customers Using Virtual Assistants
Female	33,75%	30,59%
Male	66,25%	69,41%

Table 10

Marital Status Distribution of Banks' Virtual Assistant Users

Marital Status	Ratio of Bank Customers	Ratio of Customers Using Virtual Assistants
Divorced	4,74%	5,45%
Single	26,41%	35,08%
Married	66,85%	58,36%
Widow	1,99%	1,11%
Grand Total	100,00%	100,00%

As the last but not the least, it is also possible to analyze the consumers using virtual assistants in terms of their mobile phone configuration. Considering that criteria, it is concluded that the clients using virtual assistants are a little more android users, as given in Table 11.

Table 11

Mobile Phone Configuration of Banks' Virtual Assistant Users

Operating System of Mobile	Ratio of Bank Customers	Ratio of Customers Using Virtual Assistants
Android	59,70%	61,60%
iPhone	40,30%	38,40%

2.3 Interviews with Executives of Banks on Artificial Intelligence and Digital Banking

Within context of qualitative analysis of the research, several interviews on digital banking and artificial intelligence with CEOs and c-level executives of local and global banks have been performed. Besides several interviews of those executives with the media have been reviewed and analyzed.

The first interview has been carried out with the executive vice president of one of the banks in Turkey, in charge of Digital Banking. Before focusing on the positioning of artificial intelligence in the company's and customers digital life, the executive described the key component financial health of customers, as the management of monthly budget, being ready for unexpected expenses, aware of financial opportunities for reaching dreamed future and targets. And the Bank offers various personal advices to enable customers have financial health.

Highlighting the leading role of Artificial Intelligence and Big Data, the executive explained that in order to understand, distinguish the needs of customers and bring with personal offers and advices, they are using the most valuable asset of the digital era 'data'. But in order to mine, analyze and interpret the customer data, other competences including data analytics and artificial intelligence is required. Considering, the expectations of the customers, they are building insights based on artificial intelligence technologies. She added that, one of the main digital strategies of the bank is to enrich the personal offers for customers, in every touch point, mainly in digital channels. WhatsApp channel and virtual assistant are outstanding artificial intelligent services. The customers are able to communicate verbally or in black and white with the Bank, via the virtual assistant and chat-bots.

The virtual assistant, which is a replacement of traditional human communication, offers nearly 200 services, thanks to natural language processing and establishing dialogue with customers. By means of WhatsApp chatbot, the Bank is able to support customers with more than 100 services, including inquires on credit card application, notification of stolen/lost cards, ATM/Branch location, fx rates and loan debt payment calculation.

The second interview has been performed with the executive vice president of another one of the Banks in Turkey, in charge of Digital Banking and Payment Systems. The executive, explained how the union of finance & banking knowhow and artificial intelligence created practices which add value to customers. She described their digitalization strategy as to offer the storified data based solution to correct customer at correct time. Highlighting the intelligence and insight behind the communication with customers, executive added that that are using artificial intelligence to generate customized offers and contents which will ease their financial life.

The Bank is using machine learning methods for customer modelling credit risk calculations and pricing, which were carried out via traditional statistical approaches in the past. In addition to that, they are positioning artificial intelligence based chatbots and robo-advisors in the heart of its channels. The executive explained that those technologies enhance the automation of the internal and external processes, create efficiency and brings new opportunities to both customers and the bank. Besides, those AI based services add value to decision mechanisms of customers, in the sense of 'speed' and 'accuracy'. She noted that we are in digital age encouraged by artificial intelligence, considering decreasing trend of data storage and processing expenses and increase in the data volume due to digital activities of individuals.

The Bank is offering its customers customized contents in its mobile app, via a communication channel supported by artificial intelligence. The bank is serving more than 20 million personal intelligent financial insights and solution offers, per month. Executive added that they have a sales and advice intelligence which is based on machine learning algorithms. This model matches the needs of customers with the related financial products. The chat-bot of the bank is also built on artificial intelligence, serves as a touchpoint where the customers can perform financial transactions and inquiries. The chat-bot is able to understand 90% of the customer requests.

In addition to the interviews made, several interviews of global banks' executives on digitalization and artificial intelligence given to the mass media have

been analyzed. The interview of a multi-national bank's executive chairman on digital banking strategies was one of the relevant ones.

The chairman explained that in order to reach their strategy of bringing opportunities to everyone, the bank has been focusing on digitalization as well as artificial intelligence, for many years. Chairman explained that, the bank is operating on artificial intelligence, to increase its customer base and reach operational excellence with efficiency.

Due to the strategy on data and technology, the Bank has focused on financial health, and delivery of better service to its customers explained chairman. They are aiming to enable the customers to do better financial decisions and improve their financial health.

The chairman described data as the most valuable asset and critical driver of economic value. Besides, chairman added that big data is used in every contact point and channel for clients, with artificial intelligence technologies, noting the huge data volume. That data can be reused, with advanced analytics, to create financial health of customers. At the end of his speech, he reminded the limitation in usage of private customer data.

Another interview of a well-known global bank's executive in charge of digital banking has been analyzed, as well. The executive director has focused on their chatbots and virtual agents which are the core services delivered based on artificial intelligence.

She explained that their value adding virtual agents deliver continuous automated services, which enable customers to fulfill their expectations. Those intelligent applications continued to create value to the consumers, within the pandemic and even post-pandemic period. She added that, during the pandemic where the amount of digital transaction requests has increased, although the real agents had difficulties to reach customers, virtual agents did their best and responded to most of the client requests.

2.4 Covid-19 Pandemic, an Accelerator of Technology Adoption

Customer behavior was reshaped and affected by lockdown, remote working applications and economic stagnation, which led to modification in the digital and conventional market relations at the time of Covid-19 Outbreak. There has been a quickening in digital insertion and modernization around the world. Turkish Ministry of Transport and Infrastructure stated that mobile data utilization had gone up by 5,7%, while the increase in Internet usage was 20% during 2Q20 . (Sayan, 2020). 61% of social platform members were more active due to lockdown. (AdColony, 2020). Social isolation caused consumers to prefer online shopping over conventional. The attractiveness and market share of online shops surged greater than conventional shops in urban areas of India (Gupta, Singhal, 2021). During 1Q20, internet traffic of online shops increased 251% and mobile applications deployed twice as much, when compared with 1Q19 (Zeo Agency, 2020).

Total number of Bank branches dropped to 10,015 from 10,099 in Turkey at the beginning of the Covid-19 outbreak, after the arguments regarding branches' role due to crowd utilization of digital channels (The Banks Association of Turkey, 2020, 2021). When considering legislations of regional lawmakers regarding open banking and digital onboarding, it would be possible to witness tragic decreases in the number of branches (Webrazzi Insights, 2020). In March, 2020 there has been a modification in the Information Systems and Electronic Banking regulation of BRSA, which enables banks to serve open banking services to their customers. (BRSA, 2020). According to new digital onboarding regulation of BRSA which was announced in May 2021, customers could be onboarded without physically visiting any bank branch. Economic liveness and the magnitude of financial processes were declining, along with regulatory developments and digitalization initiatives as a result of Covid-19 outbreak and stagnation. Banks in Turkey exhibited reduction in call center transactions to 112 million from 118 million at the time of outbreak, similar to branches' workload. Contrary to decreasing trend in branches, ATMs and call centers, clients who use mobile and internet banking services has increased at the time of the initial span of outbreak as shown in Figure 8,9. (The Banks Association of Turkey, 2020, 2021)



Figure 7. Changes in no of digital customers (The Banks Association of Turkey, 2020, 2021)

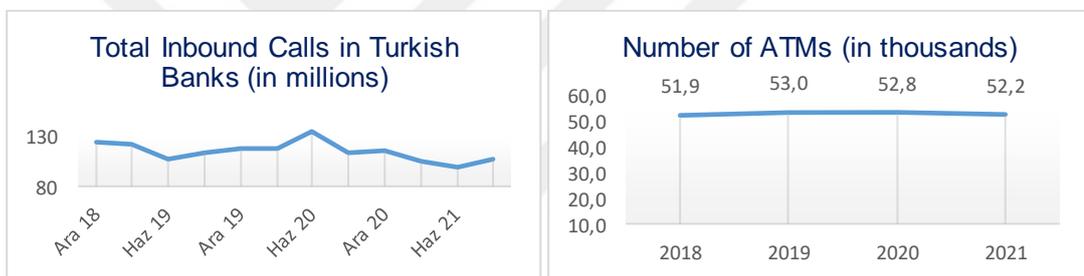


Figure 8. Changes in no of ATMs & Call Center inbound calls (The Banks Association of Turkey, 2020, 2021)

According to McKinsey’s Global Banking Annual Review 2021: The great divergence (December, 2021), the rate of digital banking adoption has doubled during the pandemic. The digital banking metrics has been compared, as given in Figure 10. (McKinsey, 2021)

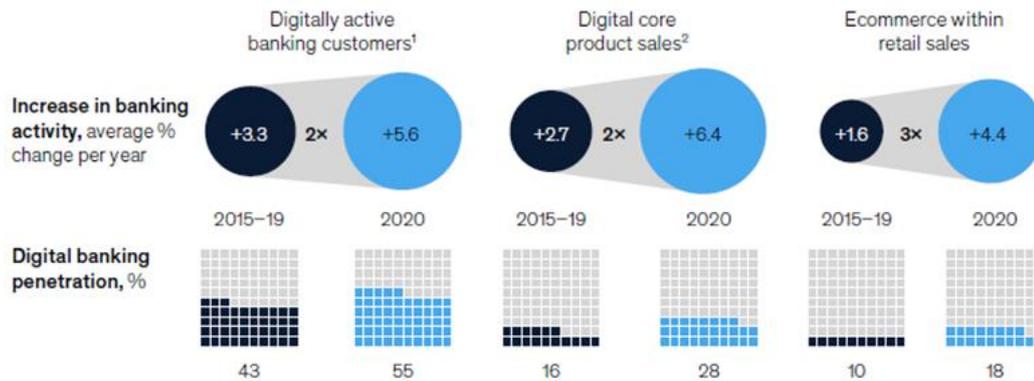


Figure 9. Digital banking adoption in pandemic (McKinsey, 2021)

Consumers who stopped to do transaction onsite or call center channels preferred to enrich their transaction portfolio in mobile banking or perform mobile transactions for the first time.

On the other hand, customers are demanding high quality omni-channel services from the financial institutions. The demand has been improved in post-pandemic period and caused Banks to search innovative solutions for digital services. Within this era, virtual agents, chat-bots and robotics have been the leading disruptive technologies used in the financial services industry, as it is in recent years. (CBOT, 2021) During the three year pandemic period, the usage of artificial intelligence solutions in banking services have increased from %20 to %49.

In such a dynamic environment where the habits and behavior of the consumer is also changing rapidly, technology for sure is a facilitating and fastening factor making the old business systems obsolete.

In addition, the pandemic has brought on a series number of challenges in the implementation of AI in the banking sector. Although banks' interest in AI technologies remains high, the reduction in revenue has resulted in a decrease in short-term investments for AI technologies (Anderson et al., 2021). Wu and Olson (2020) emphasize the necessity of banks to proceed planning relevant budgets for AI expenditures in order to mitigate upcoming risks, improve the orchestration of automated and manual services. During the pandemic and post-pandemic era, there is

a surge in the adoption of AI-driven services such as chatbots and robo-advisors (Agarwal et al., 2022; Butt, Lee, 2022)

Due to the expectations of customers and conjectural investment necessities, today investigating the indicatives of accepting AI based banking services is critical, especially in the post pandemic period, where the resources are scarce but at the same time too valuable as they will be used for reducing the costs by new digitalization initiatives.

2.5 Technology Acceptance Models

With this thesis, from a scientific perspective, it is aimed to integrate TAM with different technology acceptance models covering the necessary factors that are critical in accepting Banks' AI based digital solutions. Technology Acceptance Model, enriched with several constructs of UTAUT (Venkatesh, Morris, Davis, Davis, 2003) is planned to be executed to understand the motives behind adoption to Banks' Virtual Assistants. Several research have focused on mitigating the differences between the model exploring the determinant factors and what the real life determinants are in the business practice (Butt, Lee, 2022). Similar to Technology Acceptance Model, UTAUT focuses on exploring the variables affecting the adoption to technology and the relationships between these variables. (Davis, 1989; Shumaila, Gordon, John, 2010).

Above-mentioned technology acceptance models were cited in different academic studies, mainly on adoption to AI services, virtual assistants, conversational assistants, robotic process automation, finance robots, e-banking and mobile apps (Table-12).

Table 12

Research on Adoption to AI Based Banking Services, Models Used & Findings

Research	Model Used	Acceptance of the Model
Belanche, Casalo, Flavián, 2019	TAM extended with subjective norms, familiarity, age and gender	Findings are partially consistent with the model. (Subjective norms affect adoption to AI- robo-advisors. Familiarity has a moderating impact.)
Song, 2019	TAM extended with subjective norms.	Findings are partially consistent with the model. (Perceived usefulness and ease of use have an impact on intention to use AI Virtual Assistant)
Gunadi, Bernardinus, 2019	Ridwan, TAM extended with service quality	Findings are consistent with the model. (Information Service Quality, Perceived Ease of Use, and Perceived Usefulness have correlation on Intention to use Virtual Assistants.)
Godhuli, 2020	TAM	Findings are consistent with the model. (perceived ease of use, enjoyment, trust, risk affected intention to use Conversational Assistant)
Nashold, 2020	TAM integrated with trust	Findings are partially consistent with the model. (Trust has an impact on adoption of Virtual Finance Assistant)
Siderska, 2021	TAM extended with security and functionality	Findings are partially consistent with the model. (Usefulness has an impact on adoption of Robotic Process Automation)
Mer, Amarpreet, 2021	UTAUT extended with Perceived Risk and Trust	Findings are partially consistent with the model. (Effort expectancy, trust, social influence, performance expectancy and perceived risk have an impact on millennials' behavioral intention of e-banking.)
Nazri, Azreen, Nor, 2021	TAM extended with trust, lifestyle.	Findings are partially consistent with the model. (Perceived usefulness, trust, credibility and compatibility with lifestyles influence intention to use mobile banking.)
Salam, Saha, Rahman, Mutsuddi, 2021	TAM	Findings are partially consistent with the model. (Personal interaction, capability, risk, and privacy influence mobile banking adaptation.)
Manrai, Gupta, 2022.	TAM extended with subjective norms and trust.	Findings are partially consistent with the model. (Trust on service, subjective norms, perceived usefulness, ease of use and attitudes influence artificial intelligence technology adoption in investment services in India.)

Studies related to TAM deal with influence of variables including usefulness, ease of use, effectiveness on adoption to that technology (Laukkanen, 2007).

As in various research, the coverage of TAM is not adequate, it is expected to build an enriched or extended TAM which include other factors (Sun, Cao, You, 2010). As an example, TAM integrated with trust and self-efficacy, was used in AI based banking acceptance. It is revealed that this integration explains and predicts better the adoption (Luarn, Lin, 2005). Besides, as TAM originally does not cover subjective norms, with the launch of extended TAM, subjective norms have been added to the new model (Venkatesh, Davis, 2000), and it was revealed that subjective norms have a positive impact on intention to use new technologies (Song, 2019).

On the other hand, Diffusion of Innovation (DOI) theory focuses on the relative advantage, efficiency and compatibility features of new technologies, which are different from the above-mentioned variables. Although DOI is mostly referenced to express diffusion of new ideas, it is utilized to explain dispersal of new technologies, as well (Rogers, 1995). DOI is also used with TAM to evaluate internet, mobile and AI based banking adoption (Zolait, Sulaiman, 2008).

Besides, stimulus organism response (SOR) is another relevant theory which is used to establish research model to evaluate how intelligence and anthropomorphism effects perceived cost, risk and trust (organism), which have an impact on consumers' AI based or mobile banking app adoption (response), (Lee, Chen, 2022).

In addition to SOR and DOI, UTAUT mostly deals with other social factors such as, social influence, self-efficacy which determine adoption to use the Virtual Assistant (Venkatesh, Morris, Davis, Davis, 2003). UTAUT is treated as a complicated model in the literature, due to its coverage of high number of variables and integrations to various other models. Consequently, within the context of this research, TAM with some extensions from UTAUT, DOI and integrated with perceived risks, subjective norms, familiarity, and other personal characteristics and demographics are used to evaluate the impact of determinant factors on attitude towards and intention to use artificial intelligence based banking service or namely virtual assistant. (Table 13)

On the other hand, UTAUT is mainly focusing on additional factors including, social influence, self-efficacy, hedonic motivation (enjoyment) which determine adoption to use the mobile banking applications [76].

Table 13

Technology Acceptance Models the Variables Derived From

Variables	Technology acceptance model, the variable derived from
Usability	
Ease of Use	TAM
Age	
Enjoyment (Hedonic Motivation)	UTAUT
Self-Efficacy	
Complexity	DOI
Confidentiality (Security)	
Performance	
Proactivity	
Awareness	
Financial Risk	
Design	The author has integrated to the model during the research
Modality	
Trust	
Complaint Handling	
Personal Innovativeness	
Familiarity	
Attitude towards AI based banking	TAM, UTAUT
Intention to Use AI based banking	

Variables included in the research design and hypotheses proposed are given in detail with the related literature in the following sections.

2.6 Attributes of AI based banking applications

2.6.1 Usability. Usability and ease of use are the two main components in adoption to a technology, and usability has been described as the consumers' perception of whether experiencing a technology can bring advantages and benefits to herself (Davis, 1989). It is also defined as 'practicableness', in the meaning of convenient interfaces or applications, and ability to use efficiently, no matter the conditions are. (Daniel, 1999; Mols, 2001; Sundarraj, Wu, 2005). Various research has found out that, functionality of Banks' digital apps and their inimitable content influence on acceptance of those apps (Lee, Chung, 2009; Kaura, Durga Prasad, Sharma, 2015).

The usability is also referred as a significant indicative of acceptance of banks' internet and AI based solutions (Pikkarainen, Pikkarainen, Karjaluoto, Pahnila, 2004; Gounaris, Koritos, 2008; Gu, Lee, Suh, 2009). Several research revealed that usefulness significantly influence adoption to banks' digital customer solutions and virtual assistants. (Akturan, Tezcan, 2012; Maditinos, Chatzoudes, Sarigiannidis, 2013; Aboelmaged, Gebba, 2013; Azmi, Zahari, Yunus, Kamar, 2021)

On the other hand, some other research on adoption to artificial intelligence based technologies, especially virtual agents, focused a necessity to improve usability of the mentioned AI based services, to accelerate the adoption to them (Jung, Dorner, Weinhardt, Puzmaz, 2018). Besides, various research has revealed that the usability deficiencies of virtual assistants, lead to not fulfilling the expectations of consumers and negative impact on adoption to those virtual assistants (Myers, Furqan, Nebolsky, Caro, Zhu, 2018; Li, Yeh, Chang, Tsai, Chen, Chang, 2020).

2.6.2 Ease of use. The use of technology and its components with less effort is defined as ease of use. Being one of the two main elements of TAM, with ease of use

people welcomes new technologies as a matter, a change and a new demeanor (Davis, 1989). Innovations and new applications that are easy to use will bother people less than complex applications (Moon, Kim, 2001).

Banking applications that are easy to learn and use are appreciated by customers as these factors ensure that mobile banking is accepted by customers (Jahangir, Begum, 2008; Azmi, Zahari, Yunus, Kamar, 2021). In other words, customers' thinking that applications are easy to use leads to acceptance of digital banking services and customer satisfaction (Davis, 1989; Sally, Heidi, Christine, 2006; Gounaris, Koritos, 2008; Akturan, Tezcan, 2012; Farnaz, Mohd, Ahmad, Norhayati, Ahamad, 2012).

2.6.3 Confidentiality risk. There are various risks which behave as a barrier for individuals' adoption of mobile banking and artificial intelligence based banking applications. The leading risks are confidentiality, security, performance and financial risks. Security risk which is potentially the most concerning one includes data leakage, account take-overs and fraudial transactions (Akturan, Tezcan, 2012). Formerly, security risk is described also as a threat that potentially leads to information disclosure and fraud (Kalakota, Whinston, 1997). Bank customers believe that their accounts including passwords can be taken over (Poon, 2008). Even, some of them think that their mobile devices or passwords shared through mobile devices can be stolen, as well (Coursaris, Hassanein, Head, 2003).

The properties of popular intelligent assistants of Amazon, Apple, Microsoft and Google brings confidentiality risks regarding the information submitted to those assistants.

Usage of mobile devices, may lead to certain contrary beliefs and experiences that can probably affect user perceptions related to information confidentiality and privacy, as well as user willingness to disclose information (Wottrich et al., 2018). Communication privacy management theory, elaborated by Petronio (2002), has been used to reveal people's disclosure attitude and behavior including their personal data. This theory uses the boundary metaphor, which is the segregation between private and

public data, in order to conceptualize the privacy management process (Child & Petronio, 2011). People manage their privacy by closing or opening this boundary to other people, allowing the public to access certain pieces of personal information (Zlatolas et al., 2015). The boundary is developed by a number of rules, aimed at reducing risks and maximizing the benefits of this exposure (Metzger, 2007).

A serious number of consumers do not adopt to mobile banking and AI based banking due to pay cash practices, security and confidentiality concerns on digital channels (Daniel, 1999; Aladwani, 2001; Ezeoha, 2005; Littler, Melanthiou, 2006; Kuisma, Laukkanen, Hiltunen, 2007; Tavilla, 2015). Security or confidentiality risk is determined to be a factor that affects attitude towards mobile banking and AI based banking, negatively. (Milind, 1999; Bestavros, 2000; Akinci, Aksoy, Atilgan, 2003; Akturan, Tezcan, 2012; Maditinos, Chatzoudes, Sarigiannidis, 2013; Hanafizadeh, Behboudi, Koshksaray, Tabar, 2014; Martins, Oliveira, Popovic, 2014). Conversely, confidentiality influences attitude towards mobile banking and artificial intelligence based banking, positively.

2.6.4 Performance. A service malfunction or interruption is defined as the performance risk observed by people (Akturan, Tezcan, 2012). Failure of bank systems to serve can lead to financial and data loss (Yiu, Grant, Edgar, 2007). In addition, the performance risk is described as the virtual customer representatives not recognizing and misdirecting the given commands. This situation causes the expectations of the customers not to be met and the compliance with these representatives is negatively affected (Myers, Furqan, Nebolsky, Caro, Zhu, 2018; Li, Yeh, Chang, Tsai, Chen, Chang, 2020).

The performance risk observed by the customers had a significant adverse effect on the customers' orientation towards mobile banking services, and consequently had an unfavorable impact on the acceptance of digital banking (Featherman, Pavlou, 2003; Akturan, Tezcan, 2012; Maditinos, Chatzoudes, Sarigiannidis, 2013). On the contrary, offering good performance to customers enhances the acceptance of digital banking.

2.6.5 Financial risk. Financial risk is defined as residual risks of mobile and internet banking, along with security and threats that may cause economic markdown as a result of valuation and expenditure of services (Akturan, Tezcan, 2012). Due to payment processes and monetary loss heeds, financial risk observed by customers has an influence adversely on acceptance of digital banking services (Kuisma, Laukkanen, Hiltunen, 2007; Akturan, Tezcan, 2012; Maditinos, Chatzoudes, Sarigiannidis, 2013).

2.6.6 Enjoyment. Degree of using a technology is considered amusing is stated as enjoyment. (Davis, Bagozzi, Warshaw, 1992). Subjective enjoyment can be referred as an inherent characteristic. The effect of enjoyment on accepting a technology has been pointed out by a number of research. (Davis, Bagozzi, Warshaw, 1992; Igarria, Iivari, Maragahh, 1995; Teo, Lim, Lai, 1999)

In addition, it has been proven that joy effects how users feel about mobile and AI-based financial services (Venkatesh, Thong, Xu, 2012; Maditinos, Chatzoudes, Sarigiannidis, 2013; Boonsiritomachai, Pitchayadejanant, 2017). Moreover, it is stated in various research that the most important factor in encouraging Bank clients to use internet banking is enjoyment (Boonsiritomachai, Pitchayadejanant, 2017).

Similarly, within the scope of Artificial Intelligence adoption, hedonic motivation is determined as an accelerator for using the consumers' Google Assistant based smart devices. The greater consumers' enjoyment of their smart assistants, the greater their attitude to use them in their daily lives. Enjoyment has been revealed to have a positive impact on the intention to use virtual assistants (Wald, Piotrowski, Araujo, van Oosten, 2023).

2.6.7 Awareness. The concept of "Awareness" refers to making customers aware of the benefits and ways of using virtual assistants and digital banking services. Banks frequently invest in marketing to build consciousness regarding digital banking services. Clients will be notified on its benefits, drawbacks, and adverts through

effective marketing techniques, and they will get used to utilize it (Mohd, Mohd, Mohd, Mohd, 2011).

Customers who have sufficient information about digital and AI-based banking services view them as more trustworthy and safer than those who do not have (Ba, 2001).

According to numerous researches, consumers' knowledge of AI-based and digital banking applications, as well as their understanding of such services' challenges, offers, opportunities, strengths, and benefits, lead to high adoption of those apps (Sathye, 1999; Howcroft, Hamilton, Hewer, 2002; Pikkarainen, Pikkarainen, Karjaluoto, Pahnla, 2004).

2.6.8 Design. The design of digital banking features mostly refers to the quality of the mobile banking application, web site and their components. The design of companies' digital service channels and web sites in the new digital era has an impact on customers' perception on service quality, as well as service adoption. (Wang, Law, Guillet, Hung, Fong, 2015; Ananda, AlLawati, 2018). The design of technology based platforms of the Banks, including mobile banking and artificial intelligence based banking applications have an influence on their service quality and adoption. (Ibrahim, Joseph, Ibeh, 2006; Ho, Lin, 2010; Ananda, Al Lawati, 2018). That's why the design of AI chatbots or virtual assistants is suggested to be an accelerator of trust and intention to use those disruptive technologies. (Wang, Law, Guillet, Hung, Fong, 2015).

2.6.9 Complexity (Efficiency). With the term Complexity, it is aimed to define a technology which is perceived as difficult to experience and understand (Cheung Chang, Lai, 2000). The complex technologies lead consumers to use additional talents

to adopt those technologies. And for the consumers who lack those talents, it is not easy to adopt those complex technologies.

Various research revealed that the perceived complexity has a negative impact on adoption and intention to use digital banking, including AI based banking services (Margaret, Thompson, 2000; Mallat, 2007; Sheikh, Rajmohan, 2017; Azmi, Zahari, Yunus, Kamar, 2021).

2.6.10 Modality of virtual assistant (voice, text, tapping/ male vs female assistant). The recent literature suggests that voice (vs. text or tapping) interaction leads to more positive attitude toward the Virtual Assistant system mediated by perceived human likeness of the Virtual Assistant. On the contrary, in various research, it is also claimed that the increased human likeness of a virtual assistant or a chatbot materially increased consumers' fear of using them. (Song, Shin, 2022).

In another research, it is also revealed that customers who are using voice based Artificial Intelligence tools, were the most worried ones on security and found text-based AI applications to be the most welcomed apps. (Voorveld, Araujo, 2020).

Besides, it is also emphasized in the literature that gender stereotype has an influence on consumers' perception of virtual assistants. It is also revealed that female-voiced assistants are perceived as being more preferable than male-voiced assistants (Cho, Molina, Wang, 2019).

2.7 Attributes of Customers' Banks

2.7.1 Trust. The banks' and digital services' credibility perceived by the customers refers both a difficulty and an opportunity for adoption of those services (Aladwani, 2001). A loyalty exists when the consumer has confidence in the bank (Dayal, Landesbeg, and Zeisser, 1999). Moreover, it is believed that conventional customers

will be likely to migrate from branches to digital banking channels if they find those channels trustworthy. (Mohd, Mohd, Mohd, Mohd, 2011).

2.7.2 Complaint handling. Consumers share their problems regarding financial products and applications to Banks via variety of ways. These problems are then reviewed, addressed and the consumers are informed about the outcomes. There are various problem management solutions, such as web forums, in addition to call centers and online customer care professionals regarding digital banking applications. It is shown in various research that problem management solutions have a direct impact on customers' experience and behavior regarding digital banking (Fathollahzadeh, Hashemi, Kahreh, 2011).

2.8 Attributes of Customers using AI applications

2.8.1 Self-Efficacy. Self-Efficacy is described in numerous researches as an individual's level of skill and capability to employ a novel technology, such as internet banking service (Bandura 1977; Venkatesh, Morris, Davis, Davis, 2003; Boonsiritomachai, Pitchayadejanant, 2017). Persons who embrace innovations inclined to actively seek, and experiment with them (Succi, Walter, 1999).

In several research, it is asserted that self-efficacy has a significant impact on the acceptance of digital banking services. (Chan, Lu, 2004; Luarn, Lin, 2005; Dasgupta, Paul, Fuloria, 2011; Sripalawat, Thongmak, Ngramyarn, 2011; Boonsiritomachai, Pitchayadejanant, 2017).

2.8.2 Personal innovativeness. Individual propensity for innovation represents a person's eagerness to discover, investigate, and employ innovations (Lu, Yao, Yu, 2005). A consumer's propensity for innovation can be classified as either intrinsic innovativeness or digital-related innovativeness, when examining the impact of personal attributes on acceptance of digital banking. It is posited that digital-related

innovativeness has a favorable influence on the acceptance of digital banking services (Lassar, Manolis, Lassar, 2005).

2.8.3 Familiarity. Familiarity is described as the precondition of trust (Luhmann, 1979). Familiarity is also described as being used to experience technologies, in similar kind. Individuals may have different level of experience on newly faced applications and that's why consumers can have high, mid or low level familiarity on disruptive technologies (Young, Hawkins, Sharlin, Igarashi, 2009).

In various research, familiarity with artificial intelligence based banking services, including virtual assistants, robo-advisors, chatbots is revealed to influence attitude towards those robo-advisors (Venkatesh, Davis, 2000; Belanche, Casaló, Flavián, 2019). Besides, it is concluded in other research that, lack of social awareness, familiarity with different technology form significant barriers to adopting e-banking systems (Mwela, 2014).

If the levels of familiarity of a consumer is low, usability has an impact on adoption and loyalty through consumer satisfaction. However, if familiarity increases, then perceived usability influences on loyalty not only through its effect on satisfaction, but also in a direct way. Consequently, the higher level of familiarity, the higher the weight of usability in the meaning of AI based technology adoption and loyalty (Casaló, Flavián, Guinalú, 2008).

2.8.4 Life style & subjective norms. Subjective norms are defined as the individual's perception of her relevant connections and those connections' belief on doing a specific behavior or not, considering their influence on herself, as well the influence of media (Fishbein, Ajzen, 1975). Subjective norms can impact consumers' decisions experiencing an innovation for first time (Taylor, Todd, 1995). Those innovations, or new technologies can be mobile and artificial intelligence banking.

That's why, subjective norms and life style have an influence on and are accelerators of adoption to robotics (Belanche, Casaló, Flavián, 2019).

On the other hand, lifestyle of digital banking customers shares some common and unique characteristics, leadership skills, family, health, community and fashion consciousness. Those characteristics strongly influence adoption to mobile and AI based banking (Hanafizadeh, Behboudi, Koshksaray, Tabar, 2014; Al-Dmour, Dawood, Al-Dmour, Masa'deh, 2020).

Besides, in various research, e-lifestyle of mobile banking customers were categorized, including digital laggards, traditional banking likers, digital followers, digital carers, and digital seekers, and it is revealed that consumers' e-lifestyle strongly moderates the effects of individual attitudes, on adoption to mobile and AI based banking (Yu, 2015).

Pedersen and Ling (2002) suggested that external and social influence cannot be ignored in any technology acceptance model due to their contribution to technology adoption behavior. Social norms' impact on technology adoption have been validated in studies such as e-mail usage (Karahana, Limayem, 2000) and digital banking (Chan, Lu, 2004; Hernan, Rosa, 2010).

2.8.5 Generation. The age and generational cohort of a customer can influence their attitude and intention to use mobile app (Venkatesh, Morris, Davis, Davis, 2003; Kumar, Lim, 2008). Age is also considered a determinant factor in the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, Davis, 2003). Moreover, older individuals are generally regarded as more cautious in adopting new technologies compared to younger generations (Hess, 1994).

In contrast to baby boomers, Generation X and Y exhibit greater willingness to embrace new technologies, as they possess a stronger affinity for technology (Freestone, Mitchell, 2004; Goi, Ng, 2011). Generation X began using mobile devices at very early age and had the opportunity to fulfill their desires through phones or tablets. Thus, they find it natural and effortless to perform any of their banking

transactions via mobile-based, internet-based or AI-based banking applications, as these applications meet the expectations of these generations (Boonsirito machai, Pitchayadejanant, 2017; Goi, Ng, 2011). Furthermore, Generation Y, having been exposed to mobile devices at older stages of their lives, exhibits a more conservative approach in utilizing mobile banking applications or AI-based banking services, even with virtual assistants, in comparison to Generation X.

On the other hand, usage of virtual assistants in different generations have also been evaluated in the literature. Virtual assistant usage frequency of four different age groups are given in Figure 11, below, which on the contrary and interestingly explains that elder generations are more inclined to use virtual assistants frequently (Marta, Sarita, Hector, 2018).

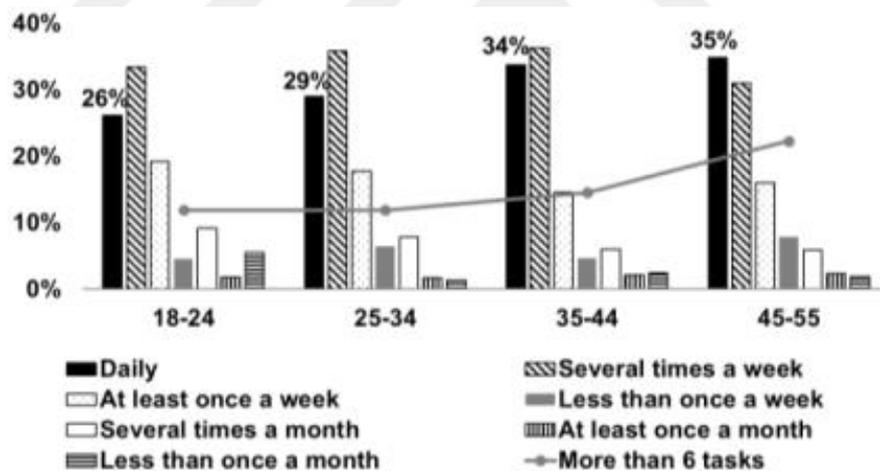


Figure 10. Virtual assistant usage frequency of different age groups (Marta, Sarita, Hector, 2018)

2.8.6 Gender. Females are more eager to consult other people compared to men if they face an innovation (Venkatesh, Morris, Davis, Davis, 2003; Sun, Zhang, 2006). Interestingly, female users of mobile phones that have performed digital banking transactions perceive that ease of use leads to perception of more usefulness of the device to conduct banking transactions. This confirms previous studies that have

shown a direct influence of users' gender and digital banking application's ease of use, on those applications (Davis, 1989; Luarn, Lin, 2005).

On the other hand, it is revealed in various research that, male customers are more inclined to see if there is a relative advantage in the technology or artificial intelligence to determine its usefulness. Male, undergraduate students, were slightly more inclined to treat digital banking applications as a practical tool for banking transactions. (Hernan, Rosa, 2010)

2.8.7 Nationality. Cultural factors, have an impact on attitude and intention to use mobile banking applications, AI based banking robots and especially virtual assistants (Changchit, Klaus, Lonkani, Sampet, 2020; Tubadji, Toby, Don, 2021). According to the recent literature, most of consumers who use digital platforms in different geographies of the world are aware or use virtual assistants. Distribution of awareness and usage of virtual assistants in different countries are given in Figure 12. More than 50% of all digital consumers across the world (56%) are aware of virtual assistants. Besides, more than %25 of them (28%) are using those applications, whereas just 5% used but gave up. And only %12 of those clients is not aware of those technologies. (Marta, Sarita, Hector, 2018).

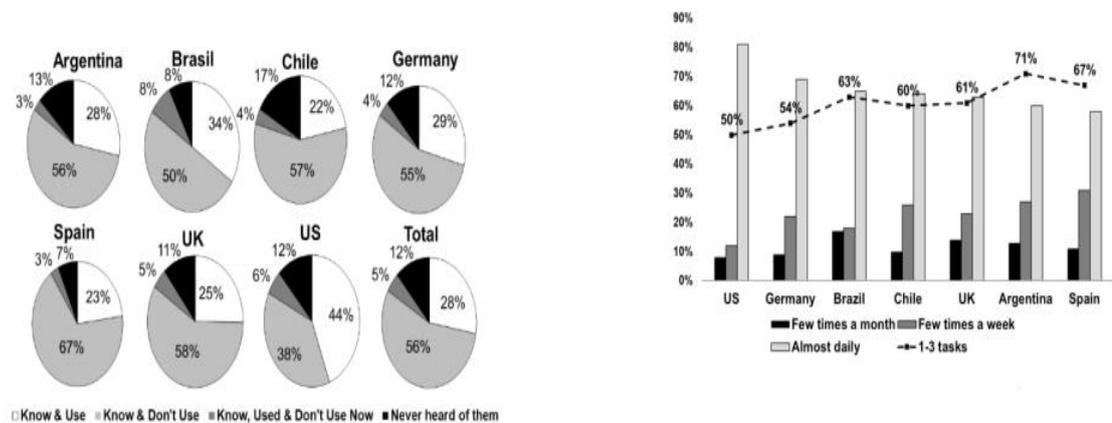


Figure 11. Distribution of awareness and usage of virtual assistants in different countries (Marta, Sarita, Hector, 2018)

However, several significant differences exist in countries, as given in Figure 12. In-line with the expectations, the digital consumers of US (44%) use virtual assistants, the most, whereas Chile citizens (22%) use virtual assistants the least. 17% of them are not aware of them. Spanish people are the ones that have an idea about the virtual assistants, the highest. The ratio of citizens who have an idea about virtual assistants but do not use them is highest (67%) in Spain among all geographies, while it is lowest (38%) in US (Marta, Sarita, Hector, 2018).

2.8.8 Use of e-commerce. In broad scope, e-commerce is defined in various literature as the set of commercial transactions performed between business to business, business to consumer and similar combinations, using the Internet or mobile connections (Ezzaouia, Bulchand-Gidumal, 2020; Alzahrani, 2019; Phiri, 2019; Fonseka et al., 2021). Transactional processing and communication between business to consumers in e-commerce platforms is being operated through Artificial Intelligence based tools, including chatbots and virtual assistants, in the recent years.

As chatbots and virtual assistants are widely used in e-commerce platforms, it is worth to search the impact of e-commerce use and routines on adoption to use AI based banking apps. As per the impact of e-commerce usage on adoption to virtual assistant, %20 of e-commerce users explains that existence of online chatbot in an e-commerce platform encourages them to complete an online purchase transaction (Datareportal, 2023).

Finally, considering the Theory of Planned Behavior (Icek, 1991) and Technology Acceptance Model, attitude to use mobile banking & AI based banking has a positive influence on intention to use mobile & AI based banking, as attitude toward the technology and behavior, behavioral control and subjective norms can predict intention to use the technology and behave with strong accuracy.

All the references of the literature reviewed are given in the References part of this thesis.

Chapter 3

Methodology

3.1 Research Design

Based on the variables required to address pre-defined problem statements and research purposes and the interaction between those variables discussed in the literature review, the preliminary research model has been determined (Figure-13). While defining the initial model, the above-mentioned technology acceptance models, including TAM, UTAUT, DOI and SOR with some additional constructs, have been considered and the necessary variables are adapted either from those models or developed throughout the research.

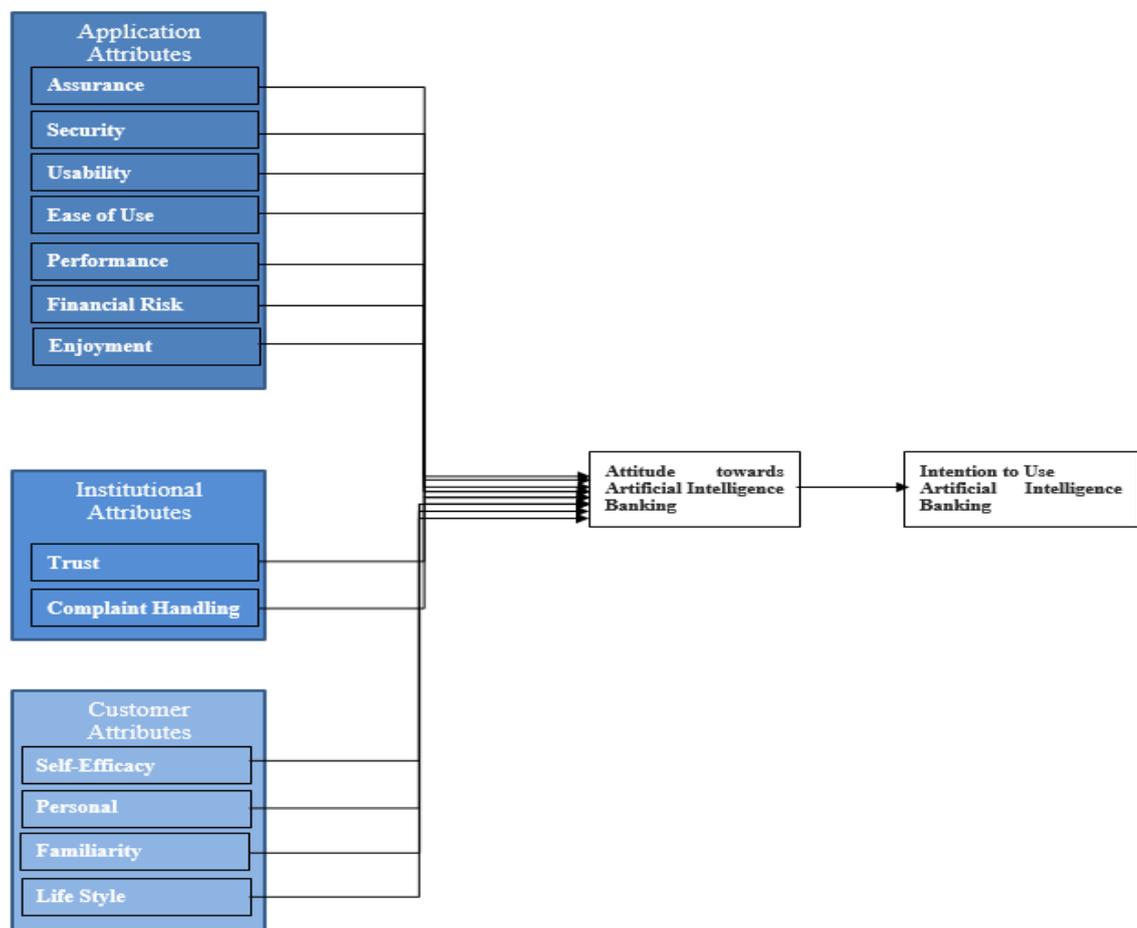


Figure 12. Preliminary research model

Considering the above-mentioned preliminary model and the literature review related to the factors which have been included in the model, it is possible to describe and detail the hypotheses, accordingly (Table 14).

Table 14

List of Preliminary Hypotheses

Hypothesis		
H1	Usability -> Attitude	Usefulness positively affects the attitude towards AI based banking services.
H2	Ease of Use -> Attitude	Ease of use positively affects attitude towards AI based banking.
H3	Security -> Attitude	Security has a positive impact on attitude to use AI based banking applications.
H4	Performance -> Attitude	Performance has positive impact on attitude towards AI based banking applications.
H5	Awareness -> Attitude	Awareness positively affects the attitude towards AI based banking.
H6	Design -> Attitude	Design of the AI based banking service positively affects the attitude towards AI service.
H7	Financial Risk -> Attitude	Financial risks in AI based banking service negatively affects the attitude towards AI service.
H8	Enjoyment -> Attitude	Enjoyment of the AI based banking positively affects the attitude towards AI service.
H9	Trust -> Attitude	Trust positively affects the attitude to use mobile and AI based banking applications.
H10	Complaint Handling Attitude -> Attitude	Successful complaint handling positively affects attitude to use AI based banking applications.
H11	Self-Efficacy -> Attitude	Self-Efficacy positively affects attitude towards AI based banking applications.
H12	Personal Innovativeness Attitude -> Attitude	Personal innovativeness has a positive impact on attitude towards AI based banking.
H13	Familiarity -> Attitude	Familiarity to AI technologies has a positive impact on attitude towards AI based banking.
H14	Age	Generation Y has a more positive attitude to AI based banking compared to Baby -Boomers, as well as intention to use it.
H15	Age	Generation Y has a more positive attitude to AI based banking compared to Generation X, as well as intention to use it.
H16	Modality	Voice (vs. text or tapping) interaction leads to more negative attitude to use AI based banking service.
H17	E-commerce usage	E-commerce usage leads to more positive attitude to use AI based banking service.
H18	Lifestyle	Attitude to use AI based banking differs based on consumers' lifestyle.
H20	Nationality	Attitude towards AI based banking differs based on consumers' nationality.
H22	Attitude -> Intention	Attitude towards AI based banking positively affects intention use AI based banking.

In order to address the problem statements, within the context of the research, it is planned to carry out both quantitative (survey) and two round qualitative analysis (focus group, in depth interviews and interviews with the practitioners). And to be able to measure all the variables within the context of research model, appropriate scales that will be benefited for the factors included in the preliminary model, have been revealed from various literature (please see Table 15).

Table 15

List of Scales That Will be Benefited for the Variables in the Preliminary Model

Variables included in the preliminary model	Scale Benefitted
Intention to AI based banking	Kim et al. (2007)
Attitude towards AI based banking	Davis (1989)
Usability (Usefulness)	Davis (1989)
Ease of use	Davis (1989)
Performance	Stone and Gronhaug (1993)
Financial risk	Stone and Gronhaug (1993)
Security	Pikkarainen et al. (2004)
Awareness	Developed by the author
Design	Developed by the author
Trust	Noel Yee-Man Siu, Jeremy Chi-Wah Mou (2005)
Complaint handling	Noel Yee-Man Siu, Jeremy Chi-Wah Mou (2005)
Enjoyment	Boonsiritomachai, Pitchayadejanant (2017)
Self-efficacy	Bandura (1977)
Personal innovativeness	June Lu, James E. Yao, Chun-Sheng Yu (2005)
Familiarity	Casaló, L.V., Flavián, C., Guinalíu, M. (2008)
Life Style	Taylor, Todd (1995); Venkatesh, Davis (2000), Developed by the author

3.2 Settings and Participants

Before the data collection stage, it is worth to mention the universe of participants for the analysis. As described in the literature review, by nature of the constraints in and complexity of virtual assistant usage for banking purposes, tech-savvy, financially literate, digital active consumers are on the target of local and multinational Banks. Those target customers are included in the scope of this research, as participators. Besides, considering the virtual assistants usage statistics mentioned in the literature review and as the customers above 45 or have less than undergrad degree do not much prefer to use virtual assistants, the consumers in those boundaries should not be targeted.

However, depending on the nature of analysis, different samples under the above-mentioned universe have been studied both for qualitative and quantitative analysis, with different size and criteria. The characteristics of the participants for each analysis have been outlined in the following corresponding parts of the thesis.

On the other hand, in order to provide privacy of participants, they been informed about the research methodologies, confidentiality of the data they shared, restrictions of their usage, right the withdraw from the interview and survey which is voluntary basis, before they participate. They have been notified also on the fact that survey results will be kept confidential and anonymous, during the research, personal data, including age, gender, marital status, monthly income etc. will be set apart from the research data and if the research is published, only group data without any personal information will be shared. All those information has been shared with the participators via the scripts of In-Depth and Focus Group interviews, Information & Consent Form and the Research Survey, itself (Appendix A, Appendix C).

3.3 Procedures

3.3.1 Data collection instruments & procedures.

3.3.1.1. Qualitative data collection. After the interviews with the digital banking executives of local and global Banks were carried out in one to one and structured way (the first round of qualitative analysis mentioned in the previous sections), it is followed by the second round qualitative research. Structured interviews with the bank and non-banked customers, as well as customers who are using or not using AI based banking services have been carried out. In depth interviews have been performed with 7 Turkish 2 EU citizens, between 06 and 12 June, 2022, with the outline and set of questions given in Table 16.

Table 16

Outline Of In Depth Interview

Interviewer: İsmail Burak Erkek

Interviewee:

Date:

Introduction:

"Hi. This is İsmail Burak Erkek.

This interview has been arranged to receive your comments and ideas on the customers' adoption to Artificial Intelligence Based Banking Solutions (e.g. virtual assistants, virtual agents, and chatbots) and determinant factors in this adoption, within the context of my ongoing PhD thesis. The obstacles, faced in the adoption of artificial intelligence based banking solutions, accelerating impact of Covid-19 pandemic on customers' intention to use those artificial intelligence based services, your experiences and recommendations are more than welcome.

Interview has been planned to take approx. 40-60 minutes. If you mind, I prefer to record the interview to be able to document all our conversation. Please feel confident that the records will be kept confidential and the interview report and thesis will not include any identification information of the interviewees. Before initiating the interview, be aware that if you do not want to answer any of questions, you may skip, and even withdraw from the interview.

If you agree with the procedure, I will start our discussion and questions. If you do not have any idea about any of the questions, comment and direct me, please.

Thanks in advance for your contribution."

Table 16 (cont.d)

Questions:

1. I would like to know something about your technology usage. Please describe me the things you do in digital platforms. Which technology and digital platforms are you familiar with? *(If needed prompt with further questions: In which kind of industries, are you using digital? Would you give me some detail?)*
2. Are you using digital in banking services, especially any of mobile banking, internet banking and call center services? What kind of transactions are you performing in those digital banking applications?
3. Can you please tell me the frequency and reasons of your transactions performed in digital banking apps?
4. I would like to know what you think about artificial intelligence (AI). Please describe me the things you do by using artificial intelligence. Which kind of AI technologies are you using, in your daily life? *(If needed prompt with further questions: Would you give me some detail?)*
5. Please tell me what you think about Artificial Intelligence (AI) based Banking applications (including virtual assistants, virtual agents and chatbots)?
6.
 - 6.1. Can you tell me what effects your adoption to AI based banking applications? *(If needed probe further with questions: Would you give me some detail? What kind of factors affect your intention to use artificial intelligence based banking applications, including application attributes (e.g. ease of use, usability, design, proactivity, performance), your personal traits (e.g. innovativeness, self-efficacy, familiarity, lifestyle) or institutional attributes (e.g. trust) of the banks? Is there anything else?)*
 - 6.2. If you do not use AI based banking services, now I want you think why you do not accept AI Based Banking solutions? What are the obstacles, you faced in the adoption to artificial intelligence based banking applications?
7. Now, can you please describe the impact of new digital era and Covid-19 pandemic on your or others' usage of artificial intelligence based banking services?

Closure:

Would you prefer to comment further or you have finished? There will be further interviews with other interviewees and I will evaluate the data gathered in those interviews, including yours. If you request, I can share the results with you, as well.

Thank you very much

Regards

In depth interviews have been arranged to receive a set of sample customers' comments and ideas on their adoption to Artificial Intelligence Based Banking Solutions (e.g. virtual assistants, virtual agents, chatbots) and determinant factors in this adoption. The obstacles, faced in the adoption of artificial intelligence based banking solutions, accelerating impact of Covid-19 pandemic on customers' intention to use those artificial intelligence based services, have been evaluated, in the interviews, as well.

Within the context of this qualitative analysis, I've met with 9 Bank customers, of which are customers of different Banks, but in similar segments. They are between 30-45 ages, white collar, financially literate and digitally active.

Interviewees are mostly familiar with the digital technologies. They especially use digital applications in Video Streaming (e.g. Netflix, amazon, apple tv, YouTube for movies and series), Finance (for banking, investment transactions), E-commerce (e.g. getir, hepsiburada, Trendyol) and Social Media (e.g. Twitter, Instagram). The sample clients which I have the in depth interview, are frequently using mobile and internet banking applications, but less frequently call center services. Almost all the interviewees are performing their daily deposit, credit, debt payment, investment, money transfer transactions via the mobile banking applications.

Most of the interviewees used virtual assistants, virtual agents or chat-bots, a few times in the recent years. Some of them are using those technologies frequently, but some gave up using them.

The evaluations and data gathered from the interviews have below-mentioned conclusions regarding the determinant factors on adoption to use AI based banking services:

Usability (Functionality):

5 out 7 interviewees believe that usability of the AI based services has direct impact on their intention to use the services. 2 of those interviewees assume that functionality of the AI services effects adoption to use them.

They are explaining the functionality of AI based banking solutions as an obstacle they faced in the adoption to those solutions. One explained the reason as:

“I believe that AI services can be used to attract customers who are not aware of or open to use digital banking apps and do not actively use digital channels. However, AI based banking technologies are not adequate to solve the complex problems of active digital customers.”

Another one prompted: “AI based banking services do not satisfy my current financial needs.”

Ease of Use:

3 out of 7 interviewees, that I had the in depth interview, think that ease of use of the AI based banking solutions has an impact on their attitude and intention to use those solutions.

One interviewee explained his claim as: “I preferred to use live-chat for asking a financial info, as it is much easier to ask the info to the live-chat service of my Bank compared to have the info via call center or by questioning in the official web site of the Bank.”

On the other hand, ‘complexity’ which is the opposite of ‘ease of use’ can be used for describing how a technology is difficult to discover and use. In contrary to others, 2 out of 7 interviewees believe that AI based banking services are complex to use.

Performance (Understanding Capacity):

Almost all of the interviewees believe that current performance of AI based banking technologies have a negative impact on adoption to use those technologies. With the poor performance of the mentioned intelligent banking solutions, it is referred to inability of recognizing and processing the correct requests of clients, delivered via either voice or text.

The interviewee told, “The reason of why I am not using virtual assistants is that the voice recognition system has some difficulties in interpreting my verbal requests and I will repeat my request for several times.” However, the performance of virtual assistants is evolving in recent periods, as the Banks are aiming to improve their understanding capacity (Table 17).

Table 17

Understanding Capacity of Turkish Banks' Virtual Assistants

Virtual Assistant Understanding Capacity				
	<i>2021 Q3</i>	<i>2021 Q4</i>	<i>2022 Q1</i>	<i>2022 Q2</i>
True Positive	59%	67%	64%	62%
False Positive	29%	14%	18%	20%
True Negative	10%	11%	15%	14%
False Negative	2%	8%	3%	4%
Total	100%	100%	100%	100%

Design:

2 out of 7 customers that I have made a deep interview has claimed that poor design of the AI based banking services has an impact on their attitude and intention to use those services.

One interviewee proposed that, if the design of AI services of the Banks are improved and integrated to Apple's popular AI assistant 'Siri', more customers will prefer to use those services.

Security & Confidentiality:

2 of the interviewees explained their concerns regarding the security of AI based banking technologies.

One of them underlined his concern by saying that: "The reason behind not using AI based banking applications, especially virtual assistants using voice recognition mechanisms, is sharing verbally financial info in public environments."

During the interviews, another determinant factor in adoption to use those technologies, namely 'confidentiality', has been discovered. With confidentiality, it is referred to keeping personal information secret or private. One participant shared that

“As the best practices and standards regarding the ethical issues have not been established yet, artificial intelligence technologies and sharing biometric data (e.g. Voice records) with those technologies seems scaring.

Awareness:

One of the interviewees who is using live-chat application of a financial institution, mentioned that he started to use that service, as a consequence of the information, notification and reminders to use the live-chat application. He believes being aware of the AI Service has a positive impact on adoption to use that technology.

Proactivity:

During the interviews, another determinant factor on adoption to use AI based banking services has been mentioned. 2 out of 7 interviewees claimed that proactivity of the AI services has an impact on intention to use those services.

One participant has told that “Proactive virtual assistants is more useful, as they are aiming to predict and satisfy my needs by proposing new offers, without waiting for the client request.”

Complexity (Efficiency):

Most of the interviewees has claimed that, in line with the usefulness of the AI services, efficiency of the services effect intention to use them. With the term efficiency, they refer to being able to perform financial queries or transactions, regardless of the time and location, which is a characteristic of all digital services.

Enjoyment:

There is no finding revealed in the in depth interviews which shows us a correlation between enjoying characteristic of AI based banking technologies and the customers’ intention to use those technologies.

Financial Risk:

There is no finding revealed in the in depth interviews which shows us a correlation between financial risk of AI based banking technologies and the customers' intention to use those technologies.

Trust:

One of the interviewees has claimed that his trust to the financial company delivering AI based Banking Technologies has an impact on adoption to use those technologies.

Complaint Handling:

According to one interviewee, complaint handling capabilities of the Banks delivering the AI based Banking services affect attitude and intention to use those services.

Self-Efficacy & Familiarity:

An interviewee has shared his idea which proposes that his familiarity and self-efficacy on AI services has a positive impact on attitude and intention to use AI based Banking services.

Life Style & Personal Innovativeness:

There is no finding revealed in the in depth interviews which shows us a correlation between life style and personal innovativeness of the consumers and their intention to use Artificial Intelligence based banking technologies.

In the next stage, a focus group interview has been carried out with 4 customers, by using discussion outline given in, Table 18.

Table 18

Focus Group Interview Discussion Outline

Moderator: İsmail Burak Erkek

Participants: 4 people

Date: 12.16.2022

Environment: Via zoom, phone or video recorded and note-taking

Introduction:

1. Welcome

Hi. Welcome to our meeting. This is İsmail Burak Erkek, a PhD candidate from Bahçeşehir University.

Today, I will be moderating our group discussion. Thank you for participating the interview.

In this group interview, our aim will be to get your perception, as a Bank customer, regarding adoption to Digital Banking, especially Artificial Intelligence (AI) Based Banking Services (e.g. virtual assistants, virtual agents, and chatbots). The results of this discussion will be used in my ongoing PhD thesis. We planned to learn what effects positively and negatively your intention to use AI based banking services and how it can be improved. We have invited you, considering the fact that you are tech-savvy, financial literate and familiar with those Banking technologies.

2. Ground rules (Guidelines)

The group interview has been planned to take app. one hour. You can share your ideas, comments and critiques freely, as there is not any single truth. Besides, be a ware that if you do not want to answer any of questions, you may skip, and even withdraw from the discussion.

I will record the discussion, in order to not miss any part of it and document every comment. Please feel confident that the records will be kept confidential and the interview report and thesis will not include any identification information of the participants. Instead, the data gathered will be used anonymously in the PhD thesis.

If you agree with the procedure, I will start our discussion.

3. Discussion

Opening Questions

1. Can you please introduce yourself to other participants, by sharing your name, job, and the technology platforms you use?
2. Are you using digital in banking services, especially any of mobile banking and internet banking applications? What kind of transactions are you performing in those digital banking applications and can you please tell me the frequency and reasons of your transactions performed in digital banking apps? (Please talk to each other)

Transition Questions

3. Can you please tell me what you think and feel about Artificial Intelligence (AI) based Banking applications (including virtual assistants, virtual agents and chatbots)? Please describe me the things you do by using artificial intelligence, for banking transactions.
-

Table 18 (cont.d)

Key Questions

4. If you use AI based banking services;
 - a. Can you please tell me about positive experiences you had while using those services? What do you like best regarding the services?
 - b. Let's list/ share these (*application attributes (ease of use, usability, design, proactivity, performance...), institutional attributes (trust, complaint handling...)*) on the screen/ flip chart. If you had to pick only two factors that are most important to you for deciding to use/ choosing an AI based banking solution, what will they be, what do you look for? You can pick that you mentioned or that was mentioned by others.
5. If you do not use AI based banking services, now I want you think why you do not accept AI Based Banking solutions? What are the obstacles, you faced in the a adoption to artificial intelligence based banking applications?
6. Can you please tell me about disappointments you've had with AI based banking applications? Regarding this, Let's assume that you are in charge and can make changes on AI Based banking services that would improve it. What would you do?
7. Now, can you please describe the impact of new digital era and Covid-19 pandemic on your or others' usage of artificial intelligence based banking services?

4. Conclusion & Ending Questions

“Assume that you had a few seconds to talk to your Bank’s EVP in charge of digital and AI solutions, today’s discussion topic, what would you say?”

I will summarize you the conclusions I had during this valuable group interview:

Is there anything else I have missed?

Thank you very much for your kind contribution and time...

The focus group interview has been planned to get the perception of a sample Bank customers in a discussion environment, regarding their adoption to Digital Banking, especially Artificial Intelligence (AI) Based Banking Services (e.g. virtual assistants, virtual agents, chatbots). It is aimed to learn what effects positively and negatively their intention to use AI based banking services and how it can be improved. This feedback led to some changes on the initially proposed research model, which will be given on the following parts of the thesis.

Within the focus group interview, I have made a discussion with 4 people, who are Bank customers, financial literate, tech-savvy and familiar with digital banking solutions. They are using Finance (e.g. Forex trade, mobile banking, netekstre), Social Media (e.g. Instagram, Youtube), Streaming (e.g. Netflix, Disney Plus, beinsports) applications.

They are daily using mobile banking applications for every available non-cash transaction (deposit, credit, investment, debt payment etc.) and even cash transactions including money withdrawal via QR code. Besides, they are also using investment applications (e.g. Investing.tr, yatırım dünyam, e-trader) for investment transactions.

Two of the participants believe that Artificial Intelligence (AI) based Banking applications are not mature enough to be massively used by all customers. They have used chat-bots for financial services and commented that those bots do not understand, interpret and respond their questions correctly. That's why, they think that those apps are time consuming, tiring and un-satisfactory. On the other hand, other participants believe that those AI based banking services create value and efficiency to their digital experience.

The participants of the focus group mentioned that they best like the performance of those AI based applications for simple transactions, including credit card pin receipt, eft/ money transfer limit increase, as the applications respond the requests of the customers meaningfully, for those transactions.

Three of the participants shared two factors that are most important to them for deciding to use an AI based banking solution as the "performance" and "ease of use" of the application. On the other hand, all of the participants agreed on the impact of their familiarity and self-efficacy on adoption to use AI based banking services.

If they were in charge and had the chance to make changes on AI based banking services, they would improve the "functionality", algorithms and vocabulary of chatbots and virtual agents (assistants). In addition to increasing the set of services delivered by the applications, they also preferred to improve the "response times and rates" of the apps. One of the participants said that "If the virtual agent or chatbot could

not respond timely to the request of the customer, then it is better to direct the client to a real agent (Bank employee).”

All the participants shared the idea that, the new era and Covid-19 pandemic had an impact on the digital transformation and digital banking evolution, and consequently AI based banking services. But this is an indirect impact.

On the other hand, following the in depth and focus group interviews with the customers, a second interview has been planned and performed with the Executive Vice President of a Bank in Turkey in charge of digital banking. For the second time, she underlined the criticality of proactivity, design, security, confidentiality and performance perspectives of the artificial intelligence based banking services. And added that emerging AI strategy of financial institutions will be to deliver proactive AI services to their clients, depending on their needs and expectations. This will be one of the backbones of financial health management.

Considering the results of in depth and focus group interviews and interview with executives, it is possible to conclude that some of the variables in the conceptual model and related scales will remain as it is, while some of them will no longer be in place and new variables will be included in the model. Under the scope of application attributes, performance (for sure), ease of use, usability (functionality), design, confidentiality (security), awareness will be kept as they are, while new variables including proactivity and complexity (efficiency) will be included in the model and financial risk and enjoyment will be removed, as they have not been supported in the in depth and focus group interviews, as well as in the 2nd round executive practitioner interviews.

Within the context of the financial institutional attributes, customers' perception of trust and complaint handling may still be in the conceptual model, if needed. But one participant of the focus group shared that, on the assumption that the client has a trust on the Bank delivering the AI service, the client uses AI services of that Bank. That's why he believes institutional attributes have an impact on adoption to use AI based banking services.

On the other hand, as familiarity, self–efficacy and personal innovativeness have been evaluated by the interviewees as relevant independent variables that have an impact on adoption to use AI services within the scope of the customer attributes, those attributes will still be in the conceptual model. On the contrary, life-style of the customers have not been treated as a relevant factor that have an impact on adoption, during the interviews, and thus this variable will be removed from the research model.

Considering the abovementioned evaluations that have been made during the two round qualitative analysis (in depth interviews, focus group interview and two times interview with the executives), the proposed model has been finally modified slightly, as given in Figure 14.

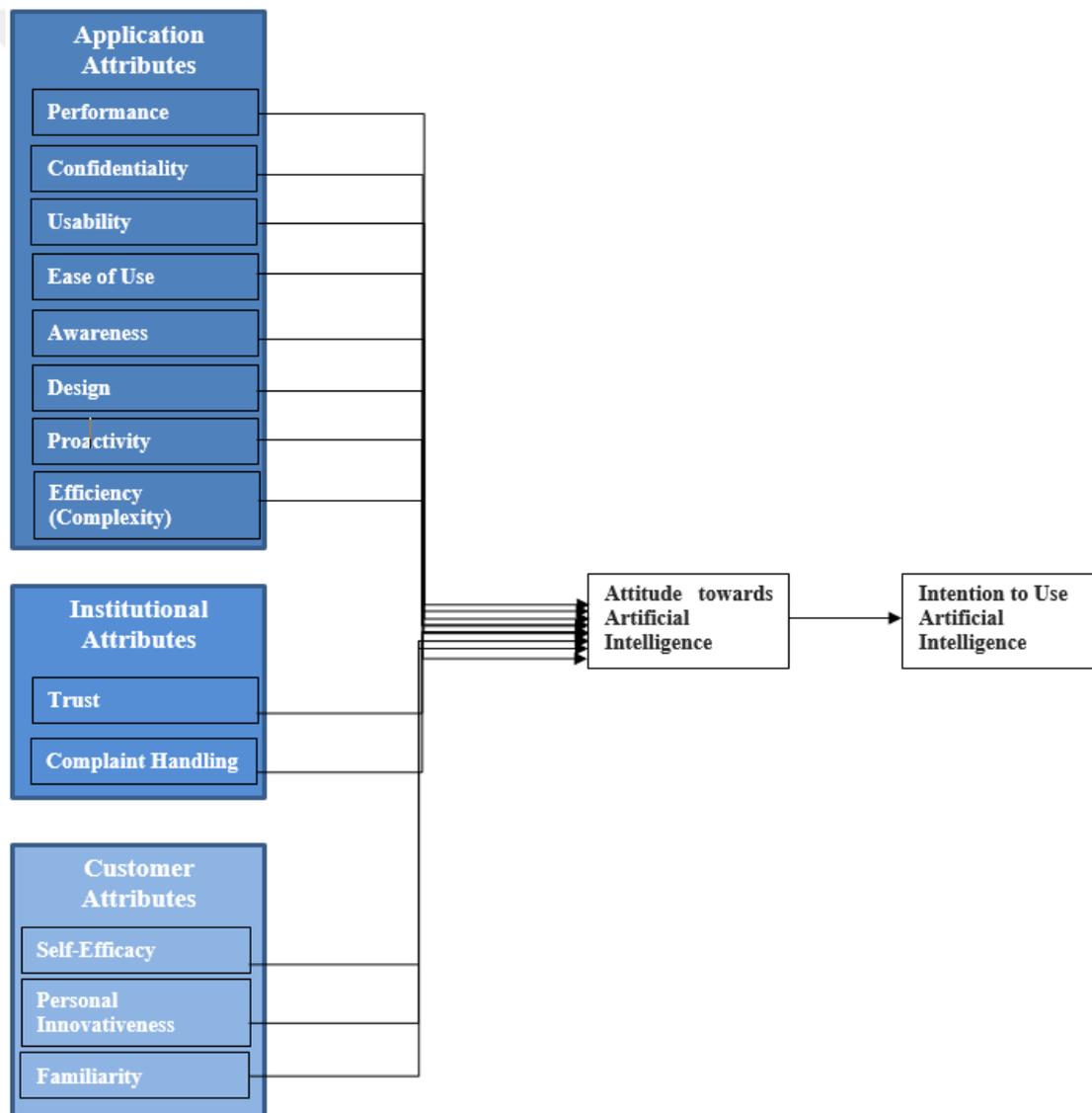


Figure 13. Refined model

In-line with the refined model, the hypotheses have been updated, accordingly (Table 19).

Table 19

List of Final Hypotheses

Hypothesis		
H1	Usability -> Attitude	Usefulness positively affects the attitude towards AI based banking services.
H2	Ease of Use -> Attitude	Ease of use positively affects attitude towards AI based banking.
H3	Confidentiality risk-> Attitude	Confidentiality risk has a negative impact on attitude to use AI based banking applications.
H4	Performance -> Attitude	Performance has positive impact on attitude towards AI based banking applications.
H5	Awareness -> Attitude	Awareness positively affects the attitude towards AI based banking.
H6	Design -> Attitude	Design of the AI based banking service positively affects the attitude towards AI service.
H7	Proactivity -> Attitude	Proactivity of AI based banking service positively affects the attitude towards AI service.
H8	Complexity (Efficiency) -> Attitude	Complexity of the AI based banking app negatively affects the attitude towards AI service.
H9	Trust -> Attitude	Trust to the bank positively affects the attitude to use mobile and AI based banking applications.
H10	Complaint Handling -> Attitude	Successful complaint handling has a positive influence on attitude to use AI based banking applications.
H11	Self-Efficacy -> Attitude	Self-Efficacy of the consumer positively affects attitude towards AI based banking applications.
H12	Personal Innovativeness -> Attitude	Consumer's personal innovativeness has a positive impact on attitude towards AI based banking.
H13	Familiarity -> Attitude	Familiarity with AI technologies has a positive impact on attitude towards AI based banking.
H14	Age	Generation Y has a more positive attitude to AI based banking compared to Baby -Boomers, as well as intention to use it.
H15	Age	Generation Y has a more positive attitude to AI based banking compared to Generation X, as well as intention to use it.

Table 19 (cont.d)

Hypothesis		
H16	Modality	Voice (vs. Text or tapping) interaction with AI based banking application leads to more negative attitude to use the application.
H17	E-commerce usage	E-commerce usage leads to more positive attitude to use AI based banking service.
H18	Nationality	Intention and attitude towards AI based banking differs based on consumers' nationality.
H19	Attitude -> Intention	Attitude towards AI based banking application positively affects intention use AI based banking.

3.3.1.2. Quantitative Data Collection. For the quantitative analysis, convenience sampling method has been chosen to be able to determine the sample population. A questionnaire, including 63 scale and 19 socio demographic, socio-economic and banking preference questions (Appendix-C), has been delivered to 450 participants, via Google Forms, in April 2023. The anonymous data filled by participators are stored in Google databases. 349 out 450 participants are Turkish and 101 participants are European Union citizens. 20 of those participants did not fill the survey properly or they were treated as outliers in the quantitative analysis. Those participators have been detected via the Normality Analysis, via IBM SPSS. At the end, the sample consists of 430 eligible participators, 96 of them are EU and 334 of them are Turkish citizens. 60 Out of 96 EU citizens are Spanish and the remaining are from Benelux countries, Germany or Romania.

Characteristics of sample population, including nationality, generation, socio-economic and socio-demographic attributes, e-commerce and virtual assistant usage habits, banking preferences were analyzed in detail (Table-20), as well as other information such as the frequency of their transactions performed via virtual assistants for non-banking purposes (Appendix F). By the way, it is worth to mention that 27 out of 93 EU Citizen (%28,1) are using ChatGPT.

Table 20

Distribution of Sample Population based on socio-demographic & economic info

Sample Population	N	%		N	%
Gender			Education		
Female	168	39	Undergraduate	298	61,1
Male	262	61	Graduate	98	25,1
Virtual Assistant (VA) Usage			PhD and above	34	10,0
Daily	21	4,9	Working Status/ Occupation		
Weekly	25	5,8	Private Sector Employee	315	73,2
Monthly	28	6,5	Public Employee	48	11,1
Quarterly	15	3,5	Retired	27	6,3
Annually	54	12,6	Self-Employment	21	4,9
Less Frequent	59	13,7	Entrepreneur	7	1,6
Not Used at all	228	53,0	Student	5	1,2
Generation			Unemployed	7	1,6
Y	255	59,3	Monthly Income		
X	135	31,4	Less than 10.000 Turkish Lira (TL)	3	0,7
Baby Boomers	40	9,3	10.001 – 25.000 TL	76	17,7
VA Usage for Non-Banking Purposes			25.001 – 50.000 TL	153	35,6
I do not use	151	35,1	50.001 – 100.000 TL	127	29,5
(Apple) Siri	135	31,4	More than 100.000 TL	71	16,5
Google Assistant	59	13,7	Virtual Assistant Used/ Known		
Chat-bots for e-commerce	58	13,5	I do not use it	157	36,5
(Amazon) Alexa	27	6,3	Garanti BBVA	108	25,1
Other Banking Channels Used			BBVA	54	12,6
Mobile Banking	373	86,7	Iş Bank	46	10
Internet Banking	359	72,6	QNB Finansbank	11	2,5
ATM (Cashpoint)	219	50,9	Yapi Kredi Bank	8	1,8
Bank Branches	133	30,9			

Table 20 (cont.d)

Sample Population	N	%		N	%
Bank Call Center	74	17,2	ABN Amro	7	1,6
Private Banking Representative	51	11,9	ING	7	1,6
			Other	32	7,4

In order to proceed with the quantitative analysis, the referenced scales that will be benefitted for the quantitative data collection have been updated, based on the qualitative data collection results, mentioned in the previous section (Table 21).

Table 21

Up-to-date Scales Benefitted for the Quantitative Analysis of the Model

Factors included in the Model	Scale Benefitted From	Other Referenced Scales
Intention to use AI based banking	Venkatesh, Davis (1996)	Kim et al. (2007)
Attitude towards AI based banking	Davis (1989)	Taylor, Todd (1995), Venkatesh, Davis (2000)
Usefulness	Davis (1989)	Venkatesh, Davis (1996), Venkatesh, Davis (2000), Agarwal, Karahanna (2000)
Ease of use	Davis (1989)	Venkatesh, Davis (1996), Venkatesh, Davis (2000), Agarwal, Karahanna (2000)
Performance	Stone, Gronhaug (1993),	Kleijnen et al. (2007), Hubert, Blut, Brock, Backhaus, Eberhardt, T. (2017)
Awareness	Developed by the author	
Confidentiality Risk	Dinev, T., Hart, P. (2006)	Ha, Chen, Uy, Capistrano (2021)
Trust	Noel Yee-Man Siu, Jeremy Chi-Wah Mou (2005)	
Complaint handling	Noel Yee-Man Siu, Jeremy Chi-Wah Mou (2005)	

Table 21 (cont.d)

Factors included in the Model	Scale Benefitted From	Other Referenced Scales
Self-efficacy	Bandura (1977)	Taylor, Todd (1995), Compeau and Higgins (1995), Venkatesh, Davis (1996), Bhattacharjee (2001), Suh, Han (2002)
Personal innovativeness	June Lu, James E. Yao, Chun-Sheng Yu (2005)	Agarwal, Prasad (1998), Agarwal, Karahanna (2000)
Complexity (Efficiency)	Moore, Benbasat (1991)	Tan, M., Teo, T. S. (2000), Al-Jabri and Sohail (2012)
Familiarity	Casaló, L.V., Flavián, C., Guinalíu, M. (2008)	Belanche, D., Casaló, L. V., Flavián, C. (2019)
Design	Developed by the author	
Proactivity	Developed by the author	

Considering the new set of variables in the refined research model and above-mentioned references for quantitative analysis, the details of the scales and items to be used in surveys have been determined (Table 22). For 15 variables, 63 items have been included in the questionnaire. The original items derived from the benefitted scales have been translated and back translated (Appendix B).

Table 22

Scales & Questions used in the Survey

Scales – Questions
Usefulness
<i>PU1</i> I can accomplish my banking tasks more quickly using Virtual Assistant.
<i>PU2</i> Virtual Assistant enhances my effectiveness in utilizing banking services.
<i>PU3</i> Virtual Assistant is comfortable to use at any time.
<i>PU4</i> Virtual Assistant is comfortable to use everywhere.
<i>PU5</i> Virtual Assistant enables me to make better decisions in utilizing banking services.
<i>PU6</i> I can find the content desired within Virtual Assistant.

Table 22 (cont.d)

Scales – Questions

PU7 Overall, I find Virtual Assistant useful.

Ease of use

PEOU1 Learning to use Virtual Assistant is easy for me.

PEOU2 It is easy to use Virtual Assistant to accomplish my banking tasks.

PEOU3 It is easy for me to become skillful at using Virtual Assistant.

PEOU4 Overall, I believe Virtual Assistant is easy to use.

Confidentiality Risk

PRV1 I am concerned that the information I submitted to Virtual Assistant could be misused.

PRV2 I am concerned about submitting information on Virtual Assistant, because of what other people might do with it.

PRV3 I am concerned about submitting information on Virtual Assistant, because it could be used in a way, I did not foresee.

PRV4 I am quiet sensitive about how the Virtual Assistant handles my (personal) information.

PRV5 I am concerned about threats to my privacy with Virtual Assistant today.

Performance (Understanding Capacity)

PR1 I think that Virtual Assistant will really (understand accurately my intent and) perform as well as it is supposed to.

PR2 I think that Virtual Assistant will provide the level of benefits that I would be expecting.

PR3 I think that Virtual Assistant will be reliable for the level of benefits I was expecting.

PR4 I think that Virtual Assistant will be really dependable.

Trust

PCRED1 I don't notice any inconsistencies as I use Virtual Assistant.

PCRED2 Overall, I trust Virtual Assistant.

PCRED3 The Virtual Assistant information system is not trustworthy. (R)

PCRED4 Whenever I make a mistake using the Virtual Assistant system, I recover easily and quickly.

PCRED5 The Virtual Assistant system gives error messages that clearly tell me how to fix problems.

PCRED6 I am confident of using Virtual Assistant even if there is no one around to show me how to do it.

Complaint Handling

CH1 There is no latency in the Bank's compensation for the problem they create.

CH2 You are able to talk to a "live" person using a telephone number.

Table 22 (cont.d)

Scales – Questions

CH3 It is easy to consult to the Bank's online customer services (e-mail, chatbot, FAQ etc.), in case a problem occurs.

CH4 The Bank takes care of problems promptly.

Awareness (Visibility)

AW1 My Bank informs me for further usage of Virtual Assistant.

AW2 My Bank offers methods for more comfortable usage of Virtual Assistant.

AW3 My Bank informs me about the ads the Virtual Assistant will provide.

Personal Innovativeness

PITT1 If I heard about a new information technology, I would look for ways to experiment with it.

PITT2 Among my peers, I am usually the first to explore new information technologies.

PITT3 I like to experiment with new information technologies.

PITT4 In general, I am hesitant to try out new information technologies. (R)

Self-efficacy

SEF1 I can use Virtual Assistant without help.

SEF2 I can use Virtual Assistant by following the manual (online instructions). (R)

SEF3 I can use Virtual Assistant if I can ask for help when needed (if there is no one around to show me how to do it). (R).

SEF4 I could use Virtual Assistant if I have ever used a similar application before.

SEF5 I am confident of using Virtual Assistant if I have just seen someone using it before trying it myself.

Attitude to Use Virtual Assistant

ATUAB1 I think that using Virtual Assistant is a good idea.

ATUAB2 I think that, using Virtual Assistant for financial transactions would be a wise idea.

ATUAB3 I think that Virtual Assistant is a preferable banking channel.

ATUAB4 I prefer the Virtual Assistant over Customer Representatives (person).

ATUAB5 I believe the importance of Virtual Assistant will increase in the future.

Intention to use Virtual Assistant

ITUAB1 I plan to use Virtual Assistant in the future.

ITUAB2 I intend to use Virtual Assistant in the future.

ITUAB3 I predict I would use Virtual Assistant in the future.

Table 22 (cont.d)

Scales – Questions
Complexity (Efficiency)
COMP1 Virtual Assistant requires a lot of mental effort.
COMP2 Virtual Assistant requires a lot of technical skills.
COMP3 Using Virtual Assistant can be frustrating.
COMP4 Virtual Assistant is an easy way to conduct banking transactions. (R)
Familiarity
FAM1 I have used (worked with or studied) robotic artificial intelligence (Virtual Assistants) in non-banking services.
FAM2 Throughout my life I have had experience interacting with robots (Virtual Assistants).
FAM3 I am familiar with robots or robot contents (texts, audiovisuals, etc.).
Design of Virtual Assistant
DOAB1 Design of Virtual Assistant helps me in finding which banking service I need.
DOAB2 Virtual Assistant is designed in such a way that I can understand which function delivers which banking service.
DOAB3 I think that the design of Virtual Assistant enables me to perform any query or transaction I need.
Proactivity
PROA1 Virtual Assistant can guide me before I activate it.
PROA2 Virtual Assistant can understand my banking needs, before I ask it to do.
PEOU3 Overall, I believe Virtual Assistant is proactive.

3.3.2 Data analysis procedures. Initially, the survey results which have been uploaded to IBM SPSS have been evaluated in terms of missing values to be excluded from the analysis and it is revealed that there is no missing value. Then, the values assigned to negative questions, namely 3rd item of Trust (PCRED3), 2nd and 3rd item of Self-Efficacy (SEF2, SEF3), 4th item Complexity (COMP4) and 4th item of Personal Innovativeness (PITT4) have been reversed. Outliers or extreme values within the collected data have been analyzed and descriptive statistics gathered via Normality Analysis (Appendix-D). The Skewness and Kurtosis values of the variables have been evaluated and as they are all between +1.5 and -1.5, it is possible to accept that there

is a normal distribution in data that is used for the model evaluation (Tabachnick, Fidell, 2007) (Table-23).

Table 23

Skewness and Kurtosis Values of the Variables in the Model

Variable	Skewness		Kurtosis	
	Statistics	Std. Error	Statistics	Std. Error
Usefulness	-.466	.118	-.199	.235
Ease of Use	-.527	.118	-.183	.235
Confidentiality	.104	.118	-1.060	.235
Performance	-.137	.118	-.215	.235
Complaint Handling	-.379	.118	-.018	.235
Awareness	.046	.118	-.613	.235
Personal Innovativeness	-.386	.118	-.201	.235
Self – efficacy	-.387	.118	-.676	.235
Attitude	-.199	.118	-.268	.235
Intention	-.439	.118	-.401	.235
Familiarity	-.345	.118	-.715	.235
Proactivity	-.052	.118	-.175	.235
Design	-.064	.118	-.049	.235
Trust	-.120	.118	.060	.235
Complexity	-.058	.118	.111	.235

Following the normality analysis, reliability and validity analysis of scales, T-factor tests (exploratory factor analysis) of variables have been carried out, respectively, with IBM SPSS, in order to verify the reliability and construct validity of factors and items under those scales and prevent multi-collinearity. The details of reliability and validity analysis will be given in the next section.

Following the reliability and validity analysis, research model fit analysis has been performed with IBM AMOS tool. The model was tested for fit measures. Then, correlations and regression between the variables have been tested, in order to verify

the hypotheses, via both IBM SPSS and AMOS. For the confirmation of above-mentioned 19 hypotheses, regression, ANOVA and T-tests have been performed.

3.3.3 Reliability & validity. As a consequence of reliability analysis performed with IBM SPSS, all of the variables in the research model, except one namely ‘Complexity’ variable, are concluded as reliable. Consequently, the Complexity variable has been eliminated from the research model. The Cronbach Alpha values of the remaining variables are above the lower/ tolerance limit, which is assumed to be at least 0.7 in the literature (Cortina, 1993) (Table-22). For all other item level reliability statistics, please see Appendix E.

Table 24

Reliability Statistics of Variables in the Model

Variable	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Usefulness	.919	.919	7
Ease of Use	.892	.893	3
Confidentiality risk	.950	.950	5
Performance	.845	.845	3
Complaint Handling	.831	.833	4
Awareness	.929	.929	3
Personal Innovativeness	.836	.842	4
Self – efficacy	.733	.736	3
Attitude	.898	.898	3
Intention	.947	.947	3
Familiarity	.860	.862	3
Proactivity	.855	.855	3
Design	.887	.888	3
Trust	.817	.815	6
Complexity	.529	.532	4

Within the context of evaluation of the validity of factors in the model, Exploratory Factor Analysis has been performed with IBM SPSS. The test includes Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity, as well. The KMO sampling adequacy has been calculated as 0.925 with significance, which should be greater than 0.8 (Table-25)

Table 25

Exploratory Factor Analysis Test Results

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.925
Bartlett's Test of Sphericity	Approx. Chi-Square	15757.220
	Df	946
	Sig.	<.001

As the 1st Ease of Use (PEOU4), 4th and 5th Attitude (ATUAB4, ATUAB5), 4th and 5th Self-Efficacy (SEF4, SEF5), 1st Performance (PR1), Trust and Design items have been loaded to several factors or can not be loaded into any factor, they have been eliminated from the research model, at the end of factor analysis (Appendix G). In total 12 out of 14 factors were loaded, with cumulative % 79.45 total variance explained, which should be greater than % 50 (Table 26).

Table 26

Exploratory Factor Analysis Variance Explained

Comp.	Total Variance Explained								
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	14.290	32.477	32.477	14.290	32.477	32.477	8.890	20.205	20.205
2	5.085	11.556	44.033	5.085	11.556	44.033	4.426	10.059	30.264

Table 26 (cont.d)

Total Variance Explained									
Initial Eigenvalues			Extraction Sums of Squared			Rotation Sums of Squared			
Comp.			Loadings			Loadings			
	Total	% of Variance	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	
3	3.538	8.040	52.073	3.538	8.040	52.073	2.989	6.793	37.056
4	2.467	5.606	57.680	2.467	5.606	57.680	2.880	6.544	43.601
5	2.067	4.698	62.377	2.067	4.698	62.377	2.693	6.120	49.720
6	1.480	3.364	65.742	1.480	3.364	65.742	2.652	6.027	55.747
7	1.353	3.076	68.817	1.353	3.076	68.817	2.512	5.709	61.456
8	1.232	2.801	71.618	1.232	2.801	71.618	2.343	5.326	66.782
9	1.078	2.450	74.068	1.078	2.450	74.068	2.109	4.793	71.575
10	.861	1.957	76.025	.861	1.957	76.025	1.752	3.981	75.556
11	.763	1.735	77.760	.763	1.735	77.760	.901	2.049	77.605
12	.746	1.696	79.456	.746	1.696	79.456	.815	1.852	79.456
13	.696	1.582	81.038						
14	.595	1.352	82.390						
15	.591	1.343	83.733						
16	.512	1.165	84.897						
17	.492	1.118	86.016						
18	.449	1.020	87.036						
19	.415	.943	87.979						
20	.379	.862	88.841						
21	.362	.824	89.665						
22	.353	.803	90.468						
23	.339	.771	91.239						
24	.309	.703	91.942						
25	.291	.662	92.604						
26	.269	.611	93.215						
27	.254	.577	93.792						
28	.238	.542	94.334						
29	.232	.527	94.861						
30	.220	.501	95.362						
31	.202	.458	95.820						
32	.190	.433	96.253						
33	.189	.430	96.683						
34	.186	.424	97.107						
35	.168	.382	97.489						
36	.159	.362	97.851						
37	.151	.343	98.194						
38	.136	.309	98.503						

Table 26 (cont.d)

Comp.	Total Variance Explained								
	Initial Eigenvalues			Extraction Sums of Squared			Rotation Sums of Squared		
	Total	Variance	Cumulative %	Loadings			Loadings		
				Total	Variance	Cumulative %	Total	Variance	Cumulative %
39	.135	.306	98.808						
40	.128	.290	99.098						
41	.118	.268	99.366						
42	.106	.242	99.608						
43	.100	.227	99.835						
44	.073	.165	100.000						

Extraction Method: Principal Component Analysis.

3.4 Limitations & Suggestions For Future Research

Although the distribution of sample participated to the survey, focus group and in-depth interviews are proportionally in-line with the whole population using banks' virtual assistants, in terms of socio-demographic and socio-economic criteria, it should be noted that mostly tech-savvy, financially literate, digital active consumers are included in the scope of this research, as participators. Besides, as the customers above 45 or have less than undergrad degree, do not much prefer to use virtual assistants, the consumers in those boundaries corresponds to a limited group within the sample chosen. In order to reflect the perceptions of those groups and especially non-users, it may be worth to increase the sample size, further.

During the quantitative research studies of this thesis, a significant disruptive technology within the artificial intelligence perimeter, has been launched by OpenAI, which is called ChatGPT. Usage status and frequency of ChatGPT could not be asked to Turkish citizens within the survey, but were asked to EU citizens, as the survey has been shared with EU citizens in a latter period. Being familiar with such disruptive virtual assistants even for non-banking purposes, can facilitate adoption to banks' virtual assistants. Among the sample of EU citizens, %29 of have used ChatGPT, yet.

As ChatGPT is a very disruptive chatbot or an intelligent assistant compared to its predecessors, acceptance of Bank's virtual assistants may increase after a period of time. That's why, it might be a good idea to repeat the research once again, after ChatGPT or similar new generation chatbots becomes very mature in people's daily lives.

Finally, the quantitative research was limited to participants from Turkey, Spain, Netherlands, Germany and Romania. To be able to make a comprehensive analysis, the sample can be organized in the future in a way that cover other European countries' perceptions.



Chapter 4

Findings

Before the confirmation of the hypothesis, an analysis has been performed via IBM AMOS software, in order to put forward whether such a research model can be formed with the collected data and model fits the data. With the help of Structural Equation Model/ Path Test, it is aimed to verify the model is working in line with the data.

As the CMIN value was also calculated as 2.702, which should be less than 3.000, CFI value has been calculated as .906, which should be greater than .900 and RMSEA as .063, which should be less than 0.8, it is concluded that the research model fits the data used (Table 27).

Table 27

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	184	2297.018	850	.000	2.702
Saturated model	1034	.000	0		
Independence model	88	16347.877	946	.000	17.281

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.859	.844	.907	.895	.906
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Table 27 (cont.d)

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.063	.060	.066	.000
Independence model	.195	.192	.197	.000

Following the model fit analysis, in order to test the hypothesis, correlation and regression tests were performed, respectively. Correlations between 12 variables of the research model has been evaluated with the Pearson correlation coefficient, via IBM SPSS. As a consequence of the correlation analysis, it is revealed that Attention towards and Intention to use Virtual Assistants are highly correlated with almost all of the remaining independent variables, except Self-efficacy of the customer who may use virtual assistant (Table 29).

After the correlation analysis, multi regression and multi collinearity tests have been carried out for the relationship between independent variables and the dependent variable attitude, as well as the relationship between attitude and intention to use virtual assistants, via both IBM SPSS and AMOS. Adjusted R Square of the model, which describes how strong the relationships are, was calculated as .524, which is relatively high (Table 28). Considering the influence of design and complexity of the virtual assistant and trust of client to the bank on attitude to use that virtual assistant was impossible to be investigated as those variables have been eliminated from the analysis, 6 out of 11 remaining hypotheses have been verified with the multi-regression analysis. It is found out that, usefulness, proactivity and performance of virtual assistants and complaint handling of Banks positively influence attitude, confidentiality risk of virtual assistants has a negative influence on attitude and attitude positively influences intention to use virtual assistants.

Table 28

Multi Regression, Linear Regression & Multi Collinearity Test Results

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.731 ^a	.535	.524	.70101

a. Predictors: (Constant), Proactivity, Confidentiality risk, PInnovativeness, SelfEfficacy, Complaint H., Usefulness, Familiarity, Awareness, Performance, Ease of Use

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	236.980	10	23.698	48.224	<.001 ^b
	Residual	205.903	419	.491		
	Total	442.883	429			

a. Dependent Variable: Attitude
b. Predictors: (Constant), Proactivity, Confidentiality risk, PInnovativeness, SelfEfficacy, Complaint H., Usefulness, Familiarity, Awareness, Performance, Ease of Use

Model	Unstandardized Coefficients		Standardized Coefficients		95.0% Confidence Interval for B		Collinearity Statistics		
	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	.868	.240		3.611	<.001	.395	1.340		
Usefulness	.308	.069	.283	4.465	<.001	.172	.444	.276	3.621
Ease of Use	.040	.058	.041	.691	.490	-.074	.153	.310	3.228
Confiden. R.	-.091	.029	-.111	-3.142	.002	-.148	-.034	.887	1.128
Performanc	.383	.060	.349	6.339	<.001	.265	.502	.366	2.729
ComplaintH	-.118	.050	-.101	-2.363	.019	-.216	-.020	.602	1.660
Awareness	.065	.040	.069	1.617	.107	-.014	.145	.605	1.654
PInnovative	.069	.044	.063	1.545	.123	-.019	.156	.660	1.515
Self-Efficacy	-.034	.045	-.031	-.765	.445	-.123	.054	.675	1.483
Familiarity	.043	.036	.049	1.201	.230	-.027	.114	.654	1.530
Proactivity	.125	.046	.116	2.726	.007	.035	.216	.613	1.632

a. Dependent Variable: Attitude
b. Predictors: (Constant), Proactivity, Confidentiality risk, PInnovativeness, SelfEfficacy, Complaint H., Usefulness, Familiarity, Awareness, Performance, Ease of Use

Table 28 (cont.d)

Model	Unstandardized Coefficients		Standardized	t	Sig..
	B	Std. Error	Beta		
(Constant)	1.213	.132		9.161	<.001
Attitude	.703	.039	.661	18.219	<.001

a. Dependent Variable: Intention



Table 29

Correlation Analysis Results

		Correlations										
		Usefull	Ease	Confident	Perform	Complaint	Aware	Plnnov	SelfEff	Attitude	Intention	Familiar
Easey to Use	Pearson Correlation	.781**										
Confidentiality	Pearson Correlation	.000	-.099*									
Performance	Pearson Correlation	.747**	.675**	-.139**								
Complaint H.	Pearson Correlation	.396**	.482**	-.100*	.457**							
Awareness	Pearson Correlation	.457**	.474**	-.048	.452**	.517**						
P. Innovative.	Pearson Correlation	.146**	.301**	-.147**	.199**	.359**	.259**					
Self-Efficacy	Pearson Correlation	.124*	.291**	-.258**	.109*	.260**	.108*	.406**				
Attitude	Pearson Correlation	.644**	.574**	-.168**	.670**	.303**	.406**	.212**	.117*			
Intention	Pearson Correlation	.538**	.526**	-.105*	.532**	.303**	.349**	.263**	.193**	.661**		
Familiarity	Pearson Correlation	.208**	.302**	-.162**	.212**	.275**	.233**	.483**	.440**	.248**	.404**	
Proactivity	Pearson Correlation	.524**	.484**	-.018	.533**	.323**	.456**	.141**	.046	.491**	.462**	.261**

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Regression Test performed in IBM AMOS reveal similar results with multi regression analysis carried out in IBM SPSS. 6 out of 11 claimed hypotheses have been verified and 3 of them are highly significant. As distinct from the SPSS results, Personal Innovativeness of the consumer has found out to be a determinant factor of Attitude towards virtual assistants, in AMOS, but proactivity of the assistant becomes an un-influencer of attitude towards using it.

Table 30

Results of Regression Tests performed in AMOS

Hypothesis			Estimate	S.E.	C.R.	P
Attitude.	<---	ComplaintH	-.235	.092	-2.537	.011
Attitude.	<---	Confidentiality R.	-.122	.032	-3.851	***
Attitude.	<---	Usefulness	.459	.135	3.412	***
Attitude.	<---	Easeofuse	-.052	.110	-.477	.634
Attitude.	<---	Awareness	.066	.047	1.390	.165
Attitude.	<---	Proactivity	.119	.062	1.935	.053
Attitude.	<---	Performance	.538	.123	4.392	***
Attitude.	<---	Selfefficacy	.067	.085	.789	.430
Attitude.	<---	Familiarity	.017	.052	.330	.741
Attitude.	<---	P.Innovative	.181	.078	2.319	.020
Intention.	<---	Attitude.	.806	.041	19.550	***

Remaining hypothesis related to variables Age (generation), Nationality, E-commerce usage habits and modality of the virtual assistant were analyzed via Anova and T tests on the IBM SPSS. T test analysis evaluating the acceptance of virtual assistants based on the nationality of consumers revealed that intention to use those technologies differ as per the nationality of their users and that EU citizens have more positive intention to use virtual assistants, compared to Turkish citizens (Table 31).

Table 31

T Test Results regarding the Impact of Nationality on Virtual Ass. Acceptance

		Group Statistics				
	Nationality	N	Mean	Std. Deviation	Std. Error Mean	
Attitude	Turkish	334	3.2745	1.05197		.05756
	EU Citizen	96	3.2882	.88472		.09030
Intention	Turkish	334	3.4521	1.10094		.06024
	EU Citizen	96	3.7465	.98021		.10004

		Independent Samples Test								
		Levene's Test for Equality of Variances			t-test for Equality of Means					
		F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	
						One-Sided p	Two-Sided p			
Attitude	Equal variances assumed	3.738	.054	-.117	428	.454	.907	-.01374	.11780	
	Equal variances not assumed			-.128	179.443	.449	.898	-.01374	.10708	
Intention	Equal variances assumed	3.208	.074	-2.364	428	.009	.019	-.29443	.12453	
	Equal variances not assumed			-2.521	170.006	.006	.013	-.29443	.11678	

On the other hand, in order to reveal the modality of virtual assistant's (commanded by voice, text, both) impact on adoption to use those assistants, an ANOVA test has been performed. Considering the number of customers in the sample commanding their virtual assistants by text is 104, by voice is 45 and by both is 27 and they are not very close figures, a Hochberg multiple comparison has been carried out (Field, 2013). At the end of analysis, it is revealed that the users commanding their virtual assistants via voice have less attitude to use them, compared to other group of customers (Table 32).

Table 32

Adoption of Customers Commanding the Virtual Assistants by Text/Voice/Both

Multiple Comparisons							
Hochberg							
Dependent Variable	(I) modality	(J) modality	Mean		Sig.	95% Confidence Interval	
			Difference (I-J)	Std. Error		Lower Bound	Upper Bound
Attitude	Text	Voice	.11980	.17067	.861	-.2916	.5312
		Both	-.44691	.23285	.160	-1.0081	.1143
	Voice	Text	-.11980	.17067	.861	-.5312	.2916
		Both	-.56671*	.20660	.020	-1.0647	-.0687
	Both	Text	.44691	.23285	.160	-.1143	1.0081
		Voice	.56671*	.20660	.020	.0687	1.0647

*. The mean difference is significant at the 0.05 level.

Finally, the impact of age and e-commerce usage on the attitude towards and intention to use Virtual assistants has been tested with ANOVA test, but no significant finding has been detected. Considering all the above-mentioned detailed test results, the hypotheses which have been accepted and rejected at the end of research have been concluded. (Table 33)

Table 33

Hypothesis Acceptance Status

Hypothesis			
H1	Usability ACCEPTED	-> Attitude	Usefulness positively affects the attitude towards AI based banking services.
H2	Ease of Use REJECTED	-> Attitude	Ease of use positively affects attitude towards AI based banking.
H3	Confidentiality risk-> ACCEPTED	Attitude	Confidentiality risk has a negative impact on attitude to use AI based banking applications.
H4	Performance ACCEPTED	-> Attitude	Performance has positive impact on attitude towards AI based banking applications.
H5	Awareness REJECTED	-> Attitude	Awareness positively affects the attitude towards AI based banking.
H6	Proactivity ACCEPTED	-> Attitude	Proactivity of AI based banking service positively affects the attitude towards AI service.
H7	Complaint Handling Attitude REJECTED	->	Successful complaint handling has a positive influence on attitude to use AI based banking applications.
H8	Self-Efficacy REJECTED	-> Attitude	Self-Efficacy of the consumer positively affects attitude towards AI based banking applications.
H9	Personal Innovativeness Attitude REJECTED	->	Consumer's personal innovativeness has a positive impact on attitude towards AI based banking.
H10	Familiarity REJECTED	-> Attitude	Familiarity with AI technologies has a positive impact on attitude towards AI based banking.
H11	Age	REJECTED	Generation Y has a more positive attitude to AI based banking compared to Baby -Boomers, as well as intention to use it.
H12	Age	REJECTED	Generation Y has a more positive attitude to AI based banking compared to Generation X, as well as intention to use it.
H13	Modality	ACCEPTED	Voice (vs. Text or tapping) interaction with AI based banking application leads to more negative attitude to use the application.
H14	E-commerce REJECTED	usage	E-commerce usage leads to more positive attitude to use AI based banking service.
H15	Nationality	ACCEPTED	Intention and attitude towards AI based banking differs based on consumers' nationality.
H16	Attitude ACCEPTED	-> Intention	Attitude towards AI based banking application positively affects intention use AI based banking.

Although ease of use which is one of the two constructs of TAM in acceptance of a technology (Davis, 1989) results in adoption to use internet, mobile and AI based banking applications, according to the literature (Gounaris, Koritos, 2008; Akturan, Tezcan, 2012; Farnaz, Mohd, Ahmad, Norhayati, Ahamad, 2012; Azmi, Zahari, Yunus, Kamar, 2021, Manrai, Gupta, 2022), it was not an outstanding factor in the qualitative analysis of this research, as well as quantitative analysis. Similarly, although Customers' awareness of digital banking ads, cons, opportunities, strengths and benefits result in high acceptance of those applications (Sathye, 1999; Howcroft, Hamilton, Hewer, 2002; Pikkarainen, Pikkarainen, Karjaluoto, Pahnla, 2004; Mohd, Mohd, Mohd and Mohd, 2011), there is no evidence of its impact on adoption to AI based banking apps and virtual assistants, within the context of research. On the other hand, customers' self-efficacy and familiarity with AI based banking services, including virtual assistants, robo-advisors, chatbots is revealed to influence attitude towards those robo-advisors (Belanche, Casalo, Flavian, 2019). But, It was not an outstanding factor in the qualitative or quantitative analysis of this research.

Chapter 5

Discussions and Conclusions

5.1 Conclusions & Recommendations

The findings of this study provide valuable insights into the motivations behind customers' adoption of artificial intelligence based banking services, specifically virtual assistants. Firstly, it was observed that functional attributes, including proactivity, performance, usefulness and confidentiality of AI-based banking applications, play a significant role in shaping customers' attitudes and intentions to use these applications. Customers perceive virtual assistants that are proactive, well-performing, useful, and offer a high level of confidentiality as more reliable, leading to a more positive attitude towards their adoption. Banks should prioritize these functional attributes while developing and implementing AI-based banking services to enhance customers' acceptance and usage. As reactive AI services have been implemented by local and global Banks till today, Proactive virtual assistants should be one of the new strategic targets of the Banks in their omni-channel digital banking strategy.

From an academic perspective, with this thesis, virtual assistant's proactivity, performance (essentially corresponding to understanding capacity) and confidentiality (instead of security) risk became the new determinant factors of AI based banking adoption, that take place in the literature for the first time. Considering the fact that proactivity has never used as a factor in the research of AI acceptance in any industry and has newly been brought in the literature, it might be worth for the academicians to include this concept in the similar future research models.

Furthermore, the study revealed significant differences in the adoption of AI-based banking services based on national and socio-demographic factors. Specifically, European Union (EU) citizens demonstrated a more positive intention to use virtual assistants compared to Turkish customers. This finding suggests that cultural and contextual factors may influence the acceptance and adoption of AI-based banking

services. Banks should tailor their marketing strategies and service offerings to align with the preferences and needs of specific target segments, considering regional and cultural variations. It is worth for multi-national to consider such cultural variations that have been reached in this research for the different geographies.

Academically, this thesis has been accomplished by finalizing a comparison of Turkish and EU citizen's adoption to Artificial Intelligence based banking services, namely Virtual Assistants for the first time. And despite the preconceptions, Turkish young tech-savvy population are concluded to have less positive intention to use those Virtual Assistants.

Moreover, personal traits such as personal innovativeness, was found to influence customers' intentions and attitudes towards virtual assistants. Customers who possess higher levels of personal innovativeness, tend to exhibit a more positive attitude towards AI-based banking services. Therefore, it is crucial for banks to consider customers' personal traits and design interventions to address potential barriers and enhance clients' confidence in using virtual assistants.

Additionally, although the literature suggests that voice (vs. text) interaction leads to more positive attitudes toward the Virtual Assistant system (Cho, Molina, Wang, 2019), on the contrary it was noted that customers who primarily interact with virtual assistants through voice commands exhibit lower adoption rates compared to clients who use alternative methods. This insight highlights the importance of providing a diverse range of interaction options, such as text-based or touch-based interfaces, to accommodate consumers' preferences and improve overall adoption rates. Banks should focus on developing user-friendly interfaces that enable seamless and intuitive interactions with virtual assistants, catering to the varying needs and preferences of their customers.

On the other hand, based on a theoretical perspective, the thesis has contributed to the literature by building an enriched Technology Acceptance Model, with extensions from various models, including UTAUT, DOI and SOR integrated with perceived risks covering both functional and customer based aspects of artificial intelligence based banking services.

In conclusion, this study emphasizes the significance of functional attributes, personal traits, and contextual factors in shaping customers' attitudes and intentions towards AI-based banking services. By understanding these motivations, banks can enhance the design, implementation, and marketing of virtual assistants, ultimately fostering greater adoption among clients. It is recommended that banks prioritize proactive features, address individual barriers, tailor their strategies to specific target segments, and provide diverse interaction options to ensure a successful integration of AI-based banking services and meet the evolving needs of their customers.



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