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İNGİLİZCE İŞLETME ANABİLİM DALI
ÜRETİM YÖNETİMİ VE PAZARLAMA (İNGİLİZCE) BİLİM DALI

**ONE CARD TO RULE THEM ALL: DO CONSUMERS ACCEPT
İSTANBULCARD AS A SMART CITY CARD?**

Yüksek Lisans Tezi

ÖMER HURMACI

İstanbul, 2021

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Ömer HURMACI

İstanbul, 2021

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ABSTRACT

There is an ongoing debate on the definition and the extent of smart cities. Although high-technology companies would benefit from technology-dominated definitions, inhabitants of cities would suffer from the consequences of such incomprehensive approaches. Therefore, in smart city research, socially responsible scholars take every solution into account regardless of its level of technology. This point of view protects the best interests of residents by building the smart city concept around the society itself, which also ensures a healthy participation of people in projects about their own city. İstanbulcard is a smart card that is issued by İstanbul Metropolitan Municipality. This rather low-technology multi-purpose card allows the municipality to manage some aspects of the city life. Moreover, it functions as a payment card and its area of usage is increasing progressively. This study aimed to understand important factors in the adoption of İstanbulcard for making payments in its extended usage area. An extended Technology Acceptance Model is utilized and statistical analyses were conducted with PLSc-PM technique. Results imply that perceived transaction convenience, perceived transaction speed and perceived security are significant factors in the adoption municipality cards as smart city cards. This research suggests that municipalities could take advantage of smart city cards when pursuing their smart city ambitions.

Keywords: Electronic payment, Smart city, Internet of things, Technology acceptance model, Structural equation modeling

HER ŞEYİ YÖNETEN TEK BİR KART: TÜKETİCİLER İSTANBULKART’I BİR AKILLI ŞEHİR KARTI OLARAK KABUL EDİYOR MU?

ÖZET

Akıllı şehirlerin tanımı ve kapsamı hakkında devam eden bir tartışma vardır. Yüksek teknoloji şirketleri, teknolojinin hakim olduğu tanımlardan faydalanacak olsa da, şehir sakinleri bu tür kapsamlı olmayan yaklaşımların sonuçlarından muzdarip olacaktır. Bu nedenle akıllı şehir literatüründe, sosyal yönden sorumlu araştırmacılar teknoloji düzeyi ne olursa olsun her çözümü dikkate alırlar. Bu bakış açısı, akıllı şehir kavramını toplumun kendi etrafında inşa ederek şehir sakinlerinin çıkarlarını en iyi şekilde korur ve bu da insanların kendi şehirleriyle ilgili projelere sağlıklı bir şekilde katılımını sağlar. İstanbulkart, İstanbul Büyükşehir Belediyesi tarafından üretilen bir akıllı karttır. Görece düşük teknolojili olan bu çok amaçlı kart, belediyenin şehir hayatının bazı yönlerini yönetmesine olanak sağlar. Bunun yanı sıra, bir ödeme kartı olarak kullanılabilir ve kullanım alanı da giderek artmaktadır. Bu çalışma İstanbulkart'ın genişletilmiş kullanım alanlarında ödeme yapmada benimsenmesindeki önemli faktörleri anlamayı amaçlamıştır. Genişletilmiş bir Teknoloji Kabul Modeli kullanılmış ve PLSc-PM tekniği ile istatistiksel analizler yapılmıştır. Sonuçlar, algılanan işlem pratikliği, algılanan işlem hızı ve algılanan güvenliğin belediye kartlarının akıllı şehir kartları olarak benimsenmesinde önemli faktörler olduğunu ima etmektedir. Bu araştırma, belediyelerin akıllı şehir olma yolunda ilerlerken akıllı şehir kartlarından yararlanabileceklerini gösterir.

Anahtar Kelimeler: Elektronik ödeme, Akıllı şehir, Nesnelerin İnternet’i, Teknoloji kabul modeli, Yapısal eşitlik modeli

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1. INTRODUCTION

‘Things’ began to use the Internet and this phenomenon is called the Internet of Things (IoT). Thanks to IoT technology, inanimate objects communicate to each other through the Internet in order to make our lives better. Therefore, the Internet functions as a bridge that connects devices and offer solutions. This adds an inseparable virtual layer to our lives that we often take for granted; because, it is invisible to the eye. Although some IoT devices might be small in size, their quantity is stated in millions. In 2019, there were 12,5 million IoT sensors in İstanbul and the city wants to double this number in 2024 (İstanbul Yatırım Ajansı, n.d.).

IoT is a part of everyday life and everyday business. To name a few, it shapes how we interact with cities, get educated, receive health services, collect data in business, and create new business models. This thesis focuses on how it changes the way we handle our payments and design future smart cities. Specifically, İstanbul Metropolitan Municipality’s İstanbulcard, which is envisioned to help İstanbul’s smart city ambitions and have a great area of usage in terms of payments of citizens, is under investigation.

The story of IoT has evolved in time. Now, ‘things’ are categorized with the presence or absence of an adjective standing next to them, that is, ‘smart’. Smart products and services has a potential to make an impact in world economy as well as on our daily lives in the future. Whether they are as tiny as a watch or as large a car, these smart solutions will stay as a hot topic for many years to come. Once, technology replaced human muscle-power with robots. It is time for it to replace mental-power with software that will find better and faster solutions than us thanks to data collected by smart ‘things’.

These smart things that now live under the roof of smart homes and even smart cities might be problematic, as well. As in the case of smart cities, technology (especially high technology) might cloud and divert the discussion on the real nature of solutions. It is

acceptable that ‘smart city’ concept has become a terminology, and a marketable goal that cities will strive to achieve and exploit. Nevertheless, it is a term that is created by private high-tech companies to sell their products to cities. Therefore, there is a risk that city managers will blindly pursue smart city ambitions and buy expensive but perhaps unnecessary cutting-edge technology in order to attract tourists or impress voters. This risk is about overlooking easy-to-implement low-cost solutions like İstanbulcard as well as failing to ask the question ‘for whom these solutions are there?’

This thesis defends bottom-up smart city approaches (Walravens, 2015) that are human-centric and smart city definitions that are not bound by expensive technology (Söderström et al., 2014). Therefore, considering that the smart city concept already lacks a widely accepted definition (Haarstad, 2017), this study treats it as a method to solve the problems of cities. UK Department for Business Innovation and Skills (2013, October) also emphasizes that a smart city definition cannot be written on stone and there is no limit to it. The Department describes the concept as a ‘process’ (p. 7) to enhance the quality of life. Thus, every solution counts as smart even if it is non-technology or low technology unless that solution does not create additional problems. In this way, both city managers and citizens are encouraged to find creative solutions to make their cities smarter by utilizing resources at hand. The participation of citizens in the process is important as the success of smart cities depends on whether they embrace the plans or not (Lytras & Visvizi, 2018).

The importance of including citizens in projects has been shown in previous literature (Konecnik & Go, 2008; Konecnik-Ruzzier & De Chernatony, 2013). This view posits that the people will help sustain the plans only if they embrace them. If the opinions of prospective residents are neglected, plans cannot be successful as in the case of Masdar city. Although it was vital for a city that is built from scratch to be attractive (Cugurullo, 2013), Masdar city is now a deserted experimental laboratory (Evans et al., 2016).

Some scholars agree that social consequences of putting cities and high technology in a melting pot without a careful consideration might be severe (Hollands, 2015). Moreover, leaving out cities that have low financial resources from the smart city hype might not be to

the best of their interest (Fromhold-Eisebith & Eisebith, 2019). Therefore, it is an opportunity for improvement for those cities to pursue smart city plans according to their own capability and resources. For instance, İstanbul Metropolitan Municipality has taken some humble steps to make its city smarter. Belbim, İsbak and İsttelkom are some of its subsidiaries that provide smart solutions. Having a land area of 5200 km² in Asia and Europe combined, İstanbul hosts more than 15 million people (Turkish Statistical Institute, 2021 February) excluding refugees. With many residents come several obstacles for İstanbul Metropolitan Municipality to tackle. Therefore, with the help of its subsidiary companies, the municipality tries to carry out smart city plans and enhance the quality of life of its dwellers.

Belbim, one of the aforementioned subsidiaries, offers a contactless solution for payments with its İstanbulcard. A card that has been utilized to pay transportation fees, now serves as a multipurpose smart card. İstanbulcard payment method is accepted by the municipality's own businesses, such as; bike renting, car parks, restaurants, public toilets, street vending machines and taxi service. Moreover, it is extending into the private sector with new agreements being announced each passing day. Supermarket retailers, museums, private taxi and bike services, and online grocery apps are some examples.

Aside from these, it has been utilized for other purposes, such as; a personnel card in corporate companies. This ID card can function as a door key and an employee meal card. In addition to these, it works as an İstanbulcard and can be used to handle payments including public transportation. İstanbulcard is also used to foster recycling habits and raise awareness about environmental problems. Smart recycling containers offers monetary incentives depending on the type of waste and the money can be deposited to İstanbulcard. These incentives are small; however, the municipality's Waste Management Department plans to target kids and instill a sense of social responsibility in them. The municipality itself also does socially responsible acts with the help of İstanbulcard such as distributing social aid by depositing the amount to İstanbulcard. A new project of the municipality allows small grocery stores to accept payments with İstanbulcard (Halk Bakkal, n.d.). Considering that supermarket chains have taken their share in the pie, this may be a chance for grocery stores

to recover some of their business. These examples demonstrate the possible improvements in the city life thanks to considerably low technologies like municipality cards.

Belbim (2020) states that there are over 17 million active İstanbulcards. It is known that some people outside İstanbul also possess İstanbulcards. According to the report, a total of ca. 3.5 million transactions happen each day and 99% of this amount belongs to public transportation. These numbers were more than twice in the previous year (Belbim, 2019) with 6 million transportation-related transactions out of 8 million total transactions. Belbim (2019) reports that only 500.000 Istanbulites actively used İstanbulcard's mobile app. Out of transportation, İstanbulcard is utilized to make payments in; public toilets (12 million Turkish Lira [TL]), supermarkets (8 million TL), car parks (2 million TL), cafés (41.000 TL) and recreational facilities (261.000 TL). These approximate numbers show that İstanbulcard has still a lot of room for improvement in non-transportation transactions.

Therefore, factors motivating Istanbulites to use İstanbulcard payment method beyond transportation is investigated in this work. Although electronic payment literature is maturing, research on the adoption of municipality smart cards (e.g. Belanche-Gracia et al., 2015) is rare and there is a possibility that they are not in the smart city context. This work aims to fill this gap by utilizing an extension of Technology Acceptance Model (TAM) to understand the adoption of İstanbulcard in these new usage areas. Moreover, COVID-19 pandemic inevitably became a part of this research; because, it already changed some payment behaviors. To understand its effects on preferred ways of payments, *perceived COVID-19 risk* variable is included in the research model. Therefore, the research is extended towards a health behavior as well.

To mention the outline of this research, Section 2 presents the reviewed literature on the smart city concept, electronic payments and technology acceptance models, respectively. Section 3 provides the research design and methodology of this study while Section 4 reports the results of descriptive analysis, PLSc-PM analysis and t-tests about group differences. Findings are discussed in Section 5 and conclusions are made in the sixth section.

2. LITERATURE REVIEW

The literature provided in this study is fivefold. Firstly, the dispute over the definition of smart city is presented. Compared to some technology-dominated literature, a less strict approach to realization of smart city projects is taken. Then, some concerns over possible drawbacks of smart cities are raised. Some national and local government efforts in Turkey are demonstrated. Naturally, the emphasis was placed on smart city projects in which İstanbulcard plays a role.

As İstanbulcard is a payment instrument, the second part of the literature is spared for different types of retail payment instruments. Plastic card-based payment methods are given importance, as İstanbulcard is a prepaid card.

Thirdly, theories about the adoption of new technologies are presented. A brief introduction was made about the previous theories that lead to the emergence of models about technology adoption. Then, the slow and steady progress of technology acceptance models is discussed.

To summarize the electronic payment adoption literature, a very comprehensive table is prepared in the fourth section. This table gives an idea about the important theories, statistical tools and constructs in electronic payment adoption research.

Lastly, by harmonizing the learnings on the literature and the aim of this study, hypotheses are developed. References are made to the previous literature about the relationships of constructs.

2.1 Overview of the Smart City Concept

In this section, a discussion on the smart city concept is provided. Both technology-oriented and human-centric views are presented. Possible detrimental effects of digitization

on citizens and environment are given. Turkey's understanding of smart city is mentioned briefly and some of the projects of İstanbul Metropolitan Municipality are shown.

The term 'digital city' was predominantly used between 1997 and 2010, until the year 2010 in which the European Union mentioned the word "smart", causing the number of smart city articles to spike upward (Cocchia, 2014). This hype resulted in many different definitions, indicators and views on the purpose of existence of the smart city concept. Haarstad (2017) finds European Union's smart city motivation to be economic-driven. They further argue that even in Europe 2020 strategy plan, the popular word "sustainability" has only been associated with economic terms. Similar to a subset – superset relationship, Yin et al. (2015) argues that every smart city is eligible to be called as a digital city but not vice versa.

It is known that cities freely call themselves smart; however, some finds this 'arbitrary' (Zygiaris, 2013, p.218). Hollands (2008) points out the fact that the word 'smart' induces positive associations; thus, it would be unexpected if a city did not strive to become one. Nam and Pardo (2011, June) claims that smart is a more embrative word than intelligent. Some researchers are critical about the different adjectives that describe cities and call them as 'language games' (Söderström et al., 2014, p. 307). Moreover, they also make the distinction by stating that smart city is a general term whereas 'smarter cities' is owned by IBM (Söderström et al., 2014, p. 318). Nilssen (2019) reported that googling for 'smart city' results in just over one billion sources as per 2018 July. As of January, 2021 it results in 3,900,000,000 sources.

Albino et al. (2015) claims that smart city is still a vague concept that appeared firstly in 1990s. Angelidou (2014) points out to differences in the understanding of how smart cities can be build. Angelidou (2015) states that between 1990 and 2009, smart city solutions emerged according to the demand; however, after 2009 they are shaped by the supply. They point out to the damage given by supply-side solutions to smart city strategies; as disregarding the demand can simply be considered as strategic myopia. In the same vein, Hollands (2015) points out that the main role of smart cities today is to be a problem-solver.

However, they claim that only few understand what these urban problems are and what their extensiveness is. Haarstad (2017) suggests that the focus should be on the solutions offered by the smart city rather than the description of it. The review of Meijer and Bolívar (2016) showed how scholars define the concept of smart city. Out of 51 papers, the concepts used to define smart city were as follows; technology (12), governance (6), human resources (4) and 12 papers used different combinations of these. It is noteworthy that 17 did not provide a definition. This indicates that scholars have different viewpoints on the core of smart cities.

Anthopoulos (2017) makes the distinction between smart solutions and smart ICT solutions by claiming that not every smart solution comes from ICT. However, Arroub et al. (2016, October) claims that smart cities will achieve all their goals thanks to ICT. Emerged as a concept for solving the problems of cities, the smart city concept may now cause cities to be treated as a research field to test new technologies (Ateş & Önder, 2019). On the other hand, Dameri and Rosenthal-Sabroux (2014) stresses the importance of technology; however, they point out that technology itself cannot deliver all the value. Others also voice that technology should not be perceived as a destination where cities need to arrive (Letaifa, 2015). Lytras and Visvizi (2018) raises concerns about the ability and willingness of smart city citizens to use smart city services by stressing that even all necessary technology is build, the transformation is still up to citizens. Clever et al. (2018) suggests that any effort made in smart city progression should take humans into account first.

It is evident that academy and industry assign different roles to smart city (Dameri & Rosenthal-Sabroux, 2014; Gil-Garcia et al., 2015). While academy puts the intellectual people at the core of smart city, industry has focused on technological devices and solutions. Industry has a very supply-sided view of smart city, which does not consider the people factor as a stakeholder. Hollands (2015) finds how academics approach the concept smart city to be more detailed in nature whereas they find the view of other parties to be focused on only certain aspects of it. Some also investigated the balance between technology and society on smart city approaches using publications of standards institutions (please see Joss et al., 2017 for their thorough review of smart city standards of the British Standards Institution). Nilssen

(2019) states that the discussion of smart city lacks an innovation approach and divides smart city innovations in four types; technological, experimental, organizational and collaborative. İstanbulcard falls into the organizational innovation category considering that it alters the municipality's payment process.

Some claim that there are discussions about smart cities; however, there exist less actions aiming to realize those discussions. Moreover, realization projects differ in size (Hollands, 2015) according to the budget and political support. Next section provides different approaches to the realization of smart cities.

2.1.1 Realization of the Smart City

In the smart city context, top-down approaches tend to rely on technology firms whereas it is optional in the bottom-up approach, which takes a closer look on actual problems of the citizens (Walravens, 2015). It is not surprising that technology giants view smart cities as the problems of which can be remedied only by their own products and services (Söderström et al., 2014). Angelidou (2015) claims that the emergence of smart city solutions is tied to the relationship between technology push and demand pull. Others mention technology imposition by big tech giants the visions of which on smart cities are purely economic (Kitchin, 2014). Anthopoulos et al. (2019) poses the question about how smart cities deliver value and claims that the answers in the literature are currently vague. Hollands (2015) calls everyone to rethink the notion of technology being the sole actor in tackling the obstacles that cities face. Falconer and Mitchell (2012) claims that the views of government and industry on smart cities are not in the same frequency. This difference in the approach to smart city concept makes it difficult for them to work together.

Angelidou (2017) does not consider the necessary technology required to make cities smarter to be something that is unachievable. Picking up and matching technologies that will work well are considered to be the real issues. Fromhold-Eisebith and Eisebith (2019) states that although cities in less developed countries cannot meet the needs of being a smart city

fully, the mere effect of putting effort on this matter can help those cities improve. Gil-Garcia et al. (2015) considers the smart city to be a method to tackle obstacles of cities. They do not accept ‘hard to fulfil’ smart city definitions that are dictated by those who have interest in the profitability of smart city solutions.

Gil-Garcia et al. (2015) argues that Boolean classifications of cities in terms of smartness may not be the right approach. Instead, they consider smartness as an ongoing process in which some cities are smarter than others. Meijer and Bolívar (2016) support this by suggesting that when a city is not smart, it also is not ‘stupid’ (p.398). It is argued that the culture of the city and the wants of its citizens are the answers to the question of an ideal city (Zubizarreta et al., 2016). Therefore, some researchers posit that smart city efforts should progress on predetermined goals before technology creates a mess (Zubizarreta et al., 2016).

In Turkey, although corporate companies lend a helping hand in smart city discussion, they refrain from taking a role in building it (Bilbil, 2017). Turkey faces monetary and regulative obstacles and lacks quality people regarding smart city projects (Bilbil, 2017). However, other European cities also share the same destiny. Walravens (2015) concerns that only a small amount of apps is produced by the local government of Brussels which did not put so much thought on them.

2.1.2 Problems in the Smart City

Zubizarreta et al. (2016) notes that if a solution that solves a problem in one aspect of the city causes a problem in the other, that solution is not smart. This is why meticulously designed plans play a curial role in the happiness and welfare of city residents. Corporate storytelling can convince people (or city administrators) to believe that their lives will be similar to the Jetsons. However, depleting finite resources or creating a social divide may lead to a world of the Flintstones.

2.1.2.1 Sustainability Concerns

Some scholars suggest that the concepts of smart city and sustainable city go hand in hand when we consider what they are supposed to achieve (Dameri & Rosenthal-Sabroux, 2014; Ahvenniemi et al., 2017). They also claim that there is a division in the literature regarding approaches of the scholars to smart city. One is being technology centric and the other being citizen centric. However, they posit that sustainability efforts in a city should not overlook the sustainability of its citizens. Therefore, they emphasize that when creating value, the public should come first.

Comparing smart city frameworks and sustainable city frameworks, Ahvenniemi et al. (2017) state that the points of focus for the smart city concept are ICTs, quality of life and economy whereas they are natural environment, resource and waste management, and quality of life for sustainable cities. Therefore, Ahvenniemi et al. (2017) claim that it is important to redefine the concept as smart sustainable city in order to make sure that the sustainability indicators are not overlooked.

Colding et al. (2020) claim that smart cities, contrary to expectations, may deplete unnecessary energy due to their complexity. Looking at European Union's vision for smart cities, Haarstad (2017) reports that they cannot see how smart cities will foster sustainability. They find existing research lacking in the respect of explaining the relationship between smart city and sustainability. Sustainability is an issue for İstanbul, as well. Türkoğlu et al. (2011) mentions that Chambers of Architects and Planners of Turkey sued Istanbul Municipality for their lack of sustainability concerns.

2.1.2.2 Digital Divide, Privacy, Security and Human Responsibility Issues

Digital divide in smart cities happens with the imposition of technology usage. If the members of the society do not have equal ability and/or opportunity to benefit from the technology, this will create a digital divide. On the one hand, tech-savvy and privileged people will be able to interact with the city. However, on the other hand, some minorities

will face several challenges even when conducting daily operations in the city. For instance, seniors may not be able to learn new technology that is required to interact with the city. Even more, there is a possibility that they may not want to learn them and may find them unnecessary. Moreover, not every citizen has access to the Internet or technological devices like smartphones.

The technology driven approach to cities may create more problems than the solutions it offers (Hollands, 2015). Calzada and Cobo (2015) also assert that not everybody has the chance to 'disconnect' and disconnecting has consequences for some people. They ask smart city planners to reduce the negative effects of these consequences in order not to cause a digital divide. Therefore, scholars from social sciences vision a smart city in which technology does not play as much of a significant role (Lytras & Visvizi, 2018).

Hollands (2008) approaches to the term 'smart' carefully and claims that it may conceal the negative outcomes of such cities. One of which is about the possible fragmentation of social structure in those cities. This possible fragmentation can include two groups; first of which is the one that is more tech-savvy and the second of which is the one who will serve these tech-savvy people in the city. Vanolo (2014) raises concern over the 'smart citizen' persona claiming that some citizens will be left out in this vision. Drawing attention to the ageing population, Brdulak (2017) stresses the importance of understanding the needs of the society before planning. Moreover, it is argued that technology even has consequences on politics in the city (Meijer & Bolívar, 2016).

Angelidou (2014) stresses the importance of looking at the city at hand and therewith trying to work on what the city already has rather than primarily focusing on what the city lacks. Moreover, they suggest the cities that pursue becoming smart cities to go small at first by focusing on fewer aspects to improve. They advise that digital divide, privacy and security issues must be addressed. Therefore, taking small steps in the process is essential; because, it allows the detection and corrections of the problems on the way. However, a considerable percentage of smart city projects does not satisfy the necessary due care for privacy and security issues (Angelidou, 2017).

In smart cities, governments should care for the privacy of their citizens and educate them about the consequences of data they would like to share (Abosaq, 2019). Some research found that main concerns of citizens regarding smart cities are security and privacy (Lytras & Visvizi, 2018). There is emphasis on the fact that when a city is technology dependent it is a 'hackable city', which is not only unsafe but also prone to have errors in its municipal operation (Kitchin, 2014, p.1). Therefore, steps should be taken in order to protect the privacy of citizens and technologies should not be used without a meticulous inspection about their privacy related consequences (Abosaq, 2019).

Colding et al. (2020) points out that the increase in the use of technology leads to a decrease in human responsibility in a crisis, meaning that in a case where something goes wrong, the technology will be used as a scapegoat. It should be noted the very data that administrations will use when making decisions are not exempt from their own biases. Data is the product of society because there is an inevitable human intervention in the process of data creation, collection and analysis (Shelton et al., 2015). Considering the issues above in this paragraph, the approach to and the use of data is very important in the smart city.

2.1.3 People in Smart City

Human capital in a smart city is characterized by creating knowledge, being creative and intelligent (Angelidou, 2017; Nam & Pardo, 2011, June). Subsuming many different cultures, sub-cultures and ethnicities, İstanbul has the potential to foster creativity (Alvarez & Yarcın, 2010). These creative and knowledgeable people could reshape the way we vision future cities. Moreover, smart cities themselves will attract creative people to relocate and work in them. This will enrich the culture in these cities.

However, some smart city projects show that people are not at the core in the eyes of planners (Angelidou, 2017). Some research raised concern over the unpredictability of the future society that smart cities will shape (Colding et al., 2020). Scholars raised their concerns by stating that too much technology could create a chaotic environment in which technology

controls people rather than the opposite. On the other hand, others claim that the concept of smart people is in line with what cities want to achieve (Dameri & Rosenthal-Sabroux, 2014).

To look at people's point of view about the smart city, it is shown that citizens value 'mobility, simplicity and connectivity' the most (Lytras & Visvizi, 2018, p. 12). Some cities realized the importance of citizen participation and listened to the voice of their citizens when building their smart cities. For instance, the smart city efforts in Amsterdam included its citizens' participation in the process (Yigitcanlar, 2015; Angelidou, 2017). Therefore, smart people are not just the residents of smart cities but also the creators of them.

2.1.4 The Smart City Concept of Turkey and İstanbul Metropolitan Municipality

Akin and Ongel (2017, p. 367) considers Information Society Strategy (2006-2010) of Turkey to be the pioneer of ICT strategies which are designed for the whole country. The later version of this strategy plan (2015-2018) also includes plans on smart city. Having strategy plans is vital to induce action and attract investments. However, as smart city is a new concept for Turkey, there is risk that it will be misused solely as a tool for marketing leverage and competitive advantage which might undermine its role in building a more livable city with a holistic view (Ateş & Önder, 2019).

Akin and Ongel (2017) describes the relationship between smart solutions and some 40 municipalities in Turkey. The majority of smart solutions are in the fields of transportation and e-services. They also stress that smart transportation systems are currently in use by the majority of local governments. Smart city apps about transportation are also one of the most downloaded apps in other cities that share the same destiny with İstanbul about traffic congestion (see for Brussels: Walravens, 2015). About the mobility of citizens of Istanbul, Türkoğlu et al. (2011) shows that only about a quarter of Istanbulite respondents walk to their work or school. Interestingly, half of total respondents expressed their liking for public transportation.

United Nations e-Government Knowledgebase (2020) ranks Istanbul as 12th in their e-government quality index, which is considered to be in the ‘very high’ category. The report states that compared the upper-middle income level, the amount of local online services provided by İstanbul is large. İstanbul also ranks as 10th in the participation and engagement category.

2.1.4.1 Smart City Concept at a National Level

Figure 1 describes the smart city mindset of the Ministry of Environment and Urbanization of the Republic of Turkey. The puzzle-like shape of elements in the figure can tell us that the Ministry’s approach is holistic and every dimension is connected. In the report (Türkiye Cumhuriyeti Çevre ve Şehircilik Bakanlığı, n.d.), there is emphasis on the greenness of cities and sustainability. The security of citizens in the cities (not to be confused with digital security) is another issue. Smart people are defined as having a participative spirit with high-awareness. In the smart people component, there is an emphasis on social capital, social infrastructure and cultural interaction. Thought is also put on properly hosting these smart people in smart buildings so that they experience a quality of living. Safety and energy issues are also important when it comes to the Ministry’s understanding of smart buildings.

Regarding smart economy, the stress on the efficient use of resources is expected; however, what stands out is that there is also focus on preventing unnecessary consumption. Smart space management is approached as a preventative method which will decrease loss of life and property due to natural disasters. Therefore, the vision about smart space management is to increase the durability of cities. On the subject of smart health, the importance that is given to the analysis of health-related data is prominent. Remarkably, one aim is to increase health awareness of individuals about themselves. Therefore, it can be understood that smart people in the ministry’s view are also knowledgeable about their own physical and mental health.



Figure 1. Smart City Conceptualization of Turkish Ministry of Environment and Urbanization

Source: Türkiye Cumhuriyeti Çevre ve Şehircilik Bakanlığı (n.d.). Smart Cities Newsletter. https://webdosya.csb.gov.tr/db/cbs/menu/akillisehirler-kitap_20190311022214_20190313032959.pdf. p.7.

Notes. From left to right and top to down, terms in the figure roughly translates as; Governance Mechanism, Investment, Resource Utilization; Smart Governance, Open Data, Big Data; Smart Environment; Smart Economy; Smart Energy; Smart People; Smart Transportation; Smart Buildings; Smart Health; Disaster and Emergency Management; Smart Security; Information Safety; Information Technologies; Communication Technologies; Smart Space Management; Geographic Information Systems; Smart Infrastructure.

2.1.4.2 Smart City Concept at a Municipal Level

Istanbul Metropolitan Municipality is one of the largest public organizations in Turkey and it is responsible for the administration of the city and the coordination of district municipalities. The municipality operates with its 28 subsidiary firms that are specialized in different sectors. The mayor is selected with elections that are conducted in every five years.

Istanbul is a rather sizeable city with 5200 kilometer square land area (Türkoğlu et al., 2011). In their interview-based study with top level managers working in tourism related organizations and governmental positions, Ağraş et al. (2020) reported that half of these managers considers İstanbul to be a partially smart city whereas the other half argues that İstanbul cannot be called smart. Some of these managers expressed their concern that although there are many investments on smart solutions, making İstanbul a smart city is not an easy task to achieve due to its considerable size.

Bower (2018 November, p.25) states that in order to become smarter, Istanbul Metropolitan Municipality seeks to improve the following smart city dimensions: “environment, mobility, energy, living, governance, economy and human”. Hollands (2008), mentions that by implementing a smartcard, Southampton declared itself a smart city. Yigitcanlar (2015) states that this was an attempt to draw attention to electronic services. İstanbul Metropolitan Municipality and Belbim also have a vision for İstanbulcard to be a helpful tool in İstanbul’s transformation into a smart city.

It is important for municipalities to be able to collect data about their citizens and their behaviors in the city. IBM’s earlier smart city vision is criticized by Yin et al. (2015) due to its indifference to city data. After a review of smart city literature, they found that data was the essence of many smart city architectures. Therefore, it can be said that İstanbulcard can be an important source of collecting data about the behaviors of Istanbulites.

To look at some smart solutions in İstanbul, below efforts of the municipality is examined. These efforts include the development of new usage areas for İstanbulcard. Clearly, the municipality has ambitions to create an ecosystem in which İstanbulcard will

play an important role by connecting payment systems. Although solutions that incorporate İstanbulcard are stressed, the municipality's projects are not limited to those.

Figure 2 demonstrates some of the points in the city where İstanbulcard can be utilized as a payment method. These are; 6252 public transportation vehicles, 130 cafés, 118 subway stations, 469 İspark car parks, 51 bus rapid transit stations, 163 public toilets, 64 sea transportation stations, 58 tram stations and three lift (telpher) stations. The reason why some of İstanbulcard's most innovative usage areas are not included might be the date this image is published.



Figure 2. İstanbulcard's Area of Usage as of 2019, February

Source: Akıllı Şehir İstanbul [@istakillisehir] (2019, February 21).

<https://mobile.twitter.com/istakillisehir/status/1098490699077562368/photo/1>

In order to increase the number of merchants that accept İstanbulcard as a payment method, Belbim collaborates with supermarket chains as shown in Figure 3 below. This collaboration not only allows İstanbulcard owners to pay but also reload money to their cards in the premises of these chains. This extended usage of İstanbulcard helps especially those who are unbanked to pay conveniently with a safer method than cash. This safety also applies for senior citizens and some people prefer their elder parents to use İstanbulcard rather than cash. Moreover, these supermarket chains also serve as distribution point for İstanbulcards.



Figure 3. Partnership of İstanbulcard with a Supermarket Retailer

Source: Belbim (2021, April 6). <https://www.belbim.istanbul/haber-detay?id=1079>

As the smart city concept should be human-oriented and empower its citizens, culture stands out as an important dimension of smart cities. Figure 4 demonstrates some work of art of a museum which partnered up with İstanbulcard. The benefits of this partnership allow a convenient payment method as well as discounted tickets for the promotion of İstanbulcard. Thus, the card does not limit itself to help paying for transportation, car parks or goods but extends into the payment for cultural activities. This is essential for smart cities as they should engage their citizens to participate in cultural activities.



Figure 4. Partnership of İstanbulcard with a Museum

Source: Belbim (2020, September 4). <https://www.belbim.istanbul/haber-detay?id=68>

Figure 5 is an informatory advertisement about one of İstanbulcard's collaborations with banks. İstanbulcard owners have the option to reload their cards digitally via the mobile apps of banks. Moreover, they are able to pay with İstanbulcard via the POS machines of some banks. These partnerships help İstanbulcard to become an easy to use to card and a convenient payment option.



Figure 5. Partnership of İstanbulcard with a Bank

Source: Belbim (2021, March 3). <https://www.belbim.istanbul/haber-detay?id=1078>

Aside from cash and debit cards, another way of reloading İstanbulcard is to send an SMS indicating the amount to be loaded (Figure 6). The amount that is reloaded on İstanbulcard is then reflected on the subsequent invoice of the user's GSM service. This is another contactless option of depositing money on İstanbulcard besides mobile banking applications. Again, reloading through SMS is helpful for unbanked consumers. It should be noted that this is a convenient method of payment in a situation in which consumers do not have cash or credit cards nearby. Moreover, there is an emphasis on how this method allows a hygienic transaction compared to other methods. This is beneficial for consumers considering the contagiousness of coronavirus; because, another way to reload money to İstanbulcard is to use kiosks.



Figure 6. Partnership of İstanbulcard with a Public Telecommunication Company with an Emphasis on Hygiene and Convenience

Source: Belbim (2021, February 9). <https://www.belbim.istanbul/haber-detay?id=1073>

iTaksi and BiTaksi are mobile apps that provide taxi service inside İstanbul. These mobile apps enable İstanbulites to call a taxi with their smartphones. iTaksi belongs to İstanbul Metropolitan Municipality and is one of its smart city projects (Figure 7). It offers a secure and a convenient travel to passengers. The digital top signs of taxis change according to the occupancy status of taxis and inform prospective customers about the availability of

the taxi. Inside these signs, there are smart sensors that collect data about air quality as the cars drive around the city. These data help the municipality to take actions in order to prevent air pollution. Moreover, other sensors in taxis collect data on road quality and inform maintenance teams about flaws. BiTaksi, on the other hand, is a private company. Both these companies accept payment with İstanbulcard through their mobile apps. Thanks to NFC technology, the cost of the trip can be paid at the ease of a tap.



Figure 7. Partnership of İstanbulcard with a Private Taxi Company

Source: Belbim (2021, January 12). <https://www.belbim.istanbul/Preview/tr/e5bbc335-5709-4be1-b050-69496e4c4a5f?id=1076>

An award-winning (PSM awards) partnership of İstanbulcard was with Getir which is a private company. Getir is an online grocery mobile application that is founded in Turkey. With this app, consumers can buy almost anything they can buy in convenience stores; however, with a lower brand diversity among products. This partnership allows İstanbulcard holders to shop online and pay by tapping their card on the back of their mobile phones (Figure 8).



Figure 8. The partnership of İstanbulcard with an Online Grocery App

Source: Belbim (2020, October 2). <https://www.belbim.istanbul/haber-detay?id=71>

To the best of author's knowledge, an unfortunate public transportation accident that involved a baby and her mother led a European country to allow parents with babies to use public transportation free of charge. This is a very serious issue; because oftentimes, parents with baby strollers get into buses from the middle doors and have to go to the front to pay their fees while their babies are left unprotected.

Belbim issued a 'Mother Card' (Figure 9) as a monetary help to mothers whose children are up to four years old. They can apply for this card and use public transportation without paying fees. Although this is advantageous for mothers, a solution without cards would be a better option to protect the safety of babies. A baby stroller should be good enough to work as a free pass. This proves that smart solutions are not always those that involve technology as this thesis defends it. Lastly, please note that fathers also do need a card like this; therefore, this card should have been issued as a 'parent card' in the first place if it needed to be issued at all.

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ÇOCUKLU ANNELERE
ÜCRETSİZ TOPLU ULAŞIM
DÖNEMİ BAŞLADI!**



Figure 9. Mother Card that Gives Mothers Free Pass in Public Transportation

Source: Belbim (2020, July 23). <https://www.belbim.istanbul/haber-detay?id=67>

COVID-19 pandemic surely affected how İstanbulcard promotes itself. Figure 10 shows a hand that is wearing a latex glove. The inexplicit message in the advertisement is that when in supermarket; one can pay with İstanbulcard instead of cash which might carry coronavirus droplets. This advertisement is an example to how Belbim turned the pandemic into an advantage for raising awareness about İstanbulcard. Thanks to its contactless payment feature, İstanbulcard is convenient as well as hygienic in the period of pandemic.



Figure 10. An Example of the Effects of COVID-19 Pandemic on Promotional Efforts of İstanbulcard

Source: A screenshot of a video which is retrieved from İstanbulkart (n.d.)

<https://www.istanbulkart.istanbul/>. Exact URL of the video:

https://webkurumsalapi.istanbulkart.istanbul/Media/new/migros_kampanya.mp4

Figure 11 demonstrates a product of İsbak that works with İspark car park service. The digital signboard in the figure informs drivers about the empty parking slots that are available in İspark car parks along the way. It is important to stress that these signboards also allow drivers to know that there are car parks nearby. Please note that both the availability and the location of car parks are also available in İspark's mobile app. This collaboration between two subsidiaries of the municipality touches a very crucial pain-point of many Istanbulites as they suffer from time consuming traffic congestions and the scarcity of parking spots. As simple as it looks, this is a good example to low cost smart solutions that can be provided by municipalities.



Figure 11. İspark Real-Time Digital Signboard

Source: İspark (2017, March 8). <https://ispark.istanbul/haberler/ispark-ile-akilli-otopark-sistemleri/>.

Figure 12 is a solution of İsbak that is produced as a preventative measure against the spreading of coronavirus. İsbak is a subsidiary of the municipality that specializes in smart city solutions. However, their current solutions are excessively in the field of traffic management and transportation.

This aforementioned preventive device is a pedestrian button that helps them cross the street by altering the traffic lights. The former version of this device required the pedestrian to push the button; however, in a period of pandemic, these surfaces became hazardous for human health. Therefore, İsbak began to produce devices that no longer need a physical contact to operate. This is an interesting example of a smart solution that is emerged with the urge of a pandemic. Please note the simplicity in this solution to a life-threatening problem. As this study defends, ‘smart’ does not always mean high-technology.



Figure 12. Contactless Pedestrian Button of İsbak

Source: Turk-Internet (2020, April 27). <https://turk-internet.com/ibbden-covid-19a-karsi-temassiz-yaya-butonu/>

2.1.5 Other Smart City Efforts around the Globe

Van den Bergh and Viaene (2016)'s paper on Ghent shows that the city administration works its way around in the aspect of citizens first in order to progress in becoming smart. The city put thought on the issue of digital divide and aimed for the participation of all parties. Remarkably, Van den Bergh and Viaene (2016) divide participation in smart city projects into two; passive and active. They imply that passive participation may induce active participation in the future. Furthermore, they discuss the consequences of the involvement of non-governmental parties in projects. Aside from these, they emphasize the significance of the endorsement that comes from political bodies to accomplish goals. They also claim that smart city projects cannot be successful unless they operate as a network and communicate clearly. Lastly, they advise cities to have an IT strategy.

Walravens (2015) finds the efforts of Brussels to be uncoordinated. Focusing on the mobile apps developed by governmental bodies for smart city goals, they claim that the amount is scarce and people do not download them. On the other hand, they draw attention to the vast supply of useless apps by non-governmental parties. They claim that it is the city's duty to identify and promote apps that are useful.

The endeavors of Barcelona are examined by Capdevila and Zarlenga (2015) and they point out to efforts made in order to foster creativity in local businesses. Moreover, the changing role of the citizen is discussed. Nowadays, citizens are not only the users of technology but also the creators of them. They meet and work together in common spaces to create solutions. These spaces are sometimes funded by non-governmental actors. Aside from these, the city embraces open data as it aims to be more transparent, and supportive of interested parties. The authors state that high technology companies are trying to strengthen their relationships with the local government. They further interpret this situation as risky; because, there is a possibility that the real needs of people will be neglected. Examining both top-down and bottom-up approaches, they claim that their co-existence is crucial for the inclusion of as many stakeholders as possible in smart city plans.

Abovementioned case studies of different cities present various approaches to the smart city concept by cities as well as academicians. To see some other smart city projects, please refer to Nilssen (2019) for Bodo, Fernandez-Anez (2018) for Vienna and Wiig (2015) for Philadelphia.

2.2 Electronic Payment

This section provides a background on money, payment systems and retail payment instruments. First, a brief history on money is provided. Then, payment systems are discussed without elaboration. Main emphasis in this section is put on retail payment instruments.

2.2.1 The Concept of Money

Money is a tool that can be held in a safe place until we decide to trade it for an amount of a collectively assigned value by exchanging parties (Surowiecki, 2012). Put in simpler terms; a) it helps us to store the equivalent of our labor or goods until when we decide to use it, and b) it helps exchanging parties to assign a particular value for particular goods and services, in terms of a currency rather than in terms of other goods and services (Surowiecki, 2012). Although evidence shows that the concept of “money” is being mentioned in Mesopotamia (c.a 3000-2000 BC), Lydians (7th Century BC, now located in modern Turkey) were the first ones to come up with a standardized production of metal coins (Surowiecki, 2012). Hence, they are mistakenly known as the inventors of money.

Before money was used for commercial purposes, it was used for noncommercial purposes. These noncommercial usages usually were there for problem solving. To name a few noncommercial usages would clarify the point. Money-things (e.g. wheat and sea shells, see Humphrey, 2014) were used to pay taxes (between subjects and a ruler). Sacrificing humans and animals was a form of using money (between, say, primitive tribes and their Gods). Resolving a blood feud or paying a “bride price” was another noncommercial usage of money (both between individuals) (Pryor, 1977; Surowiecki, 2012).

Tymoigne and Wray (2006), also supports this view by pointing out that the words for ‘debt’, and ‘sin’ and ‘guilt’ are sharing the same etymological roots in many languages. Moreover, it is intriguing that many unit of currencies are derived from words that are used to define weight. To clarify it better, readers can think about the prominent word ‘pound’.

One can say ‘I am 180 pounds in weight’ or ‘this computer costs 400 pounds’. Similarities like this can be found in other languages as well.

To illustrate that the flaws in the idea of ancient bartering, Surowiecki (2012) points out to the impossibility of exchange of values through barter. In their logic, it is nearly impossible to find two individuals who want to trade their goods in the exchange for what the other individual has to offer. For instance, there should be a blacksmith who wants to sell his sword and desire to have some cinnamon in exchange. At the same time and place, there should exist an herbalist who offers some cinnamon in the hope of getting a sword. These two people could have existed in different times and places but there is little chance that they existed in the same time and in proximity to each other.

Today, there is a division between commodity money and fiat money. Mishkin (2007) states that commodity money is made of precious elements. For instance, coins that are made of gold or silver are in this category. This type of money is used since ancient times. On the other hand, fiat money is paper-based and is backed governments.

2.2.2 Retail Payment Systems and Instruments

According to Federal Financial Institutions Examination Council (2016) and The Committee on Payment and Settlement (2012a) retail payments are usually low in value and high in volume exchanges that occurs between customer to customer (C2C), business to business (B2B) and business to customer (B2C; see also Humphrey, 2014). However, Federal Financial Institutions Examination Council (2016) points out that there is grey area between retail payments and wholesale payments. Humphrey (2014) suggests that the amount of the money transferred can be used to differentiate payment instruments. Kokkola (2010) states that in wholesale payments, time is the essence. Standing Committee for Economic and Commercial Cooperation of the Organization of Islamic Cooperation (2015) gives the example of Central Bank of Mexico which uses identical settlement systems for both types of payment. This approach makes it cumbersome to assign labels for different types of

payments. The committee also considers different regulations that govern retail and wholesale payments to be a distinct factor.

Another way to classify payments is to look at the number and the side of exchanging parties (Kokkola, 2010). Subscription fees that are collected by Spotify can be counted as a many-to-one transaction; however, the stipend paid to the employees of Spotify is under the category of one-to-many transaction. All other C2C, B2C and B2B transactions are one-to-one transactions. Kokkola (2010) describes a rather less mentioned category of payments, called commercial payments. These payments can imitate wholesale payment as the sources of them are well-grown international businesses.

Retail payment systems permit customers to conveniently pay for goods or services either with the help of merchants or with the help of themselves (Federal Financial Institutions Examination Council, 2016). These unattended payment technologies are implemented by various retailers. On the other hand, contactless payments are becoming more prominent each passing day. Payment of utilities via Internet gained much attention (Federal Financial Institutions Examination Council, 2016). It took only three years for online purchases made by mobile technologies to reach quarter of total purchases after iPad was introduced to the market (Mulcahy, 2019).

Proliferation of new financial innovations lowers the risks for business entry, which is especially to the benefit of rather small initiatives (Federal Financial Institutions Examination Council, 2016). Due to their concerns for convenience, consumers and merchants prefer using electronic ones and zeros over remnants of dead trees (i.e. paper-based solutions) when handling their transactions.

Recently, prepaid cards and debit cards received most of the attention (Federal Financial Institutions Examination Council, 2016) while the usage of cash is decreased in Automated Teller Machines (ATMs) and POS cash-backs (Norges Bank, 2018). Thanks to the transformation in the methods of payments from traditional solutions to electronics, the social cost of payment is diminishing (Humphrey, 2014).

The Committee on Payment and Settlement Systems (2012a) investigated innovations related to retail payments in its member countries in which Turkey also takes place. Every other innovation in retail payments are driven by consumers' desire for a faster payment process. Other focus of innovations in this area is contactless payment technologies. Innovations that aim to be used internationally are scarce; however, more or less the same innovations are developed in the investigated countries.

Rysman and Schuh (2017) states that financial sector is one of the first sectors that is affected by digitization. According to Cronin and McGuinness (2010), the payment methods used by consumers determine that countries' costs related to payments. Even though electronic payment technology lowers the costs associated with the whole process of payments, it is likely that cash payments will be present (Cronin & McGuinness, 2010).

2.2.2.1 Cash

Norges Bank (2018) defines cash both as a payment tool and as a payment method. Cash payments generally represent an interpersonal transaction in people's mind and are viewed as a very private payment method as cash does not convey personal information (Kokkola, 2010). This anonymity leads to vulnerability on the issues like concealing the source of ill-earned money and funding terror activities (see also Humphrey, 2014 for tax aversion).

In Turkey, the Central Bank of the Republic of Turkey (CBRT) is the only legal entity to produce banknotes (The Committee on Payment and Settlement Systems, 2000). The Committee on Payment and Settlement Systems (The Committee on Payment and Settlement Systems; 2000, 2012b) states that cash is the most frequently used retail payment instrument throughout Turkey. However, emphasis put on the fact that individuals are experimenting other ways to handle their payments and that companies now rely less on cash when handling wages and salaries.

The costs related to cash are higher than the price of banking services associated with cash (Kokkola, 2010). Therefore, banks in the euro area encourage the usage of cashless methods for payments. Banks are promoting the use of ATMs to individuals for attaining cash (The Committee on Payment and Settlement Systems, 2012b).

2.2.2.2 Cheques

A cheque (or check) provides information on the payee and the payer, their accounts and the monetary value to be exchanged (Federal Financial Institutions Examination Council, 2016). Although it was once the second choice after cash, with the emergence of electronic technologies, cheques lost their relative convenience to the consumers and merchants. However, electronic cheques are in use, as well. They carry their own advantages and disadvantages pertaining to their environment. Even though they may provide a faster and a more convenient transaction compared to traditional cheques, they carry the risk of loss of financial value through fraud or technical errors (Federal Financial Institutions Examination Council, 2016).

Cheques, due to their nature, provide an opportunity of delayed payments, which makes them preferable in the eyes of payers (Kokkola, 2010). However, among other non-cash instruments, their processing cost the most. Compared to cash and valuable metals, cheques carry a lower risk of theft and are more convenient when the amount of payment is rather larger (Mishkin, 2007).

Payments with cheques are administered and protected under the Turkish Commercial Code and Cheque Law (The Committee on Payment and Settlement Systems, 2012b). Although the value of payments made by cheques has increased between 2006 and 2010, the quantity of cheques used has decreased (The Committee on Payment and Settlement Systems, 2012b). Humphrey (2014) also supports this by comparing the decrease in cheques and increase in the usage of debit cards.

2.2.2.3 Plastic Card Based Electronic Payments

Card-based electronic payments can be investigated in three categories depending on the occurrence of the payment (Federal Financial Institutions Examination Council, 2016). The first category, *pay later*, is usually associated with credit cards which allows consumers to pay in installments. Due to the fact that the exchange of values happens instantaneously, *pay now* category is under the payments done by debit cards. The last category, *pay before*, is where İstanbulcard falls into, is a special type of payment that is done with debit cards by storing value in them before the purchase (Federal Financial Institutions Examination Council, 2016).

Humphrey (2014) claims that the usage of cash and cheques will diminish whereas debit and credit cards will enjoy a bigger share in the pie. Kokkola (2010) reports that, in the euro area, the use of payment cards seen a two-times increase in the last decade.

Interbank Card Center of Turkey reports that in 2020, there were 14%, 38% and 117% increase in the payments with credit cards, debit cards and prepaid cards, respectively (Bankalararası Kart Merkezi, n.d.-a). With these increments, in 2020, total plastic card based payment has reached 1.15 trillion Turkish Liras. By the end of 2020, there were 75.7 million credit cards, 144.7 million debit cards and 43.3 million prepaid cards in Turkey.

Table 1 presents an overview about Turkey on card-based payments and cash withdrawals that occurs in a month. The amount of purchase-related transactions and the volume of them prove the adoption of plastic cards in Turkey. Please note that it would be difficult to make monthly or yearly comparisons about the volume of transactions as Turkey is one of high inflation countries. Therefore, such comparisons are not presented considering that the table gives an idea about the topic.

Table 1. Card-based Payments and Cash Withdrawals Occurred in January, 2021, Turkey

Card Type	Transaction type	The Number of Transactions		Volume of Transaction (Million TL)	
		Purchase	Cash Withdrawal	Purchase	Cash Withdrawal
Credit Card	Domestic Transactions with Domestic Cards	355.977.311	10.194.394	84.390,12	9.773,04
	International Transactions with Domestic Cards	11.624.500	41.575	1.797,35	45,19
Debit Card	Domestic Transactions with Domestic Cards	197.169.501	85.585.299	16.292,71	70.086,73
	International Transactions with Domestic Cards	8.535.991	188.33	472,20	212,58
		The Number of Transactions		Volume of Transaction (Million TL)	
Virtual POS Transactions	Card Payments via Internet	89.456.664		26.131,45	
	Mail/Telephone Payment Transactions	13.824.170		9.212,18	

Source: Adopted from Bankalararası Kart Merkezi (n.d.-b). General Statistical Data for the Selected Month. <https://bkm.com.tr/en/secilen-aya-ait-istatistikler/>

2.2.2.3.1 Credit Cards

Garcia (1980) states that credit cards were first seen in the US, given to customers by hotels in 1900s. A decade after, other retailers also followed this trend. Readers should note that earlier versions of credit cards were not exempt from paper and phone confirmations (Rysman & Schuh, 2017). In 1950s, what were going to be bankcards (Diner's Club) has been first provided as entertainment and travel cards (Garcia, 1980). Bergsten (1966) points out the difference in Diner's Club and other previous retailers' cards. Diner's Club was a service and it was not associated with the selling of any goods. A similar was *American Express* which arrived in 1958. Today what we know as Visa is emerged as BankAmericard in 1960s (Garcia, 1980) and brought much convenience for both payers and banks (Rysman & Schuh, 2017). The Committee on Payment and Settlement Systems (2012b) reports that although credit cards became popular after 1990s, they were available in Turkey since 1968.

Credit cards display the symbols of the banks that issued them (Federal Financial Institutions Examination Council, 2016). The maximum amount of money allocated to a customer is the function of how financially reliable they are. Banks issue credit cards thanks to the well-trusted multinational financial companies such as; American Express, MasterCard and Visa (Federal Financial Institutions Examination Council, 2016).

Co-Branded credit cards are issued by brands and financial institutions; however, they sometimes involve banks (Federal Financial Institutions Examination Council, 2016). The aim to issue them is usually to offer customers a loyalty program.

Private label credit cards are simply marketing instruments that observe customer behaviors and differentiate brands (Ferguson, 2006). Differentiation is necessary; because, customers will choose one brand among others comparing the offerings of them (Ashley et al., 2011). Any symbol of banks is not present in these type of cards (Federal Financial Institutions Examination Council, 2016).

In order to provide a safer value exchange environment, Turkey implemented chip and PIN, being the third European country doing so (The Committee on Payment and Settlement Systems, 2012b). Moreover, interest-free partial payment was introduced.

2.2.2.3.2 Debit cards

The emergence of debit cards dates back to 1960s (Collins, 2011). Debit cards link consumers to their already available account in a bank (Federal Financial Institutions Examination Council, 2016). Although their debut dates back to quite a few decades, they received attention in 1990s. Consumers can simply use a PIN to access their funds; however, biometric readers stand as a hot topic (Federal Financial Institutions Examination Council, 2016). An option to delay the payment is not available (except in delayed debit cards) in debit card payments (Kokkolo, 2010).

The Committee on Payment and Settlement Systems (2012b) points out that the most common usage for debit cards is to get cash from ATMs. Another usage is to conduct the payment with the help of Point of Sale (POS) terminals and the technology is available since 1994. The Interbank Card Center of Turkey (Bankalararası Kart Merkezi [BKM]) promoted and encouraged the usage of debit cards in retail payments, which more than doubled their usage in two years between 2004 and 2006. They also developed facilities to allow cardholders to withdraw cash from different ATMs of their choice even if their card is issued by another bank (The Committee on Payment and Settlement Systems, 2012b).

2.2.2.3.3 Prepaid Cards

As Federal Financial Institutions Examination Council (2016) reports, prepaid cards have seen a significant growth in retail payments. The users of these cards load money on them before the actual purchase of goods or services. Thus, eliminating the risk of not acquiring the value for the receiving end. These cards can either be filled by consumers or someone else as in the case of cards that are tailored to teenagers. The spread of contactless payment technologies changed the appearances and functions of prepaid cards.

Payroll cards are used by employers as a tool to pay the remuneration of their employees (Federal Financial Institutions Examination Council, 2016). They sometimes meet the needs of employers who do not own a bank account. Like a debit card, they can be used for POS purchases along with automated utility payments. Teen cards are another type of prepaid cards that received attention by public (Federal Financial Institutions Examination Council, 2016). It makes the observation of one's child's financial decisions possible.

One of the most frequent usages for prepaid cards in Turkey is to pay public transport fees with the cards given via municipalities, some of which are also used for other kinds of payments (The Committee on Payment and Settlement Systems, 2012b). In the same vein, in Singapore and Hong Kong, electronic money and transportation mostly represents an inseparable twin in consumers' minds (The Committee on Payment and Settlement Systems, 2012a). Humphrey (2014) claims that the different usage options of prepaid cards is limited and it is unclear what the future holds for them.

Rysman and Schuh (2017) claims that although they apply to only particular points of sale, people tend to use novel payment methods. However, they point out that it is not easy to convince "single-homers" (p. 31) to use another payment method. Such a novel payment method is İstanbulcard, the usage area of which is growing each passing day.

Compared to smart cards of other cities in Turkey, İstanbulcard has a more flexible fare system that can account for payments made in different points therewith reducing the price of some consecutive payments (Babalik-Sutcliffe & Cengiz, 2015).

ING Turkey (2020, September) reported that while 70% public transport users utilized cash in 2017, it dropped as low as 48% in 2020 with the effect of both COVID-19 pandemic and ability to deposit cash online. In 2020, Bankalararası Kart Merkezi (n.d.-a) separated debit cards and prepaid cards when presenting statistics in their annual reports, which shows the importance given to prepaid cards.

2.2.2.3.3.1 İstanbulcard

İstanbulcard is a prepaid card itself; however, it deserves its own section owing to the fact that it is the focus of this thesis. Belbim (n.d.) provides a background on the history of İstanbulcard. Previous versions of İstanbulcard were only tools that were utilized for public transportation. In 1870s, first paper-tickets were available for horsecars. A decade after, jettons were used in Karaköy Tunnel which is the second oldest subway in the world. At the beginning of 1900s, the police could travel free of charge with official documents that were issued to their names. This was perhaps the first allowance in public transportation in the lands of Turkey as how it is called today.

In 1960, first bus tickets were in use in a paper form (Belbim, n.d.). These tickets are digitalized in 1995, with the help of iButton (touch on memory) technology. A certain amount of money could be loaded on these buttons that were tapped onto a validator to realize the payment. The name of the button was an abbreviation, ‘Akbil’, which stands for smart ticket.

In 2008, a look-alike of İstanbulcard were in use; however, these were disposable NFC cards (Belbim, n.d.). A year after, first İstanbulcards have appeared. İstanbulcard is customized, issued to the owner and reloadable. Moreover, it is more than a card that is used to pay public transportation fees but has other areas of usage. Finally, digitization got further and İstanbulcard has a mobile app since 2018, January. Figure 13 demonstrates a promotional effort to raise awareness of the mobile app and a new partnership with a financial company.



Figure 13. The Mobile App of İstanbulcard and a New Partnership

Source: Belbim (2020, October 20). <https://www.belbim.istanbul/haber-detay?id=1072>

2.2.2.3.3.2 Octopus Card

As Chau and Poon (2003) state, the Octopus Card of Hong Kong was born when public transportation companies decided to merge and use a common fare system. After 2000s, it started to become a card for small payments for non-transportation areas, which is described as “spreading its tentacles” (p. 131) by the authors. Moreover, the cards can be customized and used as a security key in housing (Ho & See-To, 2010). Aside from these, another source of income of Octopus Card is selling its technology to other countries (Ho & See-To, 2010).

Ming (2011) lists the values offered by Octopus Card to users, operators of the card and society in general (p.48). To mention but a few, it offers convenience, variety of outlets and discounts for customers. For the providers of Octopus Card, it offers operational, financial and business benefits. The author then names cashless society as a value to society and believes that Octopus Card will help this transformation. It is crucial to note that, especially in a pandemic period that the world is currently in, the author also emphasizes the word ‘hygienic’. These features of Octopus Card are very similar to İstanbulcard.

Today, Octopus card can be used in various point of sales (Octopus Card, n.d.). The usage area includes but not limited to parking places, government tolled tunnels, taxis, e-commerce, convenience stores, cinemas, theme parks, fast food chains, cafés and merchants who are participating in this ecosystem. The card also has its own mobile application.

2.2.2.4 Mobile Phone-Related Payments

Mobile payments can occur in either proximity (e.g. near field communication payments) or online (Norges Bank, 2018). An instrument of payment, which works with a mobile app embedded in a mobile phone, executes the payment.

In Turkey, mobile payment technology is made available for bank customers in 2000 (The Committee on Payment and Settlement Systems, 2012b). However, mobile payments with Near Field Communication (NFC) technology gained attention in 2009. It was only in 2014 that big mobile phone companies like Apple and Samsung, and search engine giant Google offered NFC payment technologies. Rysman and Schuh (2017) describe mobile payment as a ladder that leads to people having digital wallets in their cellphones. To Rysman and Schuh's (2017) surprise, mobile payment technology got attention even in Kenya (please search for M-Pesa for further reading).

2.2.2.5 Electronic Money

Money that is stored in an electronic device, both in hardware or software is called electronic money (Kokkola, 2010). Since it needs another payment instruments to completely realize the payment, it can be considered as a way of settlement (Kokkola, 2010). Mishkin (2007) notes that the concept of electronic money has come to existence with the production of debit cards. Rysman and Schuh (2017) describes this type of money as a threat to banks as they are hard for banks to charge consumers for any service related to them.

Although it is hard to predict the limits of electronic money and define it, the influence of this concept shaping the way we handle our payments, store our money and

make investments. Without the hassle of carrying cash, electronic money allows people to let their stored money go by one tap (e.g. NFC technology) or by one click (e.g. online payments). Moreover, the rise of cryptocurrencies both change people's habits in the storage of money and in the way they invest. Electronic money surely gives headaches to the banks as well as governments especially in the case of cryptocurrencies and FinTech apps. It should not go unnoticed that although they offer many benefits to the people, they are prone to have many risks, such as; theft and loss due to financial illiteracy.

2.2.2.6 Banking

Brick and mortar banks lose popularity due to the convenience that technological innovations bring. Telephone banking began in 1991 in Turkey and allowed individuals to move their funds, handle their bills and credit card balances or managing their stock investments (The Committee on Payment and Settlement Systems, 2012b). This is beneficial for both customers and the banks themselves; because, physical banks cost more (often referred as the social cost). The COVID-19 pandemic showed us the importance of digitization more than anything else did. Therefore, "Internet branches" (Sayar & Wolfe, 2007, p. 123) was, is and will be an inseparable service of banks. The Committee on Payment and Settlement Systems (2012b) finds the proliferation of Internet banking services in Turkey surprisingly good. Started in 1997, it now allows individuals to take care of their financials on variety of services. Internet banking provides information, allows transactions and can deal with investments (Akinici et al., 2004). A study on highly educated people in Turkey showed that Internet banking users were typically 31-40 years old and male (Akinici et al., 2004).

2.2.2.7 Innovations in Retail Payment Technologies

Rysman and Schuh (2017) argue that although today's payment technology is satisfactory in its speed and efficiency, there is still room for other payment technologies. Federal Financial Institutions Examination Council (2016) identifies four elements of success

in retail payments. Along with reliability and cost; convenience and speed, which are used as constructs to be measured in this thesis, are also listed. In the same vein, Humphrey (2014) claims that unbeknownst to the costs of them, consumers demand convenient and safer methods of payment. Federal Financial Institutions Examination Council (2016) points out that the likelihood of occurrences in which a fee that is too small will be paid electronically is to elevate. This is also one of İstanbulcard's strengths; because, it widens its partnerships progressively to become more convenient.

Proximity payments are executed with any device that can maintain a chip and are counted as POS payments (Federal Financial Institutions Examination Council, 2016). If this mentioned device is a mobile phone, then the payment can be classified in mobile payment category. This type of payments is advantageous because of their relative speed, cost and simplicity compared to cash or credit card. In addition to these, it enables the consumer help themselves while paying rather than handing their card to a cashier or else (Federal Financial Institutions Examination Council, 2016). To protect congruity in trade, carefully build payment systems are essential (Kokkola, 2010). Security concerns aside, hygienic advantages of this type of payments are now more prominent than ever with the recent COVID-19 crisis. However, Humphrey (2014) views *cashless society* to be far-fetched for now, considering the usage of cash in Europe.

Although the discussion on cashless society has a stronger voice in the literature, this is not the case for cardless imaginations of the future. The drawbacks of cash actually applies to cards; however, they are unseen; because, cards provide a lot more convenience and security. However, people still need to carry cards and have a chance to be a victim of theft as in the case of cash. Biometric payments offer a considerably more convenient and secure solution to these problems (Kumar & Ryu, 2009). With the ease of fingerprint tapping, eye scanning or voice command, human body itself will be a future payment instrument.

2.3 Development of Technology Acceptance Models

In search for a research model that will enable us to understand the factors in the adoption of İstanbulcard, Technology Acceptance Model (TAM) was decided to be utilized. Therefore, in this section, the progress of the Technology Acceptance Models is presented. The history of TAM starts from early research in psychology where this theory is derived from. Briefly, the models emerged with variables that predicted intention to use technology. Some scholars were critical that these variables are already a common knowledge and they do not provide much information. Therefore, the theory evolved by decomposing these constructs in order to provide managers and scholars with better insight. Titles are design in a way that it will be easier for readers who are not familiar with this field of research to grasp a better understanding. This section ends with other milestone research except TAM in technology adoption.

2.3.1 Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB)

A parsimonious theoretical model, a Theory of Reasoned Action (TRA, please see Figure 14), proposed by Ajzen and Fishbein (1980) successfully predicted various behaviors in different research contexts. Although the mentioned model was validated several times and explained variances with a tremendous success, a Theory of Planned Behavior (TPB) which was more explanatory in nature, was later proposed (Ajzen, 1985) and improved the prediction capability of its predecessor.

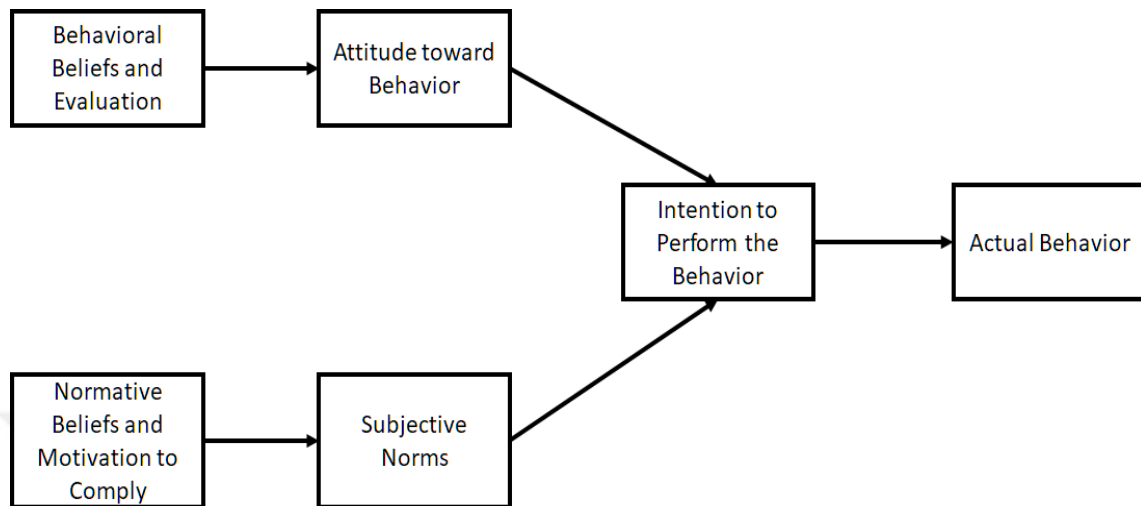


Figure 14. A Theory of Reasoned Action

Source: Adopted from I. Ajzen & M. Fishbein, (1980). Understanding attitudes and predicting social behavior. Englewood Cliffs, N.J: Prentice-Hall.

Patronized frequently by scholars, the TRA suggests that human behavior is calculable to some extent and subsumes similar patterns of thinking towards and evaluation of different circumstances (Ajzen & Fishbein, 1980). According to this model, behaviors are predicted by intentions, the antecedents of which are attitudes and subjective norms. A key aspect of the mentioned model is this simplicity, explaining a complex concept like human behavior with only three variables. This led the theory to be instrumental in scholar's understanding of human behavior. Simply put, the model is easily implementable into different areas of interest (see for medicine Natan et al., 2009; for technology Yousafzai et al., 2010; for education Pryor & Pryor, 2009; for politics Singh et al., 1995) and holds a considerable amount of predictive power. However, there have been several claims that this theory cannot be called a theory; because, it is not falsifiable (Trafimow, 2009; Ogden, 2003).

The most fundamental proposition of the theory is that beneath intentions towards behaviors lie two basic thinking processes, the first of which is “what do I think about

performing this behavior?” and the second of which is “what others would think if I performed this behavior?” (Ajzen and Fishbein, 1980). The first question forms attitudes whereas the second forms subjective norms. One of the most interesting aspects of this theory is that sometimes the latter question outweighs the former even if the outcomes of performing the behavior are one’s own concern (see Mukhtar & Butt, 2012; Kwong & Park, 2018).

Another noteworthy fact that intentions are measured by scholars in two different ways; as intentions and as estimations (Sheppard et al., 1988). Warshaw and Davis (1985) state that, more often than not, scholars do not define intention and when they do, their definitions resemble estimation. Their review also showed that some papers used intention and expectation as a mixed-construct. Although Fishbein and Ajzen (2011) do not see much value in the different treatment to intention and expectation, others disagree (Warshaw and Davis, 1985).

The TRA offers intention as the one and only immediate predictor of behavior; however, as successful as it is, not all self-reported intentions turn into actual behaviors (see Manski, 1990). Therefore, in authors' perspective, behavioral intentions should be viewed as attempts to perform a certain behavior or as they put it “readiness to perform the behavior” (Fishbein & Ajzen, 2011, p.21). Thus, researchers should be aware of the fact that there are several circumstances in which individuals do not honor their self-reported intentions by actually performing them.

Time is a prominent cause of divergences in intentions (Hughes et al., 2005). The magnitude of willingness to perform a behavior does not stay steady from the emergence of the intention to the minutes just before performing the behavior (Fishbein & Ajzen, 2011). Individuals can either avoid performing a behavior or have higher intentions to perform it as time gets closer to actual behavior. For instance, an individual who is just about to quit his or her job may decide not to if they get highly concerned about scarcity of new job opportunities.

Another effect of time on intentions is the emergence of new information (see Huffman et al., 2007 for the effect of information) that can both change the individual's beliefs and the beliefs of those who are important to the individual. It is obvious that a change in beliefs would affect attitudes that might change intentions totally or partially. Similarly, a change in the beliefs of important others might weaken or strengthen the intention towards a particular behavior (Ajzen, 1985).

Critics suggested that TRA overlooked the case when a person's opportunity to act on their intentions has taken away from them (Sarver, 1983). Therefore, the Theory of Planned Behavior (Ajzen, 1985, see Figure 15) holds a more realistic approach towards the relationship between intention and behavior, taking into account that an individual may be ready to perform a behavior only to find out that they do not have the necessary controls over the behavior. By attaching the variable *perceived behavioral control* to the TRA, Ajzen improved its explanatory power (Madden et al., 1992). There also are cases where TPB did not add so much explanatory power compared to TRA (Rossi & Armstrong, 1999).

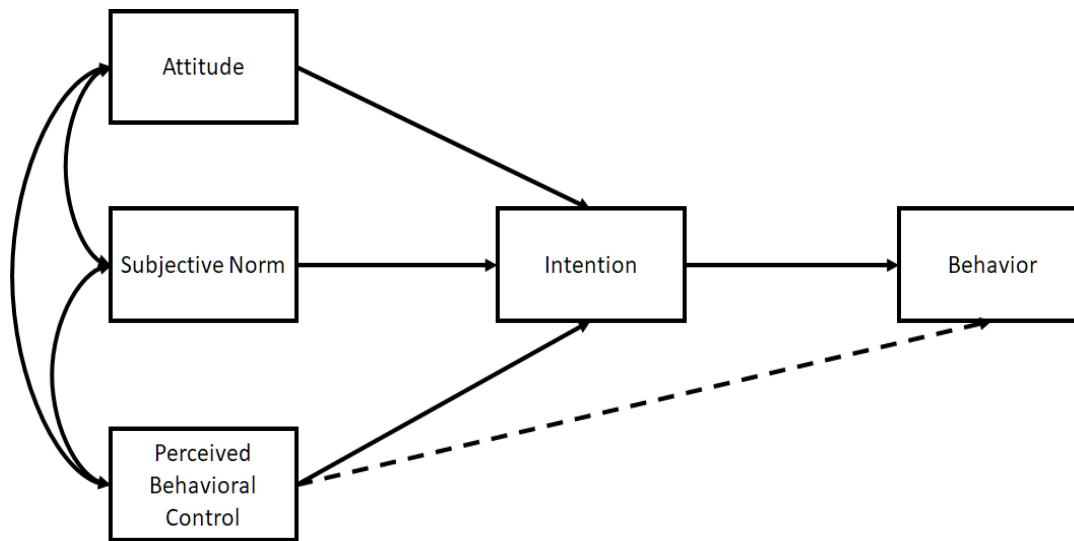


Figure 15. A Theory of Planned Behavior

Source: Adopted from I. Ajzen, (1985). From intentions to actions: A theory of planned behavior. In Action control (pp. 11-39). Springer, Berlin, Heidelberg.

In order to answer some concerns about TPB, Ajzen (2020) states that perceived behavioral control and self-efficacy are same constructs that are distinguished by how they are measured. There exist studies that prove this separability (Manstead & Van Eekelen, 1998).

The causes of uncontrollable (or less controllable) situations or incidents may be both internal and external. Internal factors are related to characteristics of the person as well as their knowledge, capabilities, moods and strength of will (Ajzen, 1985). For instance, an individual might have an intention to play tennis for long consecutive hours; however, a) they could get emotionally overwhelmed which would prevent them from achieving their goal or b) they may realize the fact that they are not skilled enough to save their energy for that long and decide to give up at some point. These would be examples for internal factors that play a role in preventing the individual from performing their intended behavior.

If another individual has plans to play tennis outside but their government declares a curfew because of a virus outbreak, this would be an example for external factors preventing the actualization of behavior. Although these two individuals might have strong intentions at the beginning, uncontrollable nature of life or their own merits might prevent them from realizing their intentions. Thus, measuring one's perceived control over a behavior improves the prediction of actual behavior.

2.3.2 Technology Acceptance Model (TAM): A Derivation of TPB

Complaining about the usage of invalidated scales for researching the adoption of new technologies, Davis (1989) meticulously designed a measure that would predict adoption better than TPB. The mentioned measure is interested in two aspects of the technology, first of which is its perceived degree of user-friendliness and the second of which is its perceived degree of contribution to one's tasks (see Figure 16).

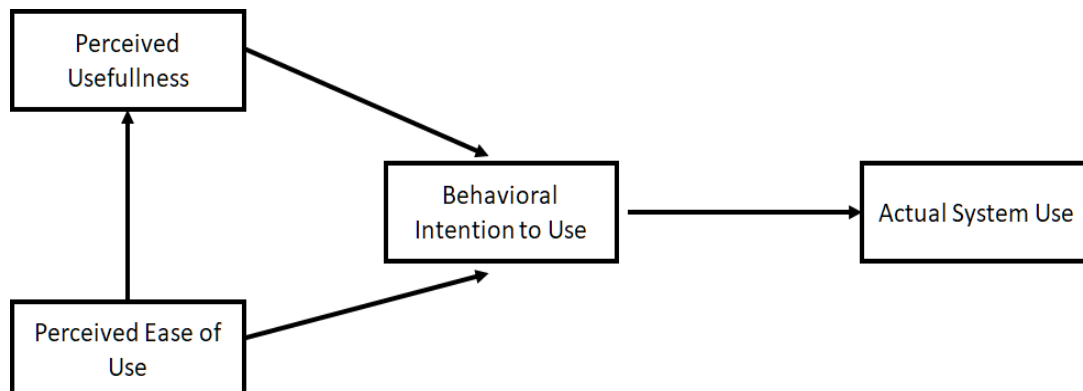


Figure 16. A Modified Version of Technology Acceptance Model

Source: Adopted from F. D. Davis, (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS quarterly, 319-340.

These two are called perceived usefulness (PU) and perceived ease of use (PEOU). PEOU resembles self-efficacy which is also a similar concept to perceived behavioral control of TPB. When stating the PEOU of a technology, an individual simply expresses their perceived self-efficacy about the technology. In a reversed perspective, Rogers' (2002) *complexity* construct is very similar to PEOU. Davis (1989) refined the scale several times and tested it in two different studies. Results indicated that psychometric characteristics of the scales were outstanding and PU was a better predictor than PEOU.

2.3.3 Model of PC Utilization

Contrary to the trend in their era, Thompson et al. (1991) preferred Triandis' (1980) behavior theory to Ajzen and Fishbein's (1980) TRA. Thus, the authors became first to implement Triandis' (1980) theory of behavior, which takes emotions into account as a different variable, to information systems (IS) research.

As cited in Thompson et al. (1991), Triandis (1971) divides attitude into three dimension; affective, cognitive and behavioral. Affective attitude consists of our feelings towards an object or a behavior. For instance, an individual might love running outside or detest liquid soaps. Our beliefs form our cognitive attitude which can either be positive or negative. A consumer might think that Norwegian products are better than Japanese products or vice versa. These beliefs can be strong or weak and they can always change. Behavioral attitude represents a person's tendency to act in a certain way towards an object or an event. A consumer might always buy the same brand of cold beverage or wear only some certain type of ties. These attitude components are affected by each other, which means that they can change the magnitude and direction of another component.

In their research model (see Figure 17), Thompson et al. (1991) used six antecedents which lead to utilization of PCs. A similar however, broader variable than social norms was used. That is, social factors. The variable *social factors* is about one's culture, values and

role that he plays in his or her social circle. It is the combination of widely approved common censuses that one is supposed to act on.

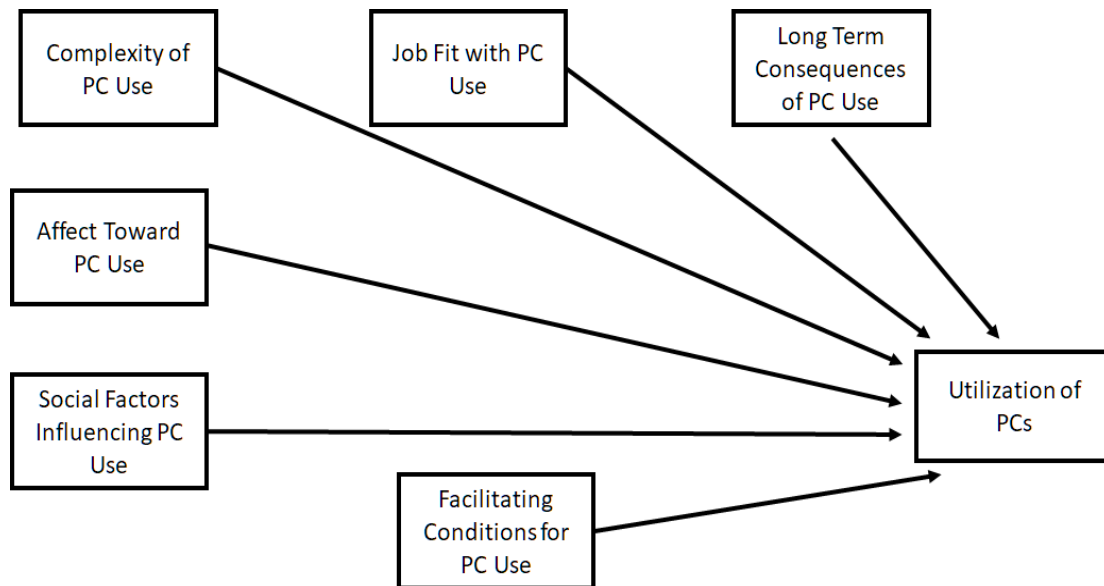


Figure 17. A Model of PC Utilization

Source: Adopted from R. L. Thompson, C. A. Higgins and J. M. Howell, (1991). Personal computing: toward a conceptual model of utilization. MIS quarterly, 125-143.

As mentioned before, attitude is divided into three parts and behavioral attitude is not measured because of the concern that measuring habits would not give any additional information (a concern for tautology) about the usage of PCs (Thompson et al. 1991). Affective attitude is measured by the “affect” variable whereas cognitive attitude subsumes three variables; two of which are near term consequences and one of which is long-term consequence. Near-term consequences are measured with complexity and job fit. The last variable is facilitating conditions which encompasses the external help available to the individual.

To authors' surprise, the relationship between affect and PC utilization was insignificant (Thompson et al., 1991). For some reason, participants did not have any emotional ties with PCs. Facilitating conditions also had an insignificant relationship with the utilization of PCs. Compared to near term consequences, long term consequence had a weaker relationship with PC utilization and Thompson et al. (1991) suggest that this is in line with the Expectancy Theory. As expected and previously demonstrated in other research (Davis, 1989) the construct job fit had a strong positive relationship with the utilization. Readers should notice that it is very similar to Davis' (1989) perceived usefulness. Social factors also had a positive relationship with utilization but more so for inexperienced users compared to the experienced ones.

2.3.4 Extrinsic and Intrinsic Motivations in Technology Adoption

Davis et al. (1992) compared the effects of perceived usefulness and perceived enjoyment on usage intentions by utilizing motivation theory. They considered perceived usefulness as an extrinsic motivation whereas perceived enjoyment was considered to be an intrinsic motivation.

According to Davis et al. (1992), extrinsic motivations evoke as the results of an expected outcome that will enhance someone's life. Intrinsic motivations are purely about the flow of action and how someone feels himself or herself during the action. Gaining time, financial valuable or reputation from performing an action is about extrinsic motivation. Intrinsic motivation can be any feeling that one prefers to experience while doing an action, for instance, enjoying doing skiing or being scared at a horror house.

The study (Davis et al., 1992) resulted in PU's dominance on perceived enjoyment because it was demonstrated that PU had 5 times more effect on usage intentions. However, this does not mean that researching the effects of perceived enjoyment is useless. Interestingly, unlike previous studies, introducing an extrinsic motivation did not derogate much from the effect of intrinsic motivation. Simply put, perceived usefulness and perceived

enjoyment had a positive effect on each other. Moreover, perceived enjoyment had more influence on usage intentions when perceived usefulness had higher impact scores. Readers should note that enjoyment is not the ultimate goal for businesses, that is, it can lead to the adoption of IS technology that will not increase performance of an enterprise. An enjoyable IS technology thus can give false impressions and enjoyment does not always turn into financial profits (Davis et al., 1992).

The meta-analyses of Cameron and Pierce (1994, 1996) also supports Davis et al. (1992) in that extrinsic rewards might go hand in hand with intrinsic motivation without one diminishing the effect of the other. However, others (Kohn, 1996; Lepper et al., 1996) disagree with Cameron and Pierce (1994).

Intrinsic and extrinsic motivations are used to understand; a) the acceptance of bicycle sharing services (Wu et al., 2019), Internet banking (Akhlaq & Ahmed, 2013), autonomous vehicles (Hegner et al., 2019) and online shopping (Shang et al., 2005), b) the use of Internet for information search (Castaneda et al., 2007), and c) knowledge sharing on enterprise social media platforms (Rode, 2016).

2.3.5 Comparison of TAM, TPB and a decomposed TPB

Taylor and Todd (1995) tested the explanatory power of TAM, TPB and a decomposed TPB in order to observe whether there is a superior model or not (see Figure 18). The predictors of decomposed variables were; PU, PEOU and compatibility for attitude, b) peer influence and superior influence for subjective norm, and c) self-efficacy, resource facilitating conditions and technology facilitating conditions for perceived behavioral control.

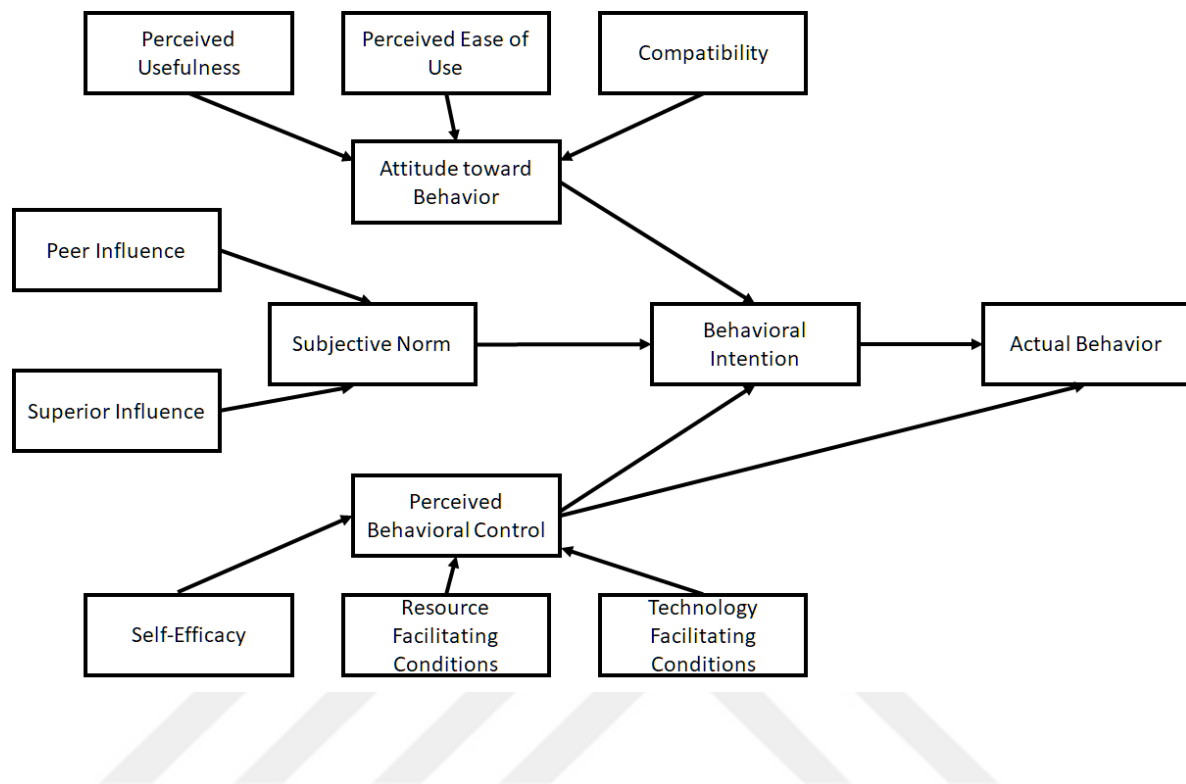


Figure 18. A Decomposed Theory of Planned Behavior

Source: Adopted from S. Taylor and P. A. Todd, (1995). Understanding information technology usage: A test of competing models. *Information systems research*, 6(2), 144-176.

The study was (Taylor & Todd, 1995) in a student setting; therefore, the source of peer influence was students whereas the source of superior influence was professors. The technologies used were computer programs that helped students improve their homework. Among three models, TAM was the most parsimonious whereas the decomposed TPB was the most complex one with its nine additional variables. To the surprise of authors, the comparison of three models has shown that those extra variables had little to add to the variance explained in usage behavior. R^2 were 0.34 for TAM, 0.34 for TPB and 0.36 for the decomposed TPB, thus, the decomposed TPB could explain only 0.02 more variance.

The results of this study (Taylor & Todd, 1995) are surprising in that adding plenty of variables to TAM did not bring more explained variance to the table. It can be understood that scholars should prefer the parsimonious TAM model if they are only interested in usage behavior. However, if they are more intrigued by how the antecedents of intention work, they should prefer the decomposed TPB (Taylor & Todd, 1995).

Some research, however, found more variance explained thanks to decomposed TPB when it is compared to TAM and TPB (Huh et al., 2009). Nonetheless, TAM had a better fit with data in that study. There exist other research the results of which are in the same line with Taylor and Todd (1995). Chau and Hu (2001) also demonstrate that decomposed TPB did not meet the expectations when it comes to predictive power.

2.3.6 TAM with Decomposed Perceived Usefulness: TAM2

After its first appearance in the literature, TAM later extended (see Figure 19) by some social influence and cognitive instrumental variables in order to improve its explanatory power (Venkatesh & Davis, 2000). The longitudinal study (Venkatesh & Davis, 2000) was conducted in four different companies that, then, were going to implement four different technologies. In the half of the cases, the usage of the system was voluntary. This voluntariness in the research was measured based on participants' opinion therefore it was *perceived* voluntariness. The reason behind this approach is that sometimes employees might feel superiors' pressure to use a system even though when there is none.

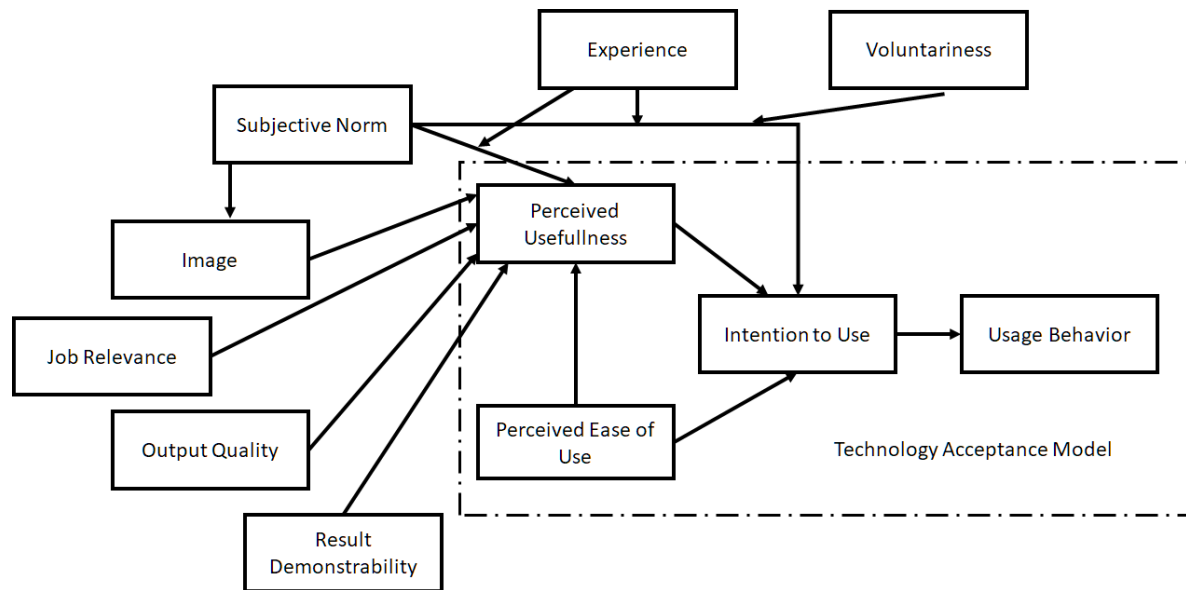


Figure 19. Technology Acceptance Model 2

Source: Adopted from V. Venkatesh and F. D. Davis, (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management science*, 46(2), 186-204.

To go through other new variables, *image* in this research (Venkatesh & Davis, 2000) is about the individuals who are using the product rather than the technology to be implemented. It measures neither product image nor brand image. It quantifies the degree to which participants think using the system enhances one's status in his or her social setting. *Experience* is one of the most crucial variables in this longitudinal study because it is inevitable that experience on systems will change over time. The more users get experience on the system the less they will value others' opinions about the usage of the system; thus, the effects of social influence factors will be diminished. *Result demonstrability* tells whether the final product of a technology could be easily describable or not. The fit between the job and the system is measured with *job relevance* whereas the extent to which outcomes of the system is successful is measured with *output quality*.

Measurement in three different time intervals revealed that TAM2 was successful in decomposing the perceived usefulness variable into its antecedents (Venkatesh & Davis, 2000). Studies in which the usage was not voluntary resulted in higher influence of social influencing factors on intention, even more so than perceived usefulness. On the other hand, when usage was optional, social influence did not play a direct role in its effect on intention. Although majority of the cognitive instrumental process variables did not show fluctuations in their influence as time passed, PEOU was an exception.

In the case of acceptance of Web 2.0 sites, Wu et al., (2011) mostly supported TAM2 although the effect of image on perceived usefulness was insignificant. Comparing users and non-users of Internet banking in their study, Chan (2004) did not find support for the effect of subjective norms on perceived usefulness regarding users; however, this was a significant relationship in the case of potential adopters. Likewise, result demonstrability was an important factor for users but for non-users. Moreover, the participants who already use Internet banking seemed not to have risk perceptions whereas it had a reverse effect of adoption regarding non-users. Interestingly, PEOU did not influence intention for both users and potential adopters of the technology.

2.3.7 TAM with Decomposed Perceived Ease of Use

In order to understand the drivers of PEOU and the effect of time on these drivers, Venkatesh (2000) examined the antecedents of PEOU in a longitudinal study (see Figure 20). The main proposition of authors was that users tend to evaluate new systems based on their preexisting beliefs about and their former experiences on the old systems. They can also base their opinion on their emotions and according to their individual characteristics, respectively; computer anxiety and computer playfulness.

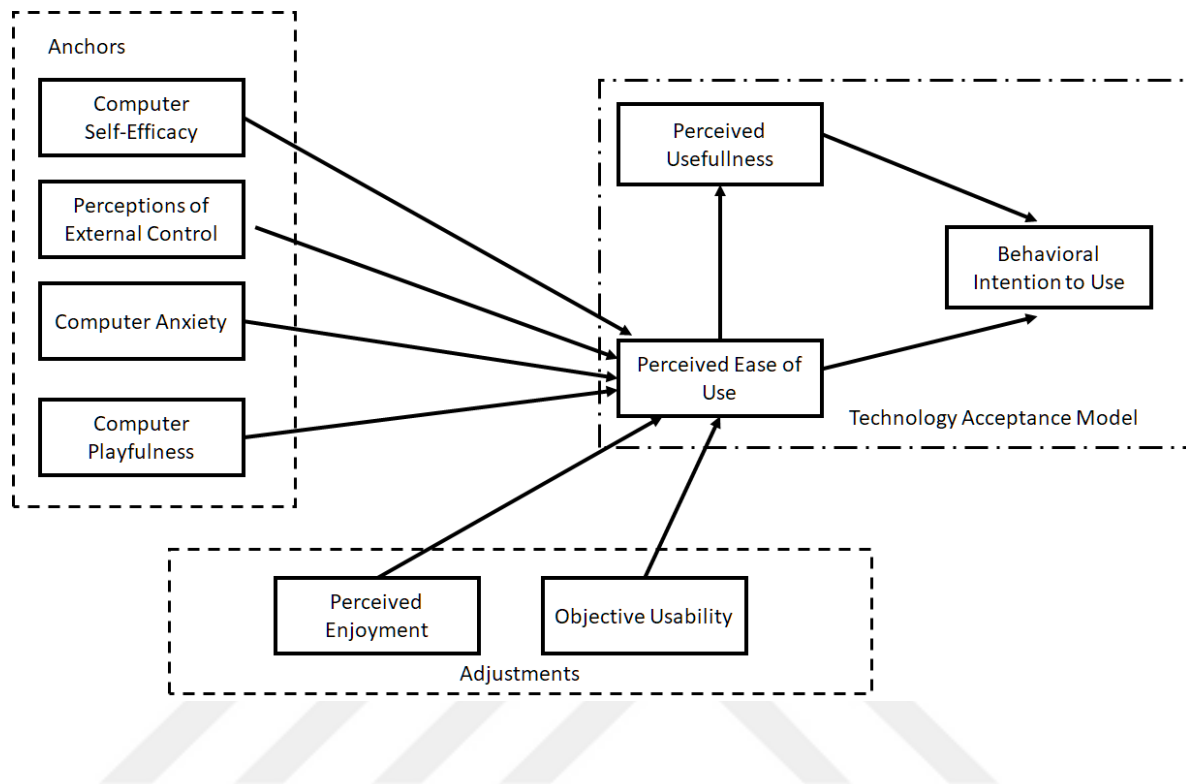


Figure 20. A Technology Acceptance Model with Decomposed Perceived Ease of Use

Source: Adopted from V. Venkatesh, (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information systems research*, 11(4), 342-365.

Computer anxiety (Venkatesh, 2000) is the negative emotions that arise when one hears about or get their hands on computers, because they think they are incapable of operating the machine. If one thinks that they can enjoy themselves being around computers, then the construct *computer playfulness* can be observed in that instance.

According to Venkatesh (2000), all these beliefs, emotions, experiences and individual differences can be described as *anchors*. Getting their hands on a new system, one can alter these previously held beliefs and adjust herself to the new situation. However, although adjustments might occur, the effects of the initial attitude towards the new system will still be present to some degree.

Readers should note that although TAM is based on TRA, Venkatesh's (2000) model resembles Theory of Planned Behavior because it includes control dimensions. Contrary to TPB, control dimensions in their research are positioned as the antecedents of PEOU and not directly linked to intention of usage. The constructs computer self-efficacy and perceptions of external control capture both internal and external control aspects. With the variable computer playfulness, researchers try to understand the effect of intrinsic motivations that influence the perceptions of ease of use. Being completely about individual's own experience interacting with the system, computer playfulness is a construct that is created to measure intrinsic motivation as well as differences among participants' characteristics.

The term adjustment on this research (Venkatesh, 2000) is used as a function of time and experience on computer usage. The rate of adjustment is measured with perceived enjoyment and objective usability. Objective usability does not have its own scale but it is measured by calculating the deviations in the mean values of external control. An expert's time taken on completing a particular task was used as an anchor point to compare with a beginners' time. Results suggested that external control dimensions did not have any direct influence on usage intentions as TPB suggested it would have. The longitudinal study showed that with time, the model could explain up to 60% variance in PEOU.

Nov and Ye (2008) introduced *resistance to change* as another determinant of PEOU. This personal characteristic describes people who are emotionally as well as cognitively against change and cannot change their habits. With the addition of resistance to change into their research model, they achieved 20% more adjusted R^2 value in PEOU as a dependent variable.

2.3.8 Unified Theory of Acceptance and Use of Technology (UTAUT)

Conducting an extensive research on popular technology acceptance models, Venkatesh et al. (2003) identified and compared eight different models of acceptance. By considering the similarities and differences in them, they come up with a holistic research

model (see Figure 21). This research model explained up to 70% of the variance that is described as a possible limit by authors.

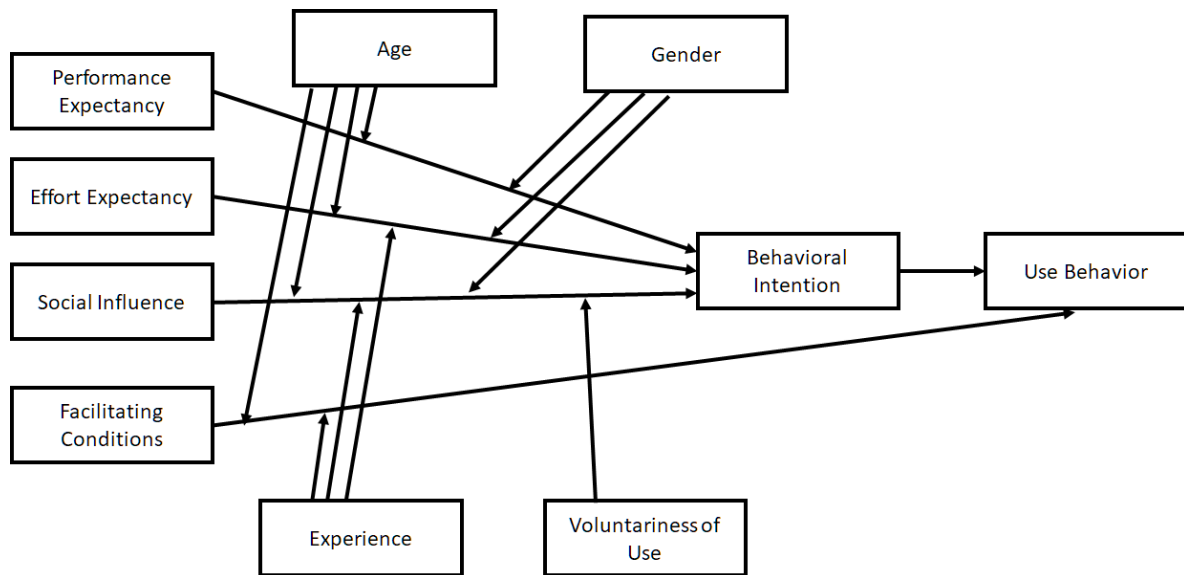


Figure 21. A Unified Theory of Acceptance and Use of Technology

Source: Adopted from V. Venkatesh, M. G. Morris, G. B. Davis and F. D. Davis, (2003). User acceptance of information technology: Toward a unified view. MIS quarterly, 425-478.

This holistic research model (Venkatesh et al., 2003) consists of four independent variables (performance expectancy, effort expectancy, social influence and facilitating conditions), four moderators (gender, age, experience and voluntariness of use), one mediating variable (behavioral intention) and one dependent variable (use behavior). The variable performance expectancy is closer to perceived usefulness whereas effort expectancy is closer to perceived ease of use in terms of their definitions.

Considering its explanatory power in intention (R^2 of 70%), the parsimony of the model is outstanding (Venkatesh et al., 2003). One of the strengths of this model is the inclusion of gender and age as moderators. These rather overlooked variables acted as a moderator in almost all of the relationships between other variables. The study found that performance expectancy was more important to men and younger while effort expectancy was more important to women and elderly. It could be that men are more result oriented while women are more interested in the journey of using the new technology. Moreover, women and elderly felt the influence of their social environment more than men and younger employees (Venkatesh et al., 2003). However, considering the digital age that we live in, the effects of age and gender might work differently than in this research.

Im et al. (2011) compared people of U.S. and South Korea in their acceptance of MP3 and Internet banking. Nations did not differ in the effect of performance expectancy; however, effort expectancy was a higher concern for U.S. citizens. To authors' surprise, these two samples did not show a significant difference in terms of social influence.

AlAwadhi and Morris (2008, January) used UTAUT model to explain the acceptance of e-government services. Results showed that performance expectancy had a considerable amount of influence on intention to adopt. However, their sample did not demonstrate a difference in gender in the influence of expectancy variables and social influence on intention.

2.3.9 TAM2 with Decomposed Perceived Ease of Use: TAM3

Venkatesh and Bala (2008) argued that although TAM is able to explain variance in intention to use, it gives little direction to managers on how to improve users' PU and PEOU. Therefore, the main objective of researchers was to establish a model (Figure 22) which managers can use as a guide when they are taking steps to better implement new information systems.

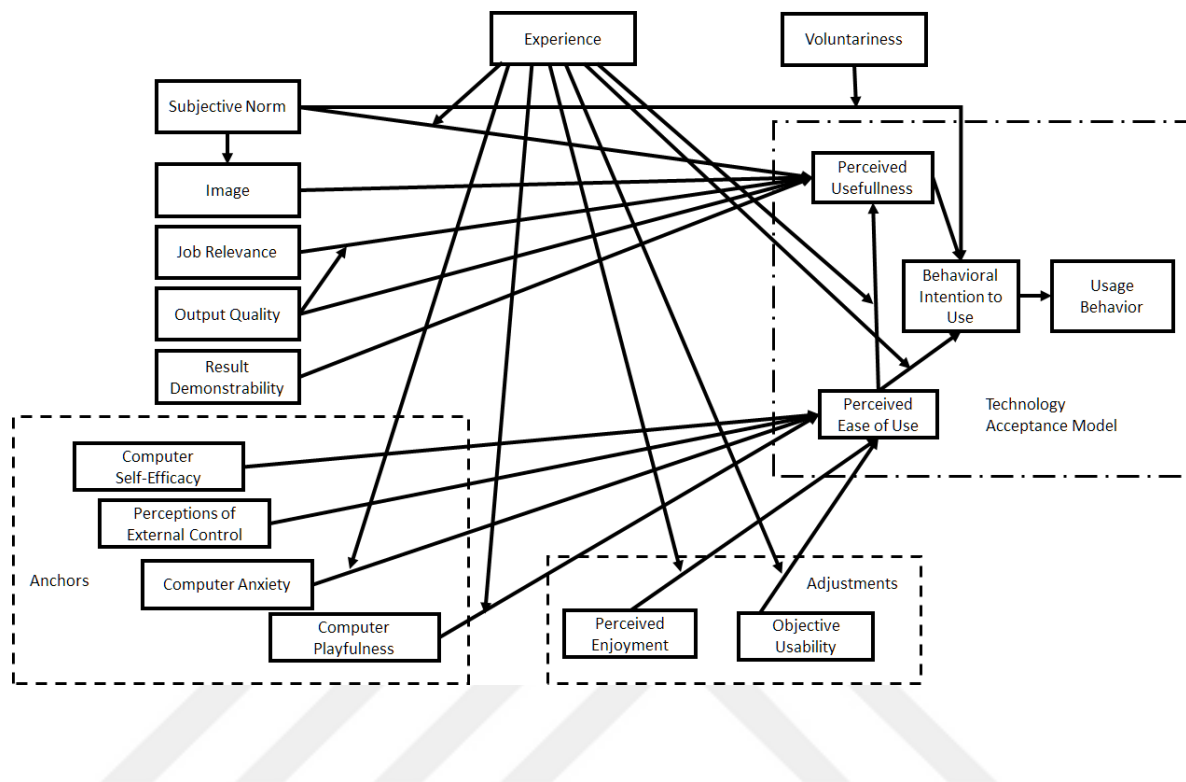


Figure 22. Technology Acceptance Model 3

Source: Adopted from V. Venkatesh, and H. Bala, (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision sciences*, 39(2), 273-315.

Since it is obvious that in order for an IS to be accepted by users it should be seen as easy to use and useful, researchers (Venkatesh & Bala, 2008) were curious about what makes users perceive an IS easy to use and useful. TAM2 (Venkatesh & Davis, 2000) already included some antecedents of PU, thus, TAM3 (Venkatesh & Bala, 2008) is theorized with adding some antecedents of PEOU (see Venkatesh, 2000) and some new moderating relationships of experience.

These antecedents of PEOU are based on Venkatesh (2000), who divided them into two; anchors and adjustments. Some of other new relationships are the moderating effects of experience on PEOU to PU; computer anxiety to PEOU; PEOU to behavioral intention.

Researchers suggested that there would be no crossover effects regarding the antecedents of PEOU and PU.

As in other research aimed at developing an acceptance model, it (Venkatesh & Bala, 2008) was a longitudinal study in different firms in some of which the use was mandatory. In the last survey that is sent to employees, only self-reported usage is measured. The addition of antecedents helped explaining up to 67% of the variance in PU and 52% variance in PEOU. The research model also explained the variance in behavioral intention up to 53 percent. The aim and main contribution of TAM3 was to create a model which managers can use in different stages of IS implementation in order to ensure the success of implementation.

Venkatesh and Bala (2008) defined seven interventions, four of which are pre-implementation interventions (design characteristics, user participation, management support and incentive alignment) and three of which are post-implementation interventions (training, organizational support and peer support). They also defined which specific variable is related with which intervention. Therefore, TAM3 improved TAM and TAM2 by offering a comprehensive guide to take actions when implementing a new system.

Jaradat and Al-Mashaqba (2014) utilized TAM3 in their study to understand the adoption of mobile payment services. Among other variables, PU affected behavioral intention to use mobile payment the most. Considering its effect on PU, subjective norms were less of a concern for participants who were more experienced with mobile payment.

Huang et al. (2012) conducted a research regarding the acceptance of data mining tools. Their sample consisted of information management and business administration graduates. As expected, the effect of job relevance on perceived usefulness of data mining tools was significant. Output quality and job relevance had a mutual effect on each other. After PEOU, result demonstrability had the highest influence on perceived usefulness.

2.3.10 Other Approaches to Adoption of Technology

TAM is not the only theory that is utilized by scholars to explain and predict the adoption of technology. Below, other significant research in technology adoption is presented with a short background. TAM and variables from these mentioned research are often mixed to achieve higher explained variance.

2.3.10.1 From Social Learning Theory to Social Cognitive Theory: A different Perspective in Technology Adoption

Social learning view (Bandura & Walters, 1977) posits that human behavior results from constant interpersonal interactions and by the effects of environmental situations. Rather than psychologists who believed all learnings are achieved through direct action and reaction, Bandura and Walters (1977) suggest that there are other ways of learning in which people observe others' actions and their consequences. In their defense, if people only learned by actually performing some particular actions, natural selection would have treated humankind worse. Another takeaway of social learning theory is that people are their own control mechanism on which actions to perform or not.

Bandura and Walters (1977) divide learning process into four categories (see Figure 23). The first of which is Attentional Processes. The question how some behavior is observed is as important as what or whose behavior is observed. A behavior can be intriguing or mundane. Thus, in order for someone to observe a behavior and then be able to repeat it, one needs to pay attention to how that behavior is performed. Obviously, the majority of the behaviors that came to our attention is performed by our social circle suggesting that our behaviors are influenced by them. Conspicuity and easiness of a behavior are another aspect of how one can pay attention to a particular action (Bandura & Walters, 1977).

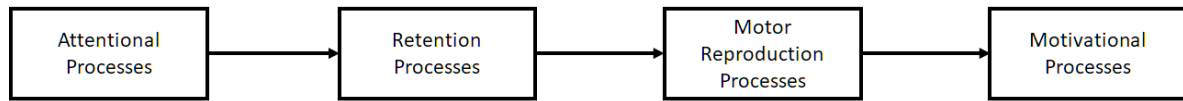


Figure 23. A Simplified Version of Observational Learning Processes

Source: Adopted from A. Bandura, and R.H. Walters, (1977). Social learning theory (Vol. 1). Englewood Cliffs, NJ: Prentice-hall.

The second of which is Retention Processes (Bandura & Walters, 1977). In the most basic sense, people will perform actions that they can remember. Humans memorize by holding verbal and/or visual codes. Repeating a behavior either physically or mentally helps the memorization process. When one remembers others doing a certain thing, the rest is about their capability of repeating the actions of others (Bandura & Walters, 1977).

The third of which is Motor Reproduction Processes (Bandura & Walters, 1977). After one attentively observes someone performing a behavior and is able to retain how it is done, then they repeat the action relying on their own memory. It is obvious that not all actions are easy to imitate and some are too complex to observe let alone to imitate. These situations in which observed behavior has much complexity, people correct their behaviors on the way either relying on self-monitoring or others' directives (Bandura & Walters, 1977).

The fourth of which are Motivational Processes (Bandura & Walters, 1977). As Pavlov's dog perceive some events rewarding, humans also perceive some behaviors rewarding. Therefore, they pursue doing behaviors which they think have positive outcomes. Conversely, if they associate a behavior with a negative outcome, they avoid executing that behavior.

Bandura (1986) later improved his views on social learning and claimed that humans are not bystanders and they actually change their environment and others, which in turn change themselves. In this renewed view, there is a reciprocity between the three elements that are; personal factors, behavioral factors and environmental factors. Social Cognitive

Theory (SCT, Bandura 1986) attaches considerable importance to self-efficacy which is one's belief about his or her capability to perform a given behavior. The theory suggests that the higher one thinks that they are self-efficient to perform a task, they will be more likely to succeed.

Compeau and Higgins (1995a; 1995b), takes a social cognitive approach in information systems research. They validate the importance of self-efficacy in IS research and suggest that those who think they are self-efficient show superior performance compared to others who do not think they are self-efficient (Compeau & Higgins, 1995a). They also found evidence on the influence of behavior modeling training on perceived self-efficacy, which was implemented with a videotape that lasted twenty minutes. They draw attention to applicability of behavior modeling to different software packages, claiming that not every type of modeling and software package make a good fit. Moreover, particular traits of the behavior modeling were one of the concerns of the researchers; because, it affects perception. Whether users had previous experience with the software was another issue; because, previously held opinions are assumed to require more effort to change.

Compeau and Higgins (1995b) also supported self-efficacy in the adoption of information systems with empirical evidence. Outcome expectations had a strong relationship with use, suggesting that users opt for rewarding behaviors. However, a counter-intuitive finding of the research was that organizational support diminished users' self-efficacy.

2.3.10.2 Diffusion of Innovation

Rogers (1983) claims that adoption or rejection of a novel technology happens in a time course rather than momentarily. Therefore, they treat it as a process and divide it into five steps (see Figure 24). These five steps are called "the innovation decision process".

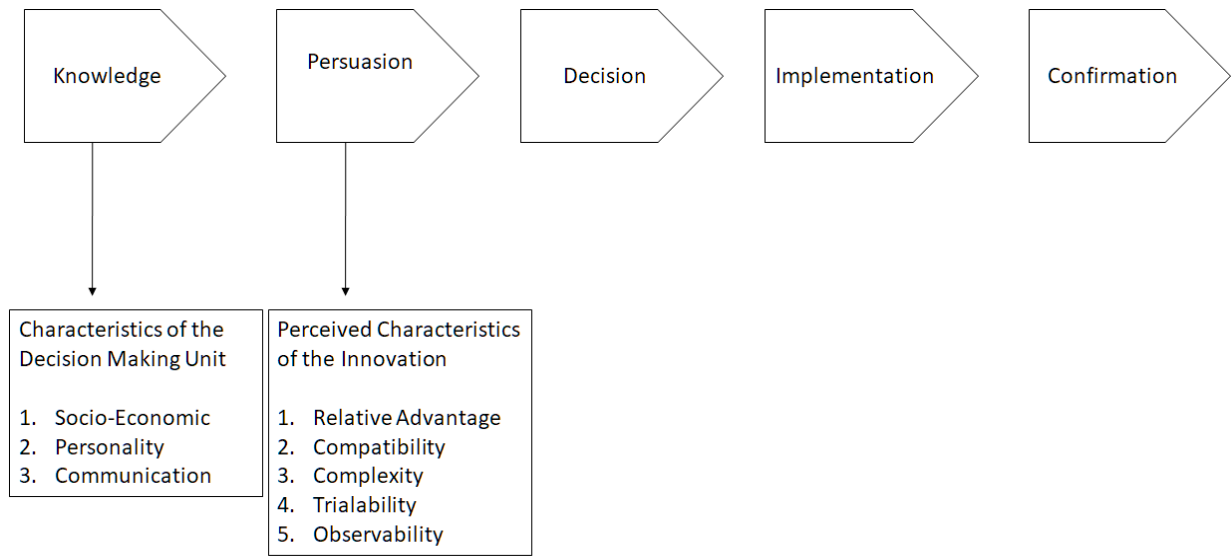


Figure 24. Five Stages in the Innovation Decision Process

Source: Adopted from E. M. Rogers, (1983). Diffusion of Innovations. The Free Press, 1983.

The Knowledge stage (Rogers, 1983) begins when an individual is aware of the innovation and has some basic idea about its features. How and where they become aware of the innovation depends on characteristics of the person.

Individuals actively search about the innovation in the Persuasion stage (Rogers, 1983). It goes without saying that in such a cognitive duration, individuals get either positive or negative opinions about the innovation. Perceived features of the innovation play an important role in this process. Intriguing for the innovator might be the question ‘where these individuals get information?’

In the Decision stage (Rogers, 1983), individuals’ final judgements or indifference to innovation can be observed. That is, individuals either call a final verdict (adoption or active rejection) or continue being indifferent to the innovation (rejecting it passively).

When individuals make use of innovations, they are in the waters of the Implementation stage (Rogers, 1983). Before this stage, everything that happened was cognitive; however, behavioral change begins with the implementation stage. After an innovation becomes mundane, this stage is considered to come to an end.

The confirmation stage (Rogers, 1983) is where the adopter decides a final verdict about an innovation. Adoption or rejection of an innovation does not have crystal clear beginnings and endings. Even after the implementation, an individual may seek or be exposed to new information that will change their decision about the continuance or discontinuance. This is a tension, caused by cognitive dissonance, between ideal and current state of the adopter.

There are some attributes of innovations that either speed up or slow down the process of adoption (Rogers, 1983). *Relative advantage* is the degree to which one perceives an innovation to be more useful (in terms of performance/price, improving social image etc.) than its antecessor. *Compatibility* might be a confusing characteristic of an innovation. It does not mean that the innovation is compatible with existing products of yours. To elaborate, here, it is a different type of compatibility than your mobile phone's upgraded version being compatible with your old headphones. The meaning of compatibility here is in between the innovation and the user rather than between or among innovative products themselves. Compatibility here describes the fit between the innovation and the prospective user. If one considers an innovation to be morally ill, harmful for some things (e.g. environment, animals) or some people they care about or a bad match with their lifestyle, then they will perceive the innovation to be incompatible with themselves. *Complexity* is similar (in a reversed sense) to perceived ease of use (Davis, 1989) and is a very intuitive characteristic of an innovation. As Csikszentmihalyi (2008) describes it, one is obliged to pay a degree of mental effort for complex tasks. However, in any case of mental overload, the person will avoid the particular task.

Thus, Rogers (1983) posits that people will prefer innovations that they can understand without putting so much effort. If there were no monetary concerns, diffusion of

innovation would be mostly about reducing uncertainty of different aspects of it. These uncertainties could be reduced to a level if trying the innovation was possible. *Trialability*, then, allows users to spend time with an innovation to see how they feel and think about it. It is obvious that triable innovations have a higher chance to be adopted rapidly. Similar to Venkatesh's & Davis' (2000) *result demonstrability*, *observability* tells if outputs of an innovation are easily explainable to users' social circle.

Adopters are classified into five categories in order to help researchers to identify some groups with common characteristics (Rogers, 1983, see Figure 25). *Innovators* (Rogers, 1983) are the least uncertainty avoidant group whose wants are supported financially, turning them into actual demands. This group of people can handle the hurdle of complicated technologies. They play a critical role being the first noncommercial sources of information about the innovation. Extraordinarily adventure-seeking behaviors of innovators make them a minority in the society.

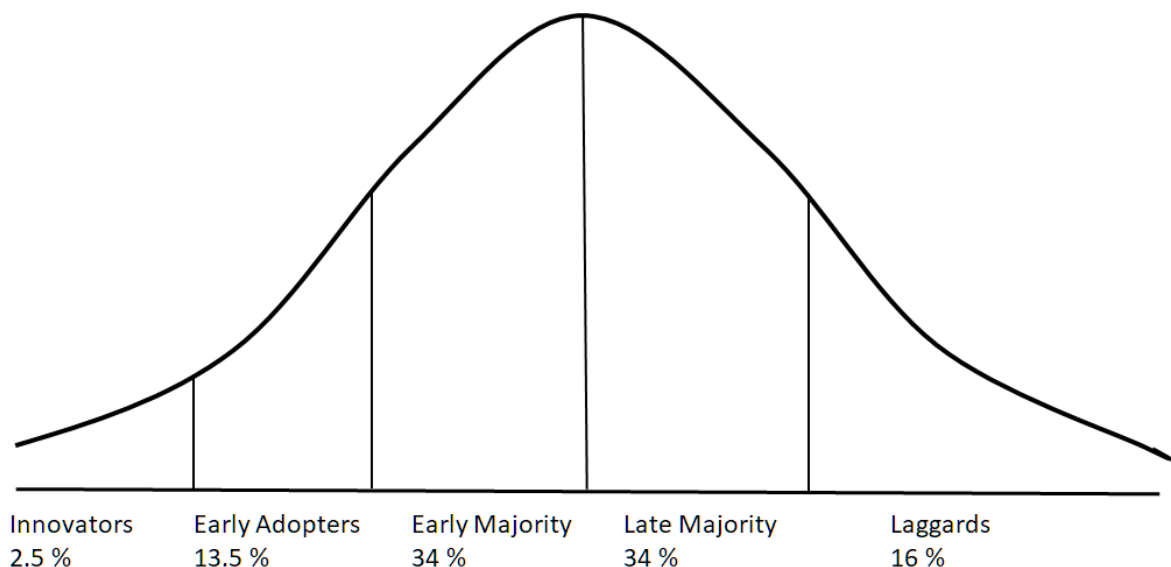


Figure 25. Innovativeness of Adopters

Source: Adopted from E. M. Rogers, (1983). *Diffusion of Innovations*. The Free Press, 1983.

On the other hand, *Early Adopters* (Rogers, 1983) are not that different from the most common type of person in the society. Therefore, they have a greater chance to influence society, as the majority of the society will see them as one of their own. These people are the ones that one reaches first before making a decision about an innovation. They are trusted and their opinions are valued.

Early Majority (Rogers, 1983) *adopters* are the ones to consult when considering an innovation but rather an assurance about the worth of the innovation. They do appreciate innovation, however, not as much to carry the banner.

In order for *Late Majority* (Rogers, 1983) to adopt innovations, there should be a push factor such as the opinions of their close ones. They resist change until they are motivated enough and they approach innovations with a greater caution than previously mentioned groups.

Laggards (Rogers, 1983) dwell on the past and use their resources very carefully. They are too late to adopt to the point that what they adopted would perhaps not called an innovation anymore. They desire no change and are happy in their comfort-zone.

2.4 Electronic Payment Adoption Research in the Literature

Table 2 illustrates some electronic payment adoption studies in the literature in a brief way. Payment types that are investigated are as follows; mobile commerce, mobile banking as well as online banking, mobile payment (including NFC and Internet based), electronic bill payment and usage of Fintech services. Care was taken to name these papers' area of investigation as how they are mentioned in the original studies. A total of 10 theories and their extensions were used. These are; the different versions of technology acceptance models, innovation diffusion theory, theory of perceived value, perceived risk theory, theory of reasoned action and planned behavior, trust transfer theory, valence framework, technology readiness model, prospect theory, flow theory and information systems success model. Therefore, it can be concluded that acceptance of different types of electronic payments were tried to be explained by various theories.

Analyses and statistical tools that are used to validate theories are also presented in Table 2 in two separate columns. Structural equation modeling is very popular among technology adoption researchers; however, it can be seen that some researchers trying rare methods (in adoption literature, to the best of author's knowledge) such as artificial neural networks. Traditional analyses such as multiple regression and cluster analysis are also preferred in these studies. Researchers' preferred statistical tools range from traditional ones to novel ones. Some are; SPSS, Mplus, AMOS, SAS, SmartPLS, PLS-Graph, Viusal PLS and LISREL.

Findings column in Table 2 also includes some important constructs in adoption research. Perceived trust, relative advantage, compatibility and observability, perceived risk, self-efficacy, social influence, anxiety, facilitating conditions, convenience, enjoyment, personal innovativeness, perceived benefit, image and several dimension of perceived risk were important variables in predicting electronic payment adoption. Basic TAM variables are not mentioned extensively; because, their significant relationships were proved frequently through years of different research. However, unexpected outcomes exist although

they are at scarce. Gbongli et al. (2019) found that technology anxiety and PEOU had a positive and significant relationship. On the other hand, the study of Koenig-Lewis et al. (2015) resulted in insignificant relationships between PEOU and both PU and intention to use. Another study, Liébana-Cabanillas et al. (2015), also did not find a statistically significant relationship with PU and intention to use. Ooi & Tan (2016) along with Shin & Lee (2014) also did not find evidence for a significant relationship between PEOU and intention to use. The study of Ramos-de-Luna et al. (2016) rejected PEOU's effect on attitude. Insignificance of the relationship between PEOU and PU was present in Tan et al.'s (2014) study.

Table 2. A Summary of the Literature on Electronic Payment Adoption

Authors	Payment Types	Theories / Models	Analyses	Statistical Tools	Findings
Abu-Shanab & Ghaleb (2012)	m-commerce	TAM	Multiple Regression	Not mentioned	• Concerning m-commerce, perceived trust is significantly associated with intention to use. • Contrary to most literature, the effects of security concerns and privacy concerns on intention to use were not supported.
Al-Jabri & Sohail (2012)	Mobile banking	IDT	Multiple Regression	SPSS v.16	• Relative advantage, compatibility and observability positively affected mobile banking adoption. Among them, compatibility was the most significant predictor. • Perceived risk had a negative significant effect on mobile banking adoption. • Surprisingly, the effects of complexity and trialability on mobile banking adoption were insignificant.
Bailey et al. (2017)	m-payment NFC	TAM	SEM	Mplus 7.3	• Regarding 'tap and go' mobile payments in retail, self-efficacy positively affected PU and PEOU whereas attitudes and intentions were negatively affected by privacy concerns. • PU and PEOU affected attitude, which predicted intention to use mobile payments in retail purchases. • The effect of new technology anxiety on PU was insignificant.
Chen & Chang (2013)	m-services NFC	UTAUT	SEM	AMOS 19.0	• Effort expectancy positively affected performance expectancy which positively influenced attitude towards NFC mobile services. • Social influence predicted attitude. • Anxiety had a negative relationship with attitude. • There was a rather less significant and positive relationship between facilitating conditions and intention. Attitude was the dominant variable which affected intention.

De Kerviler et al. (2016)	m-payment proximity (in-store)	Theory of Perceived Value	OLS, T-test	SAS 9.4	• In the adoption of in-store m-payment, benefits (utilitarian, hedonic and social) are less important than risks. • Convenience is sought-after the most while social benefits had little importance. • Enjoyment, economic and informational benefits predict adoption. • Intention to use is positively related with prior experience.
Featherman & Pavlou (2003)	e-payment bill payment	TAM & Perceived Risk Theory	SEM	Not mentioned	• Concerning electronic bill payments, risks related to performance (financial, time, privacy) exerted greater influence on adoption than psychological risks. • Social risks have found not to be important for the sample. • PEOU leads to a decrease in perceived performance risk.
Gbongli et al. (2019)	m-money	TAM	PLS-SEM & Artificial Neural Networks and Sensitivity Analysis	SmartPLS 3.2.8	• Self-efficacy predicted both PEOU and PU of mobile money. • Unexpectedly, technology anxiety led to better PEOU. • Technology anxiety did not have a significant effect on PU. • Personal innovativeness predicted intention to use.
Koenig-Lewis et al. (2015)	m-payment	TAM & UTAUT 2	SEM	AMOS 21	• Contrary to most literature, PEOU's effect on PU and intention was not found to be significant in m-payment. • Another contradictory finding was that the direct relationship between perceived enjoyment and intention was not significant. • Social influence and perceived enjoyment mitigated perceived risk. • Social influence predicted adoption.
Lee (2009)	Online banking	TAM, Theory of Planned Behavior, Perceived Risk Theory	SEM	AMOS	• Extending TAM with TPB resulted in higher predicting power for online banking adoption. • Among other risk variables, security risk was the biggest concern of the sample, followed by financial risk. • The effect of social risk on attitude has found to be insignificant. • Time/convenience risk negatively affected attitude.

					• Perceived benefit was the most important determinant of intention to use, even above attitude.
Liébana-Cabanillas et al. (2015)	m-payment	TAM	SEM	SPSS 15.0 & AMOS 18	• Trust had the highest effect on intention to use mobile payment. • Perceived risk was negatively associated with intention to use. • Surprisingly, PU was not significantly associated with intention to use.
Lu et al. (2011)	m-payment	Trust transfer theory & IDT & Valence Framework	SEM	PLS-Graph v3.01060	• Intention to use m-payment is both immediately and indirectly predicted by initial trust. • Initial trust influenced relative advantage positively while it influenced perceived risk negatively. • Perceptions of risk and cost were inhibitors of intention to use. • Relative advantage, compatibility and image affected intention to use positively. • Preexisting Internet payment trust transferred to mobile payment trust. • Students were more concerned about perceived risk and perceived cost than workers were. Workers cared the most about compatibility whereas image was more important than other variables for students.
Martins et al. (2014)	Internet banking	UTAUT & Perceive Risk Theory	SEM	Smart PLS 2.0	• There is no significant relationship between facilitating conditions and usage of Internet banking. • Performance expectancy and effort expectancy affected behavioral intention. • Social influence had little effect on behavioral intention. • Performance risks were found to be more important than social or psychological risks. • Older participants were more prone to adopt.
Ooi & Tan (2016)	m-payment NFC	TAM	PLS-SEM-ANN	Not mentioned	• Perceived compatibility affected PU, PEOU and behavioral intention of using smart phone credit card. • Perceived financial resources solely affected PU and it has no effect on both PEOU and intention. • Perceived trust determined behavioral intention and was the most

					significant predictor of it. • The relationship between PEOU and intention was insignificant whereas it was significant in the case of PU and intention.
Ozturk et al. (2017)	m-payment NFC	Valence Framework	SEM	Not mentioned	• Perceived risk did not have a significant effect on intention to use in a restaurant setting. • Privacy concern negatively influenced intention to use. • Compatibility was the most influential predictor of intention to use. • Smartphone affinity predicted behavioral intention. • Compatibility reduced perceived risk and privacy concerns. • Smartphone affinity influenced negative valence constructs; however, it had no relationship with positive valence constructs.
Ramos-de-Luna et al. (2016)	m-payment NFC	TAM	PLS-SEM	SmartPLS 3.0	• The relationship between PEOU and attitude was not found to be significant for the case of mobile payment adoption. • The effect of personal innovation on PEOU and intention to use were significant whereas it was insignificant on PU and attitude. • Individual mobility affected PU both positively and directly while its effect on attitude and intention to use were insignificant. • Compatibility had a positive, direct relationship with PU, attitude and intention to use. • Perceived security predicted attitude while its relationship with intention to use was insignificant. • Subjective norms predicted attitude.
Ryu (2018)	Financial Services (FinTech)	Valence Framework & Theory of Reasoned Action	PLS-SEM	SmartPLS 3.00	• Perceived benefit is positively associated with adoption intention of FinTech whereas perceived risk reduced adoption intention. • Compared to perceived risk, perceived benefit had a greater impact on adoption intention. • Economic benefits, convenience and seamless transaction are validated as sub-constructs of perceived benefit. Among them, convenience had the highest effect on perceived benefit. • Financial, legal, security and operational risks formed perceived risk, with legal risk having the highest impact. • Perceived benefit was found to be more important for early

					adopters than late adopters whereas perceived risk was more important to late adopters.
Shin & Lee (2014)	m-payment NFC	TAM & Technology Readiness Model	SEM	Not mentioned	• PEOU did not predict intention to use mobile payment. • All technology readiness variables (innovativeness, optimism, discomfort and insecurity) had significant relationships with PEOU. Among them, only discomfort negatively affected PEOU. • Technology characteristics variables (responsiveness and smartness) positively influenced PU.
Slade et al. (2015)	m-payment Remote payment	UTAUT	SEM	AMOS	• A significant finding was the moderating role of knowledge of mobile payment between intention to use and its predictors. • Behavioral intention to use is positively influenced by performance expectancy, social influence and innovativeness whereas it is negatively affected by perceived risk. • Trust reduced perceived risk of adoption. • Both effort expectancy and trust had no significant relationship with behavioral intention.
Su et al. (2018)	m-payment	TAM & IDT	Regression	Not mentioned	• Internet experience both directly and indirectly affected intention to use mobile payment. • Internet experience enhanced PU, PEOU and perceived compatibility while it inhibited perceived risk and privacy concern.
Sujatha & Sekkizhar (2019)	m-commerce	TAM & IDT	PLS	VisualPLS	• Compatibility is the most important determinant of PU in mobile commerce. • Perceived risk influenced behavioral intention. • The relationship between costs related to m-commerce usage and behavioral intention is insignificant.
Tan et al. (2014)	m-payment NFC	TAM	SEM	AMOS	• PEOU did not predict PU of mobile payment. • Social influence had an effect on intention to use. • Personal innovativeness had the strongest relationship with intention to use. • Results did not support the effect of both perceived risk and perceived financial cost.

Thakur & Srivastava (2014)	m-payment	TAM & UTAUT	SEM	AMOS 20	- Analyses demonstrated that social influence, facilitating conditions, PU and PEOU formed adoption readiness of mobile payment. In turn, adoption readiness affected intention to use. - Monetary risk was not a significant sub-construct of perceived risk. - Perceived risk was a significant inhibitor of intention to use. - Personal innovativeness had a relationship with adoption readiness and intention to use.
Thakur (2013)	m-payment	UTAUT	Multiple Regression	Not mentioned	Intention to use mobile payment is predicted by performance expectancy, effort expectancy, social influence and facilitating conditions.
Yang et al. (2015)	m-payment	Perceived Risk Theory, Prospect Theory & Perceived Value Theory	PLS SEM	SmartPLS 2.0	- Financial risk was the strongest inhibitor of both perceived value and acceptance intention of mobile payment, followed by perceived performance risk. - Although perceived privacy risk negatively influenced acceptance intention, no effect on perceived value was observed. - Perceived psychological risk and perceived time risk had no association with either acceptance intention or perceived value. - Among technological uncertainty, information asymmetry, regulatory uncertainty and service intangibility variables, the most significant impact on risk dimensions derives from perceived information asymmetry. - Contrary to literature, perceived service intangibility only inhibited perceived financial risk, having no observable effect on other risk dimensions.
Zhang & Mao (2020)	m-payment NFC	TAM & Theory of Reasoned Action	SEM	SmartPLS 2.0	- Relative advantage and subjective norms predicted intention to adopt mobile payment. - PU influenced relative advantage which in turn affected attitude. - Positive emotions determined attitude. - Subjective norms are determined by perceived number of peers and social image. - Responsiveness, smartness and mobility formed PU.

Zheng et al. (2012)	e-commerce	Perceived Risk Dimensions	Cluster Analysis	Not mentioned	• Regarding e-commerce, performance risk outweighed other types of risks in the study. • The sample was more concerned about non-personal perceived risks than personal ones.
Zhou (2013)	m-payment	Flow Theory & Information Systems Success Model	SEM	LISREL	• While system quality determined trust and satisfaction, it did not predict flow experienced in mobile payment. • Trust and flow had significant relationships with information quality and service quality; however, satisfaction was not associated with them. • Continuance intention is determined by trust, flow and satisfaction. • Service quality was the strongest influencer of trust.

Notes. ANN: Artificial neural network, IDT: Innovation diffusion theory, m-commerce: Mobile commerce, m-money: Mobile money, m-payment: Mobile payment, NFC: Near field communication, OLS: Ordinary least squares, PEOU: Perceived ease of use, PLS: Partial least squares, PU: Perceived usefulness, SEM: Structural equation modeling, TAM: Technology acceptance model, UTAUT: Unified theory of acceptance and use of technology.

2.5 Hypothesis development

Literature about the adoption of different electronic payment methods in different contexts helped shaping the hypotheses of this study. Most common needs of consumers as well as logical causalities are also put into consideration when selecting variables. As mentioned in section 3.1 (Purpose and Objectives), variables in the model also capture İstanbulcard's value proposition.

As technological improvements started to shape the expectations of consumers about electronic payment methods, two core values are gaining importance in the eyes of consumers; convenience and speed. Therefore, previous literature has stressed the importance of convenience (De Kerviler et al., 2016; Chen & Chang, 2013; Ozturk et al., 2017) and speed either directly (Dewan & Chen, 2005) or indirectly via time risk variables (Featherman & Pavlou, 2003; Yang et al., 2015; Lee, 2009) and via quality variables (Zhou, 2013). De Kerviler et al. (2016) found that convenience is an important factor in in-store mobile payment. Ozturk et al. (2017) also echoed the importance of convenience in intention to use restaurant NFC mobile payment method.

This study adopts Chen's (2008) *perceived transaction convenience* and *perceived transaction speed* as they increase the benefits associated with the usage of electronic payments. Hypotheses are as follows:

H₁: Perceived transaction convenience leads to perceived usefulness of İstanbulcard payment method.

H₂: Perceived transaction speed leads to perceived usefulness of İstanbulcard payment method.

Plenty of past research utilized *perceived usefulness*, *perceived ease of use* and *intention to use* in the adoption of various technologies in different industries and contexts. Im et al. (2008) states that perceived usefulness needs to be emphasized more when a product offers utilitarian value whereas perceived ease of use becomes more important in hedonic

technology consumption. Previous research utilized PU, PEOU and intention to use mobile payment, and found evidence of the effect of PU on intention to use (Ooi & Tan, 2016; Koenig-Lewis et al., 2015). In Internet-banking adoption research, Lee's (2009) and Tan et al.'s (2014) studies resulted in significant effects of PEOU on PU and PU on intention to use.

In order to measure intention to use, its scale is adopted from the QR mobile payment acceptance research of Liébana-Cabanillas et al. (2015). Belanche-Gracia et al.'s (2015) smartcard acceptance research in a city that has smart city ambitions is used to adopt scales of PU and PEOU. Hypotheses are as follows:

H₃: Perceived ease of use leads to perceived usefulness of İstanbulcard payment method.

H₄: Perceived ease of use leads to intention to use İstanbulcard as a payment method.

H₅: Perceived usefulness leads to intention to use İstanbulcard as a payment method.

Considering the life changing effects of COVID-19 pandemic, it was important to integrate it in the study as it will not only help understanding respondents' point of view about İstanbulcard but also ground useful findings for the future research for doing a comparison between pandemic and post-pandemic adoption. Previous literature demonstrated the effects of COVID-19 on the acceptance of contactless payment technologies (Puriwat & Tripopsakul, 2021). Aji et al. (2020) found evidence for the effect of perceived COVID-19 risk on intention to use e-wallet. Hypothesis is as follows:

H₆: Perceived COVID-19 risk leads to intention to use İstanbulcard as a payment method.

Similar to other technologies, smart city technologies are also vulnerable to security issues. This drawback of smart cities is echoed in previous studies (Angelidou 2014 and 2017; Lytras & Visvizi, 2018; Abosag, 2019). Kitchin (2014), emphasizing on this vulnerability, employed the term hackable city.

Fear of monetary loss is a common concern of electronic payment users. Therefore, variables related security risk played an important role in electronic payment adoption research (Abu-Shanab & Ghaleb, 2012; Lee, 2009; Ooi & Tan, 2016; Ramos-de-Luna et al., 2016; Ryu, 2018; Thakur & Srivastava, 2014). Lee (2009) found that security risk diminishes intention to adopt online banking. To better understand the effects of perceived security, this construct is adopted from Belanche-Gracia et al. (2015). Hypothesis is as follows:

H7: Perceived security leads to intention to use İstanbulcard as a payment method.



3. RESEARCH DESIGN AND METHODOLOGY

There has been some criticism over researchers' use of research methodology and research method incorrectly and interchangeably (Adams et al., 2007; Mackenzie & Knipe, 2006). Although these two terms cannot exist without one another, research methodology encompasses research method in that research methodology is the study of research methods. Research methods, on the other hand, decide how and from whom the data are to be collected, and how they are to be analyzed (Saunders et al., 2019).

Research methodology has its roots in the philosophy of defining and creating knowledge. Even if they are not aware of it, articulate it, or due to word limitations cannot express it, every researcher (including students pursuing a Master thesis or a small research in their undergraduate research methodology courses) utilizes some assumptions and techniques from different worldviews (i.e. paradigms). They *tend to* (Creswell, 2009, p. 16) lean towards certain approaches (e.g. quantitative methods) as well as certain philosophies. These philosophies are where quantitative, qualitative or mixed approaches are derived from, depending on the beliefs of the researcher on the nature of knowledge and purpose of research. Worldviews, of course, evolve in time or lose their popularity. However, they always guide researchers in their choice of different research strategies that in turn helps choosing the right and consistent research methods to answer their research problem.

3.1 Research Purpose and Objectives

Rising notion of smart cities attaches municipalities a new importance as well as giving them new duties (Calzada, 2021). Although the efforts of local governments on the ambition of becoming smart would not suffice without the support of other stakeholders, their leadership is important (Fromhold-Eisebith & Eisebith, 2019). İstanbul is home to approximately 15.5 million people, making it the most populated city in Turkey followed by

ca. 5.5 million of the capital Ankara and ca. 4.5 million of İzmir (Turkish Statistical Institute, 2021 February). İstanbul Metropolitan Municipality, thus, conducts a huge operation to serve these 15.5 million dwellers (excluding refugees that are currently in İstanbul) with its 28 subsidiary firms. These subsidiaries are grouped in the following fields; information technologies, transportation, construction, service, and environment-energy. İstanbulcard, with 18 million (non-residents also possess İstanbulcard) active users (Belbim, 2019), has an important role in the smart city vision of İstanbul Metropolitan Municipality (Belbim, 2019; İstanbulkart, 2020, February).

To the author's best knowledge, both municipality smart cards that have diverse applications like İstanbulcard and the literature on their acceptance are scarce. Managing the 14th most populated city in the world (Macrotrends, n.d.), İstanbul's municipality has to have variety of services to make the city function. Belbim's İstanbulcard, therefore, plays a crucial role for its holders to access this wide range of services offered by both the municipality and private sector. These services range from vending machines for the municipality's own water company Hamidiye to taxis, from municipality's restaurants to bike rental services and from online grocery delivery apps (e.g. Getir) to brick and mortar supermarket chains. Other points İstanbulcard touches the lives of Istanbulites are public transportation and monetary social aids that they receive. This is what makes Belbim, the producer of İstanbulcard, an inseparable part of İstanbul's smart city vision (Belbim, 2020). Figure 26 illustrates three out of four values in İstanbulcard's value proposition that are; fast, convenient and safe. As İstanbulcard is a contactless card, it can be easily claimed that it can offer these benefits to the users. Please note that this study focuses on the plastic İstanbulcard and not the İstanbulcard mobile app. Including the mobile app would raise the questions whether the mobile app itself has any effects on the adoption.

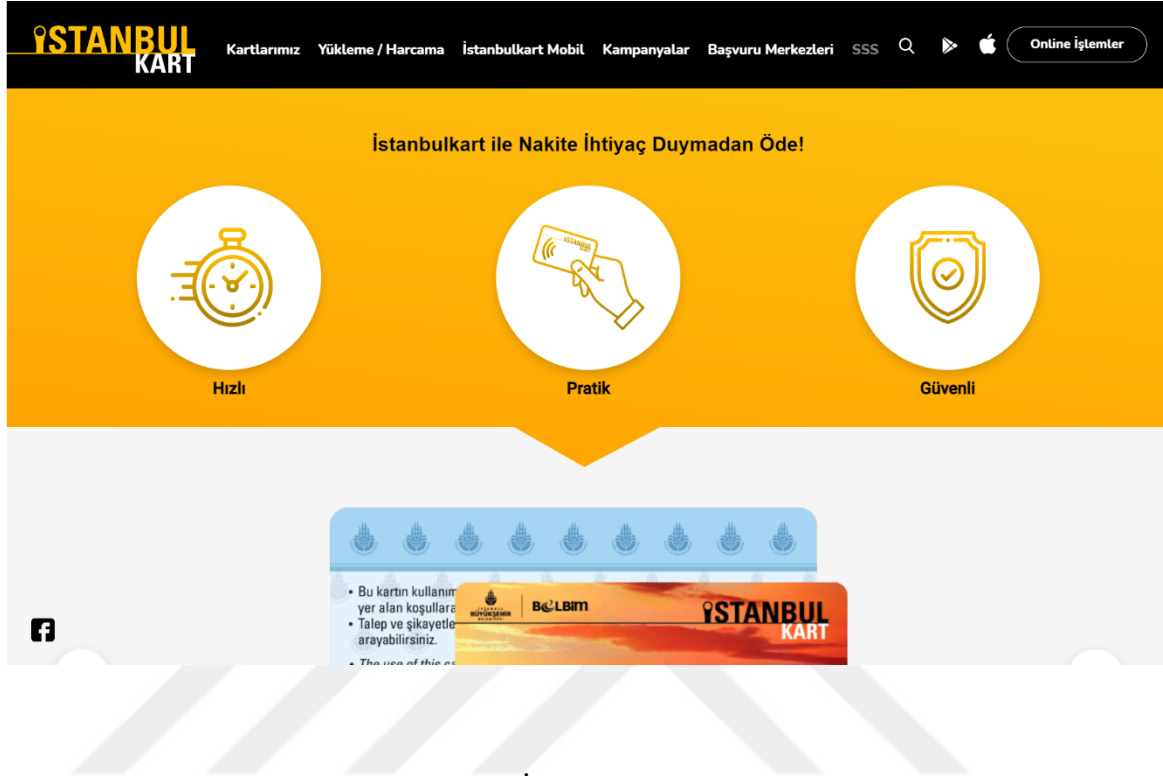


Figure 26. Value Proposition of İstanbulcard: “Fast, convenient and safe”

Source: Retrieved from <https://www.istanbulkart.istanbul/kartlarimiz>

This research adds to the smart city and electronic payment literature in terms of the adoption of municipality smartcards that have several non-transportation applications. The research also extends the TAM with additional variables. Moreover, this study also captures the perceptions of İstanbulcard users during COVID-19 pandemic crisis by utilizing perceived COVID-19 risk variable. Therefore, in a sense, this study utilizes a natural manipulator, leaving important findings for making comparisons in post-pandemic research about this topic. Lastly, considering that topics related to smart city and electronic payment are scarce in the field of business administration in the dissertation database of Turkey, this study tries to fill these important gaps.

Then, considering the lack in the literature about the adoption of both İstanbulcard and other municipal smart cards, it is vital to inquire whether İstanbulcard holders accept

İstanbulcard as a smart city card with which they can make payments at several points of the city. Therefore, this study aims to understand the factors that influence the adoption of İstanbulcard as a smart city card with which electronic payments can be made. To accomplish this purpose, this study; a) collects literature about smart city approaches b) tests the applicability of its research model into the adoption of municipal smart city card context, c) integrates variables from İstanbul Metropolitan Municipality's own value proposition which are "convenient, fast, secure and hygienic" (please see Figure 6 and Figure 26 for the values).

3.2 Research Model

"What is simple is always wrong.
What is not is unusable.

- Paul Valéry

This study utilizes seven constructs from past research. Figure 27 briefly demonstrates all hypothesized relationships, offering convenience for readers (Keeling, 2019). Except basic TAM variables (perceived usefulness, perceived ease of use and intention to use), other four variables touch on İstanbul Metropolitan Municipality's value proposition which they express in their marketing activities. These variables for key values are a) perceived transaction convenience for "convenience", b) perceived transaction speed for "speed", c) perceived security for "security", and d) perceived COVID-19 risk for "hygiene". Please note that in the marketing efforts of Belbim's İstanbulcard, hygiene (as a proposed value) is added after COVID-19 pandemic, pointing on digital methods of depositing money.

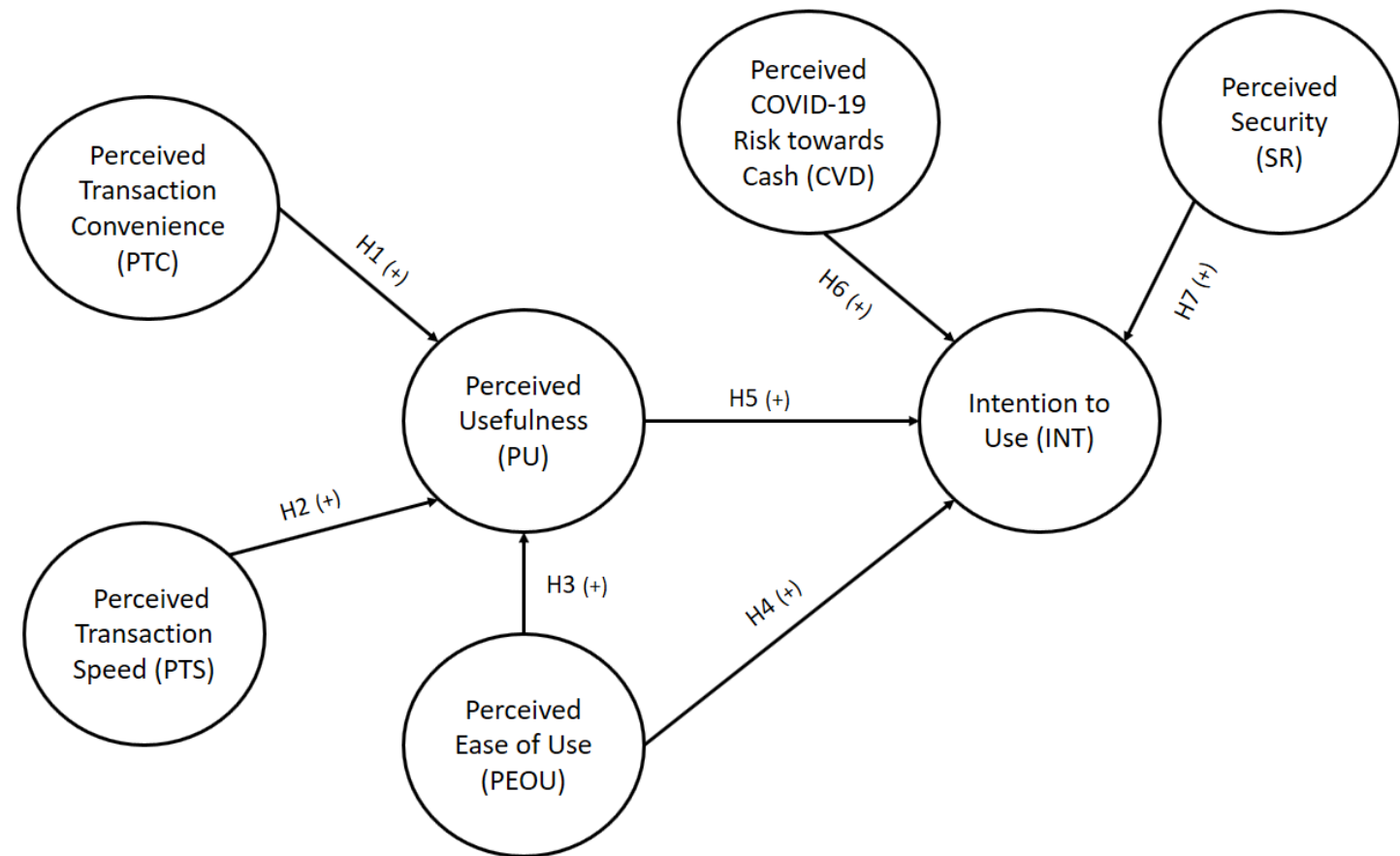


Figure 27. Graphical Representation of the Research Model

3.3 Variables of the Study

In this section, brief definitions of the variables in this study are given. More emphasis is put on perceived COVID-19 risk; because, future researchers might not know what it is. Therefore, a rather elaborate background is given to this construct.

3.3.1 Perceived Transaction Convenience and Perceived Transaction Speed

By definition (Chen, 2008), PTC and PTS capture the degree to which consumers think that İstanbulcard improves the convenience and the speed of a payment process. Compared to ease of use, convenience possesses a more comprehensive meaning and these two have been used together in previous literature, as well (Ozturk et al., 2016; Teo et al., 2015). Transaction convenience addresses available merchants that accept İstanbulcard, benefits that occur when using it, and how İstanbulcard functions with other technology (such as smartphones in the case of Getir) to realize the payment.

3.3.2 Perceived Ease of Use, Perceived Usefulness and Intention to Use

PEOU helps to understand İstanbulcard holders' expectations on the easiness of the payment and the usage of İstanbulcard (Belanche-Gracia et al., 2015). PEOU addresses consumers' perceived self-efficacy to use İstanbulcard as a payment method and inherently is a more hedonic construct.

On the other hand, PU is more performance oriented and answers more observable benefits of using İstanbulcard as a payment method (Belanche-Gracia et al., 2015). Therefore, it is a more utilitarian construct in nature.

The variable intention to use is derived from Liébana-Cabanillas et al. (2015). In this study, it measures the degree to which participants accept İstanbulcard as a payment method. Due to the reasons stated in section 3.1 (Purpose and Objectives), their acceptance of

İstanbulcard as a payment method also implies their acceptance of İstanbulcard as a smart city card.

3.3.3 Perceived COVID-19 Risk

Among other unambiguous constructs of this study, this one might need a background story. There is a possibility that future readers will not be knowledgeable of the airborne virus outbreak that started in 2019 and officially declared as a pandemic in 2020 by World Health Organization (Liu et al., 2020). Previously named as 2019-nCoV, COVID-19 is an abbreviation of coronavirus disease and 2019 is the year that it is first appeared. Although some infected people do not show any symptoms, some describes it as a heavier version of flu causing a state of severe weakness, strong coughs and difficulties in inhalation. Please note that this outbreak was present during the collection of this research's data and it continues with mutated versions during the writing process of this work.

To elaborate on this crisis will help the future readers (who possibly will find this work during the next pandemic, perhaps) to better understand what happened in the world when the hottest topic was a virus. After governments realized the severity of the situation, measures were taken in order to prevent spread; thus, there were and there are lockdowns and they continue in an on and off basis. Citizens are forced to wear masks and advised to limit their social life. Companies and states let their employees work from home in a more flexible basis. Majority of the social events are prohibited in order to prevent people from gathering.

Health specialists dominated TV presence and informed people about viruses and their contagiousness. During the period when the topic was new and concern was high, lockdowns resulted in people purchasing basic needs more than they had to do; therefore, causing a temporary scarcity and panic. Hand sanitizers became popular along with wet wipes. Supermarkets packaged fruits and vegetables in order to prevent people from hand picking although droplets in the air were the most frequent cause of infection. People's fear

of using public transportation caused high traffic congestions. A study of 13 European countries showed that 74% of respondents in Turkey stated that they were either partially or completely hesitant to use cash because of coronavirus while the average was 48% among other countries (ING Turkey, 2020, September).

Considering these, a variable about this incident is added to this study. Therefore, adopted from Aji et al. (2020), CVD helps explain the degree to which participants fear from catching coronavirus when using cash.

3.3.4 Perceived Security

In this study, opinions related to security (Belanche-Gracia et al., 2015) is measured with a positive construct rather than a risk variable. The items of the construct voices the trust of respondents in the technology's safety; therefore, making the direction of its relationship with intention to use the technology positive.

3.4 Hypothesis of the Study

Hypothesis of this study are listed below. Please refer to section 2.5 (Hypothesis Development, pp. between 79 - 82) for more details on the literature behind the hypotheses.

H₁: Perceived transaction convenience leads to perceived usefulness of İstanbulcard payment method.

H₂: Perceived transaction speed leads to perceived usefulness of İstanbulcard payment method.

H₃: Perceived ease of use leads to perceived usefulness of İstanbulcard payment method.

H₄: Perceived ease of use leads to intention to use İstanbulcard as a payment method.

H₅: Perceived usefulness leads to intention to use İstanbulcard as a payment method.

H₆: Perceived COVID-19 risk leads to intention to use İstanbulcard as a payment method.

H₇: Perceived security leads to intention to use İstanbulcard as a payment method.

3.5 Research Method

Positivists are known for their commitment to rigorous and structured scientific methods (Creswell, 2009; Saunders et al., 2019). Most commonly, positivists are associated with quantitative methods although post-positivists are testing the waters with other types of approaches. Positivists enjoy a predetermined plan and operationalized variables when doing research. Debates on the quality of marketing research were once on poor validity and inattentive operationalization of constructs (Churchill, 1979). Therefore, positivist approach helped marketing research to be more scientific.

Pragmatists (Creswell, 2009; Mackenzie & Knipe, 2006), on the other hand, are interested less in meticulous philosophical debates behind the strict processes of creating knowledge (Salkind, 2010). They prefer practicality over philosophical consistency and enjoy from a variety of techniques associated with different schools of thought in order to find best answers for research questions without limiting themselves.

Jansson-Boyd (2019) states that quantitative methods in which questionnaires are widely applied, take the lead in consumer research. Although participants cannot reveal their choices in a wider way than the researcher allowed them to do, hence the researcher creates a structured research design, the structure brings objectivity to the study,. Jansson-Boyd (2019) claims that the interest and efforts in understanding the behaviors of consumers grows therewith bringing together different research instruments of various human-related fields. However, it is a challenging task for researchers to construct a methodology incorporating the strengths of other sciences into their research although it helps them improve the quality of their work.

This study uses the traditional techniques of positivism (Creswell, 2009; Mackenzie & Knipe, 2006; Denscombe, 2010; Salkind, 2010) with a structured conclusive design on how to collect data and analyze it. This research is descriptive and cross-sectional. A non-probability convenience sampling was chosen as the sampling method. Scales are used to quantify the opinions of respondents about operationalized constructs and partial least squares path modeling is utilized for analyses of hypothesized relationships. Modelling is preferred as it presents the methods in a more digestible way for readers (Keeling, 2019). Moreover, it helps pinpointing to certain variables for improvements to get desirable consumer behaviors. All hypothesized relationships are borrowed from past research. The research adopts its core variables from Technology Acceptance Model and other variables from the studies that extended it. Traditionally and as in this study, extensions on technology acceptance models are done using the most basic TAM rather than ones that are more complex (e.g. UTAUT, also please see “Theories” column in Table 2 for TAM’s dominance).

3.6 Measurement Development

Table 3 includes constructs that are utilized in the survey via a five-point Likert scale. Item codes and their respective statements are given. All constructs and their items were adopted from the past literature and translated into Turkish. Five-point Likert scale is used to operationalize measurement constructs anchoring in the extremes with “strongly disagree” and “strongly agree” (Lee et al., 2013; Chiu et al., 2010; Stockemer, 2019). It is important to use odd number of anchors as it provides a neutral response option; therefore, enhancing the reliability and validity (Stockemer, 2019).

Table 3. Measurement Constructs

Constructs	Item Codes	Items	Adopted from
Perceived Transaction Convenience (PTC)	PTC1	I believe that using İstanbulcard payment method will be convenient.	Chen (2008)
	PTC2	I believe that using İstanbulcard payment method will be hassle-free.	
	PTC3	Compared to traditional payment methods (cash, credit/debit card), I believe that İstanbulcard payment method is more convenient.	
Perceived Transaction Speed (PTS)	PTS1	I believe that using İstanbulcard payment method will improve the speed of transaction.	
	PTS2	I believe that using İstanbulcard payment method will save me time.	
	PTS3	Compared to traditional payment methods (cash, credit/debit card), I believe that transactions will be fast if I use İstanbulcard payment method.	
Intention to use İstanbulcard (INT)	INT1	Given the opportunity, I would use İstanbulcard payment method.	Liébana-Cabanillas et al. (2015)
	INT2	I am likely to use İstanbulcard payment method in the near future	
	INT3	I am open to using İstanbulcard payment method in the near future	
	INT4	I intend to use İstanbulcard payment method when the opportunity arises	
Perceived Usefulness (PU)	PU1	İstanbulcard payment method is useful for me	Belanche-Gracia et al. (2015)
	PU2	Using İstanbulcard payment method is advantageous for me	
	PU3	Using İstanbulcard payment method enhances my effectiveness	
	PEOU1	İstanbulcard payment method is easy to use	
	PEOU2	It is easy for me to operate with İstanbulcard	

Perceived Ease of use (PEOU)	PEOU3	The use of İstanbulcard payment method is free of effort	Aji et al. (2020)
Perceived Security (SR)	SR1	I think İstanbulcard payment service has mechanisms to ensure the safe transmission of its users' information	
	SR2	İstanbulcard allows me to make small payments with security	
	SR3	I feel safe using İstanbulcard for making transactions	
Perceived COVID-19 Risk towards Cash (CVD)	CVD1	I am worried to get infected by coronavirus when using physical cash	
	CVD2	I am not comfortable making payment using physical cash	
	CVD3	I am afraid to get infected by coronavirus when using physical cash	
	CVD4	I am worried there is a coronavirus droplet in physical cash	

3.7 Sampling Design

In order to achieve the answers of the research question, processes below in this section are designed. A discussion is presented on why certain research techniques were chosen in sampling, data collection and analyses.

3.7.1 Target Population

There are 17-18 million active İstanbulcard users (Belbim, 2019, 2020). Some of them do not live in Istanbul and some of them are below 18 years old. Therefore, the population of this study is İstanbulcard holders who are over 18 years old and reside in İstanbul. To the best of author's knowledge, a sampling frame on İstanbulcard users is not publicly available.

3.7.2 Sample Size

A sample size above 200 is recommended for PLS-PM studies with similar amount of variables and indicators to this study (Hair et al., 2014, 2016; Hoelter, 1983). Israel (2013) also suggests that a sample size of 200 – 500 is adequate for multiple regression which SEM is based on. These ranges of sample sizes are also consistent with past research with similar context and amount of variables (Chen, 2008; Koenig-Lewis et al., 2015; Yang et al., 2015). This study collected 414 valid questionnaires.

3.7.3 Sampling Technique

This study implemented a non-probability convenience sampling method (Denscombe, 2010) as it is also a common technique in the previous research (Muk & Chung, 2015; Samar et al., 2017). Time limitations and lack of financials were also other considerations in this decision.

3.8 Data Collection Method

A survey is utilized to collect data on the factors affecting Istanbulites' intention to adopt İstanbulcard as a payment method. Stockemer (2019) provides a short background on the use of survey research in historical times. As they point out, surveys emerged because of the need of old rulers to know about the quantity and financial value of its subjects. As time passed, this need in information became more to the point; hence, different times required different strategies. Now, surveys are an indispensable part of quantitative research in social sciences to collect useful and precise data.

A survey is conducted to collect primary data to test hypothesized relationships; because, it is one of the most time and cost efficient ways to get particular insights on important factors (Denscombe, 2010). Denscombe (2010) claims that collecting data online does not jeopardize its quality. Therefore, Google Forms was utilized to collect data, as the platform does not charge any fee neither for hosting the questionnaire nor for using different

types of questions. Moreover, it is very researcher-friendly in that it helps to organize data and eco-friendly in that it is paper-free. Due to the fact that this study is conducted during COVID-19 pandemic, the web-based questionnaire also ensured the safety of participants by removing the need for physical contact. Participants shared their opinions voluntarily. Information that will lead to identification of specific respondents is not collected.

As Denscombe (2010) frames it, a meticulously designed background information was given to prospective participants about the research without influencing their choices on the research subject. Participants watched an introductory video on the new usage areas of İstanbulcard. As the length of the questionnaire has the risk of creating survey fatigue and compromising the quality of responses, the length is kept as parsimonious as possible (Stockemer, 2019). Words that can possess ambiguous meanings or questions that are value-laden were not used. A questionnaire that is translated into Turkish was emailed to prospective participants. This study collected 414 usable responses in one period therewith being a cross sectional research. A humble donation of food for stray animals in the campus of a university was utilized as an incentive to attract people into answering the questionnaire.

3.9 Data Analysis Method

Jansson-Boyd (2019) stresses the importance for researchers to utilize unconventional statistical tools. SEM has its own jargon and has two different versions; covariance based SEM (CB-SEM) and partial least squares SEM (PLS-SEM or PLS-PM). As Hair et al. (2011) suggests, PLS-PM is preferred; because, the aim is to test an extension of an already established theory. Moreover, Consistent PLS-PM (PLSc-PM) technique was conducted via SmartPLS; because, it offers novel approaches to reliability and validity of constructs as well as significance of relationships (Dijkstra, & Henseler, 2015).

Rather than independent and dependent variables, there are exogenous and endogenous variables in SEM. Exogenous variables are those that have an effect at least on one variable. Endogenous variables do not have an effect on any of the variables in the

research model, they are affected by other variables. Both of these are called latent variables in SEM.

Measurement in SEM is twofold; reflective and formative (see Bagozzi, 2011 for a more comprehensive discussion on them). In most simplistic terms, without too much scientific rigor, the difference between these can be described by the direction of causality. In reflective measurement, the direction of causality is towards indicators (hence, ‘reflection’) whereas in formative measurement, the construct is the consequence (hence, ‘formation’). For instance, as shown in the left-hand side of Figure 28, attitude towards a technology reflects on certain opinions of people. However, in the right-hand side, attitude towards a technology is formed by certain ‘dimensions’ (a, b and c). Please note that opinions (1, 2, and 3 in Figure 28) are naturally highly correlated whereas dimensions (a, b and c in Figure 28) do not need to be highly correlated. To elaborate on these, in survey-based quantitative studies, what respondents answer are actually indicators of latent variables. Since they are observed, the error in reflective measurement is on indicators. On the other hand, the error on formative measurement is on the construct itself.

In formative measurements, latent variables are formed by dimensions. Figure 28 demonstrates this with the example of attitude towards a technology. If one asks ‘what forms attitude’, the answer might be following dimensions; affective attitude, behavioral attitude and cognitive attitude. Please note that these dimensions could positively or negatively affect attitude at the same time (this should not be confused with negatively worded questions). For instance, one can love cryptocurrencies, use them frequently; however, think that they are too risky. Therefore, whereas the affective and behavioral dimensions are increasing positive attitudes, cognitive dimension is diminishing them in this case.

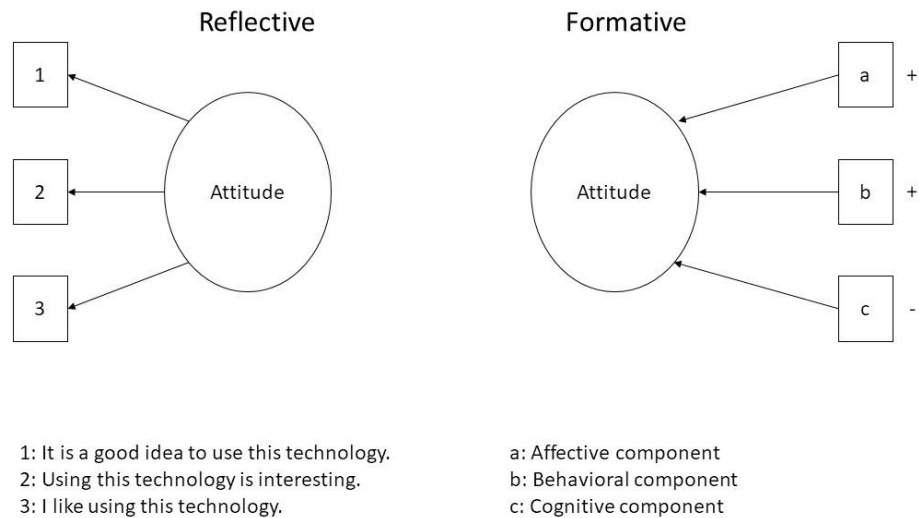


Figure 28. Reflective vs. Formative Measurement: Attitude towards a Technology

Source: Authors own collection.

Compared to other analyses (t-tests, regression, ANOVA), SEM is a holistic one which conducts several analyses simultaneously. Therefore, SEM is not a statistical analysis but a collection of several of them. It has the ability to conduct factor and path analysis at the same time. Complex set of relationships between several variables can be analyzed with SEM without too much hassle. SEM reduces the measurement error therewith increasing the reliability. One issue in SEM is the model fit. It informs the researcher about the fit between the way they designed the model and the data that is collected. Therefore, a good model fit indicates that the data confirms how the researcher identified the set of relationships between the constructs.

4. FINDINGS

The information collected via the questionnaire was twofold. First part of the questionnaire measured participants' opinions on the variables of the study. Second part collected information of demographics and psychographics of respondents. Locating demographic questions at the end of the survey is a common method in order to get higher response rates.

In this section, the results of the study are presented starting with demographics and psychographics. Respondents' age, sex and education level are displayed in a table. Moreover, their opinions on İstanbul and İstanbulcard are given. The information on their choice of payment methods and their usage of İstanbul Metropolitan Municipality's services are demonstrated. For the ease of in-text reading, some percentages are rounded.

4.1 Non-response Bias Test

An independent samples t-test analysis is conducted to investigate non-response bias (Armstrong & Overton, 1977). This test is conducted based on the assumption that the last wave of respondents carries almost the same characteristics as non-respondents. The means of the first wave and the last wave of respondents are compared and no statistically significant differences are observed (Table 4).

Table 4. Independent Samples t-test of the First 50 and the Last 50 of Respondents

Variables	t-test for Equality of Means		
	t	df	Sig. (2-tailed)
INT	-1.270	73.067	0.208
PU	0.183	79.327	0.855

4.2 Descriptive Analysis of Respondents

In order for readers to have a sense of the characteristics of respondents, some demographics and psychographics are presented below. Women participants constitute the majority (ca. 70%) of the sample of this study (Table 5). There are a total of four age brackets. The youngest kind participant of this study is 19 years old whereas the oldest is 63 years. The majority (ca. 78%) of respondents are 25 - 34 years old while 20% is shared almost equally between 19 - 24 and 35 - 44 age groups. Participants older than 44 years represent a very small minority with almost 1.5 percent. Education-wise, 272 (66%) graduate students stand out as the majority of the sample. They are followed by participants who hold a graduate degree (22%). Thus, it can be concluded that the sample is highly educated. These results do not prove but may tell us that the majority of respondents are likely to have a disposal income which they can spend with İstanbulcard.

Table 5. Demographic information of respondents

Variable	Level	Frequency	% of total sample (n = 414)
Gender	Woman	289	69.81
	Man	125	30.19
Age Groups	19 - 24	48	11.59
	25 - 34	323	78.02
	35 - 44	37	8.94
	45 - 63	6	1.45
Education	High School Graduate	5	1.21
	Undergraduate Student	25	6.04
	Undergraduate Degree	23	5.56
	Graduate Student	272	65.70
	Graduate Degree	89	21.50

Participants were asked if they knew İstanbulcard could be utilized in non-transportation payments. A rather striking result (Table 6) was that almost 45% of respondents were not aware that İstanbulcard is a valid payment method in some other services of the municipality and in some other points of sale of private companies. More than half of the respondents (63%) believed that İstanbul is a smart city; however, the results also

reveal that 78% believed that İstanbulcard is a “smart city” card. Moreover, participants who believed that İstanbulcard is a smart card constituted 85% of the sample.

Table 6. Views of respondents on İstanbul and İstanbulcard

Statements (n = 414)	Yes (%)	No (%)
I previously knew about these new usage areas of İstanbulcard.	55.31	44.69
İstanbul is a "Smart City".	62.80	37.20
İstanbulcard is a "Smart City" card.	78.26	21.74
İstanbulcard is a "Smart Card".	84.78	15.22
I actively use İstanbulcard in my daily life.	65.94	34.06

Table 7 illustrates the payment methods that are used by respondents. Multiple selection was available in the corresponding question. Credit card together with debit card was the most favorite payment method of the 414 respondents, having being used by 98% of them. On the other hand, another non-cash payment method, which is online payment, seconds this list with 65 percent followed by cash (60%) and mobile payment (33%). The category of prepaid card, which İstanbulcard falls into, was selected 12 times (3%).

Table 7. Preferred payment methods of respondents

Payment Method	Frequency	% of total payment methods used (1101 in total)	% of total sample (n = 414)
Credit card / Debit card	404	0.37	97.58
Online payment	270	0.25	65.22
Cash	252	0.23	60.87
Mobile payment	137	0.12	33.09
E-wallet	18	0.02	4.35
Prepaid card	12	0.01	2.90
Crypto currency	8	0.01	1.93
Total	1101		

As stated in the previous paragraph, respondents could select from a list of payment methods and state payment methods that was not on the list by typing themselves. Therefore, although there were respondents who opt for a single payment method, the majority selected more than one method of payment. This led to the following payment method groups in Table 8; “cash, credit card / debit card and online payment” group topping the list with 22 percent. Participants who stated that they use both cash and credit/debit card consist of 15% of the sample.

Table 8. Most preferred payment methods when multiple preferences are grouped

Payment method groups		Frequency	% of total sample
Number	Payment methods		
1	Cash, Credit card / Debit card, Online payment	94	22.71
2	Cash, Credit card / Debit card	64	15.46
3	Cash, Credit card / Debit card, Mobile payment, Online payment	58	14.01
4	Credit card / Debit card	54	13.04
5	Credit card / Debit card, Online payment	52	12.56
6	Credit card / Debit card, Mobile payment, Online payment	35	8.45
7	Cash, Credit card / Debit card, Mobile payment	12	2.90
Other groups		45	10.87

In what outlets İstanbulcard is/was being used as a payment method is an important point of curiosity (Table 9). Respondents were given to opportunity to make multiple selections in this case, as well. Havaist, an airport bus service that is no longer provided by İstanbul Metropolitan Municipality, was the most frequent (34%) service that is paid by İstanbulcard. A notable result was that of the 414 respondents, 108 (26%) never used İstanbulcard in one of its new usage areas. İspark, a service that provides car-parking areas,

is the third most frequent (21%) point of sale where İstanbulcard is used. Services of Getir, a private e-grocery company, also paid via İstanbulcard by 5% of the respondents.

Table 9. Usage of İstanbulcard in the payments of services provided by İstanbul Metropolitan Municipality or by private companies

Services	Frequency	% of total services paid by İstanbulcard
Havaist	141	34.06
None	108	26.09
İspark	87	21.01
Hamidiye Vending Machine	86	20.77
Beltur or İBB Recreational Facilities	69	16.67
İsbike	50	12.08
Getir	22	5.31
Supermarket	21	5.07
iTaksi	14	3.38
Public toilet	13	3.14
Total	611	

Lastly, Table 10 demonstrates the self-reported expenditures of respondents before COVID-19 pandemic took place. The reason for asking pre-pandemic expenditures was the lockdown during the pandemic in which people stayed at home and therefore were not able to use much of the services that can be paid by İstanbulcard. Please note that the expenditures in Table 9 also include public transportation fees. The vast majority (87%) of the sample

spent under 100 Turkish Liras monthly. Only 16 participants (4%) spent above 150 Turkish Liras.

Table 10. Monthly İstanbulcard expenditures of respondents before COVID-19 pandemic

<u>Expenditure (in TL)</u>	<u>Frequency</u>	<u>% total sample</u>
0 - 50	193	46.62
51 - 100	168	40.58
101 - 150	37	8.94
151 - 200	6	1.45
201 - 250	6	1.45
251 - 300	2	0.48
300+	2	0.48

4.3 Analysis of the Constructs

For models involving only reflective constructs as in this study, Sarstedt et al. (2014, p.108) described some evaluation stages. Based on their suggestions, a measurement model analysis was conducted to have a sense of indicators and latent variables. Consistent PLS algorithm was the algorithm that is preferred in this study; because, it yields more accurate results with reflective variables (Dijkstra, & Henseler, 2015). The item CVD2 from perceived COVID-19 risk variable was the only indicator that is removed from the study due to a very low outer loading (0.066). Second run of measurement model analysis provided the results demonstrated in Table 11 and all item loadings were above the satisfactory 0.70 threshold

(Sarstedt et al., 2014; Hulland 1999). Figure 29 illustrates the latest version of the model after CDV2 is deleted.



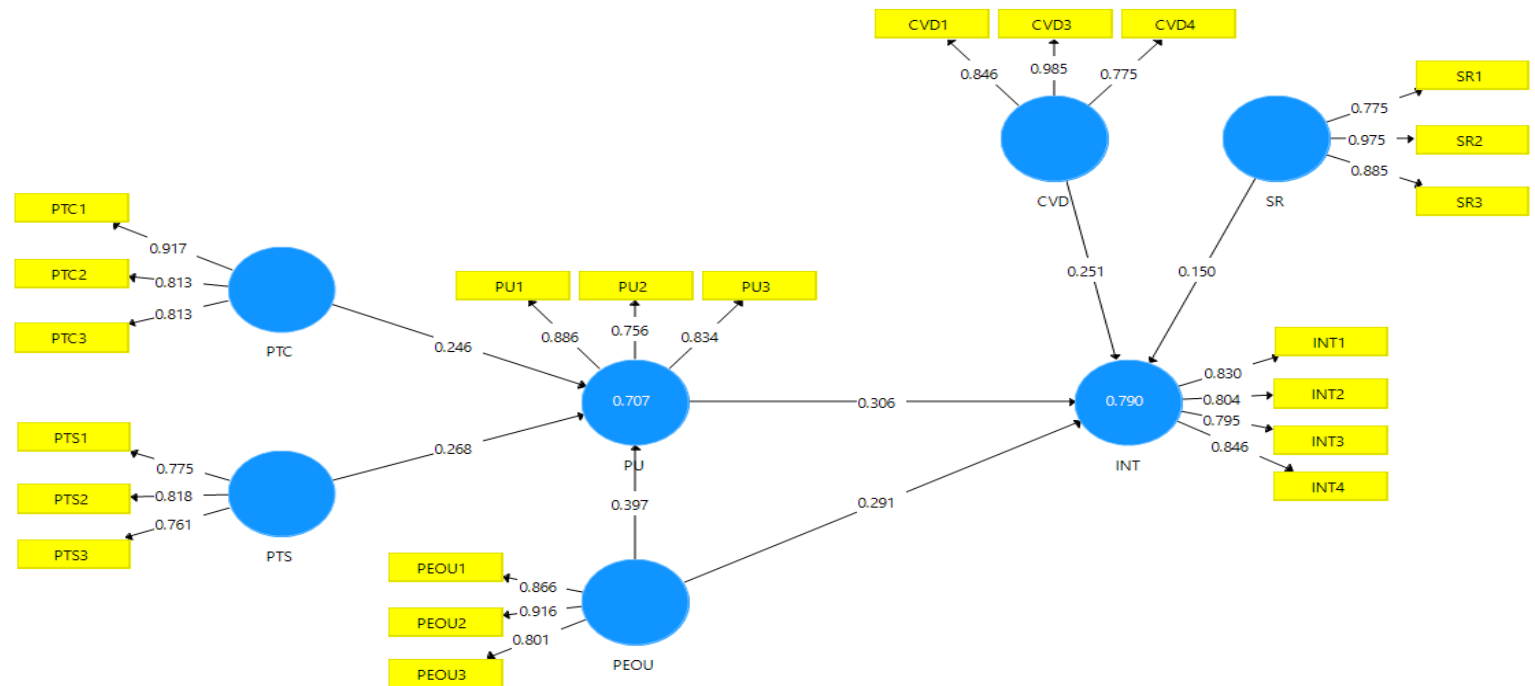


Figure 29. Revised model

For reliability and consistency tests of the constructs, Cronbach's α and composite reliability were utilized. All constructs were well above the acceptable 0.60 (Sarstedt et al., 2014; Hair et al., 2019b) cut-off point. Next, validity tests were conducted considering that a reliable measure is not always a valid measure. Two validity analyses were applied; convergent and discriminant. Convergent validity threshold is 0.50 (Fornell & Larcker, 1981; Hair et al., 2014) and this is satisfied by AVE of all constructs (Table 11).

Table 11. Assessment of the measurement model

Constructs	Items	Factor Loadings	Cronbach's α	Composite Reliability	AVE
Perceived COVID-19 risk	CVD1	0.846	0.901	0.917	0.905
	CVD3	0.985			
	CVD4	0.775			
Intention to use	INT1	0.830	0.890	0.891	0.891
	INT2	0.804			
	INT3	0.795			
	INT4	0.846			
Perceived ease of use	PEOU1	0.866	0.897	0.900	0.897
	PEOU2	0.916			
	PEOU3	0.801			
Perceived transaction convenience	PTC1	0.917	0.885	0.889	0.885
	PTC2	0.813			
	PTC3	0.813			
Perceived transaction speed	PTS1	0.775	0.827	0.829	0.828
	PTS2	0.818			
	PTS3	0.761			
Perceived usefulness	PU1	0.886	0.867	0.871	0.866
	PU2	0.756			
	PU3	0.834			

Perceived security	SR1	0.775	0.913	0.923	0.913
	SR2	0.975			
	SR3	0.885			

A more up-to-date test was used to check discriminant validity of latent variables. Heterotrait-Monotrait (HTMT) ratio of correlations was examined (Henseler et al., 2015; Hair et al. 2019a). All constructs satisfied (Table 12) the most strict cut-off value of 0.85 (Kline, 2011). Please note when constructs have similarities inherently, even 0.90 is acceptable (Henseler et al., 2015). Therefore, the conclusion is that all measurement in this study is reliable and valid.

Table 12. Heterotrait-Monotrait Ratio Analysis of Correlations among Indicators

	CVD	INT	PEOU	PTC	PTS	PU	SR
CVD							
INT	0.787						
PEOU	0.726	0.813					
PTC	0.706	0.754	0.796				
PTS	0.702	0.777	0.771	0.731			
PU	0.726	0.816	0.798	0.758	0.752		
SR	0.681	0.702	0.637	0.613	0.654	0.643	

4.4 Goodness of Fit of the Research Model

Evaluating the model fit, Hu and Bentler (1999) suggested an SRMR threshold of 0.08 and SRMR values below this cut-off point shows a good model fit. SRMR value for the structural model was 0.03, thus, satisfying the threshold. However, please note that some researchers are cautious about the usage of model fits in PLS-PM (Hair et al., 2019a).

Table 13 shows the test for multi-collinearity and all values are below five (Hair et al., 2019b). Thus, as Hair et al. (2019b) suggests, the coefficient of determination (R^2) can be examined to assess goodness of fit. R^2 for intention to use (the endogenous construct of the study) was 0.789 and this is considered as substantial in-sample predictive power (Hair et al., 2016).

Table 13. VIF values of structural model

	CVD	INT	PEOU	PTC	PTS	PU	SR
CVD		2.729					
INT							
PEOU		3.250				3.479	
PTC						3.029	
PTS						2.717	
PU		3.263					
SR		2.103					

4.5 Analysis of the Structural Model

After the measurement model is confirmed and the goodness of fit is discussed, structural model is examined. Hypotheses were tested using Efron's (1987) bias-corrected bootstrapping (Henseler et al., 2009; Hair et al., 2016) and 4999 (Henseler, 2017) subsamples were selected. The reason for selecting 4999 subsamples was its proximity to infinity in terms

of the results of the test (Henseler, 2017). This yielded the statistically significant results for H_1 , H_2 and H_7 at $p < 0.05$ and for H_3 , H_4 , H_5 and H_6 at $p < 0.001$ cut-off point (see Table 14). Therefore, all hypotheses are supported by t-tests via bootstrapping. Results are as follows; H_1 ($\beta = 0.245$, $t = 2.900$, $p < 0.05$), H_2 ($\beta = 0.269$, $t = 2.689$, $p < 0.05$), H_3 ($\beta = 0.397$, $t = 3.767$, $p < 0.001$), H_4 ($\beta = 0.291$, $t = 3.729$, $p < 0.001$), H_5 ($\beta = 0.306$, $t = 3.991$, $p < 0.001$), H_6 ($\beta = 0.251$, $t = 3.551$, $p < 0.001$) and lastly H_7 ($\beta = 0.150$, $t = 2.626$, $p < 0.05$).

Table 14. Hypothesis testing results

Hypothesis	Path	Path Coefficient	T Statistics	P Value	Remark
H_1	PTC -> PU	0.245	2.900	0.004	Supported
H_2	PTS -> PU	0.269	2.689	0.007	Supported
H_3	PEOU -> PU	0.397	3.767	0.000	Supported
H_4	PEOU -> INT	0.291	3.729	0.000	Supported
H_5	PU -> INT	0.306	3.991	0.000	Supported
H_6	CVD -> INT	0.251	3.551	0.000	Supported
H_7	SR -> INT	0.150	2.626	0.009	Supported

Figure 30 illustrates the hypothesis testing of the structural model with path coefficients and corresponding p-values. R^2 value for perceived usefulness was 0.707 whereas it was 0.789 for intention to use İstanbulcard as a payment method.

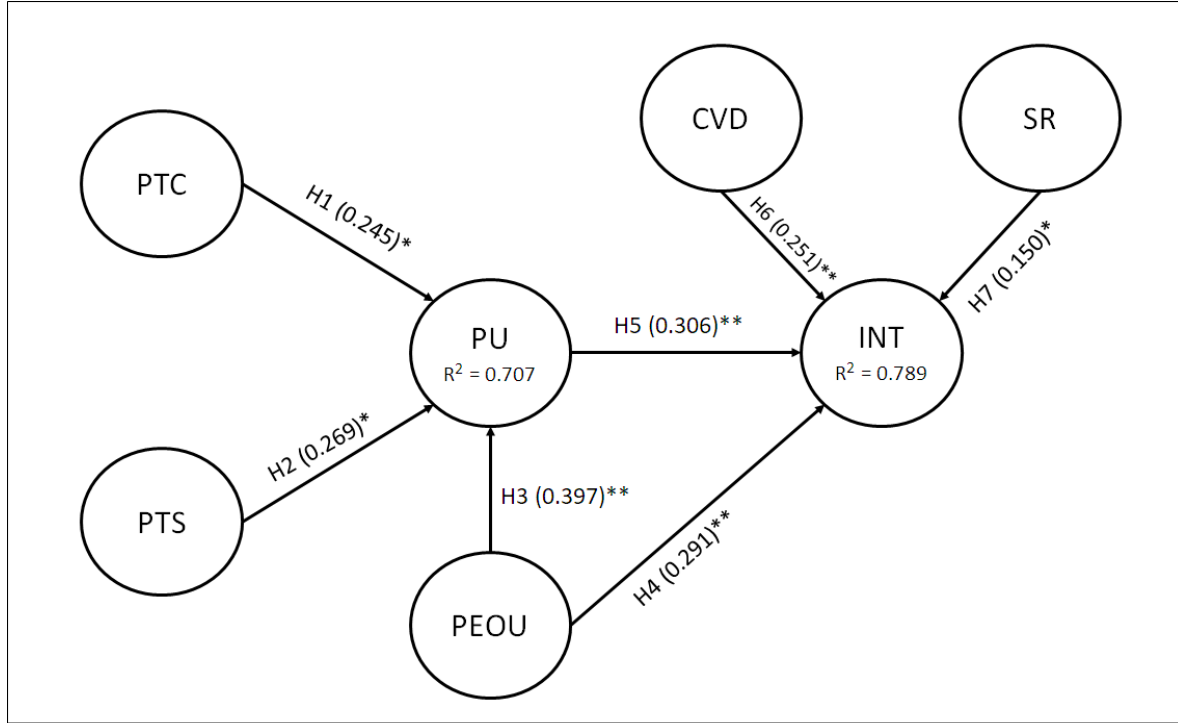


Figure 30. Structural model with path coefficients and p-values in parenthesis

Notes. *: Significant at $p < 0.05$, **: Significant at $p < 0.001$, R^2 : coefficient of determination, PTC: Perceived transaction convenience, PTS: Perceived transaction speed, PU: Perceived usefulness, PEOU: Perceived ease of use, CVD: Perceived COVID19-Risk towards cash, SR: Perceived security, INT: Intention to use.

Table 15 presents the indirect effects of PTC ($\beta = 0.076$, $t = 2.390$, $p < 0.05$), PTS ($\beta = 0.082$, $t = 2.033$, $p < 0.05$), and PEOU ($\beta = 0.122$, $t = 2.790$, $p < 0.01$) on intention to use. These findings indicate that PEOU has the largest indirect effect on intention to use İstanbulcard as a payment method.

Table 15. Specific Indirect Effects

	Original Sample	SD	T Statistics	P Values
PTC -> PU -> INT	0.076	0.03	2.390	0.017
PTS -> PU -> INT	0.082	0.04	2.033	0.042
PEOU -> PU -> INT	0.122	0.04	2.790	0.005

4.6 Tests for Group Differences

In order to conduct t-tests, the distribution of data is investigated beforehand. Normality tests of Kolmogorov-Smirnov and Shapiro Wilk (Table 16) indicate that the data is not normally distributed. However, skewness and kurtosis values between +2 and -2 are sufficient for treating the data as it is normally distributed (George & Mallery, 2010). The fact that PEOU is slightly above this range suggests that interpretations on that variable should be made with caution.

Table 16. Normality Tests

Variables	Kolmogorov-Smirnov			Shapiro-Wilk			Skewness	Kurtosis
	Statistic	df	Sig.	Statistic	df	Sig.		
CVD	0.139	414	0.000	0.936	414	0.000	-0.77	0.36
INT	0.193	414	0.000	0.881	414	0.000	-1.27	1.71
PEOU	0.207	414	0.000	0.859	414	0.000	-1.38	2.12
PTC	0.216	414	0.000	0.819	414	0.000	-1.53	1.91
PTS	0.159	414	0.000	0.912	414	0.000	-1.00	0.78
PU	0.156	414	0.000	0.907	414	0.000	-1.02	1.10

SR	0.225	414	0.000	0.857	414	0.000	-1.19	0.79
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Table 17 indicates that there are no statistically significant differences between women and men in terms of their perceptions of the variables of this study. However, please note that p-value for CVD is highly close to 0.05 cut-off point.

Table 17. Independent Samples T-test for Differences between Women and Men

Variables	Sex	N	Mean	SD	t-test for Equality of Means		
					t	df	Sig. (2-tailed)
CVD	Woman	289	3.84	0.83	1.933	412	0.054
	Man	125	3.67	0.83			
INT	Woman	289	3.88	0.79	1.205	412	0.229
	Man	125	3.78	0.86			
PEOU	Woman	289	4.06	0.85	1.663	412	0.097
	Man	125	3.90	0.93			
PTC	Woman	289	3.96	0.93	0.283	412	0.778
	Man	125	3.93	1.03			
PTS	Woman	289	3.75	0.91	0.873	412	0.383
	Man	125	3.67	0.91			
PU	Woman	289	3.88	0.83	0.457	412	0.648
	Man	125	3.83	0.90			
SR	Woman	289	3.77	1.01	0.941	412	0.347
	Man	125	3.67	1.05			

There are four age brackets in this study; however, unfortunately they are in considerably unequal sizes. Therefore, differences in age categories are only investigated for those whose sizes are closer to each other. Table 18 suggests that there are not statistically significant differences between 19 – 24 and 35 – 44 age brackets in terms of any variable used in this work.

Table 18. Independent Samples T-test for Differences between Age Brackets

Variables	Age Bracket	N	Mean	SD	t-test for Equality of Means		
					t	df	Sig. (2-tailed)
CVD	19 - 24	48	3.92	0.73	1.856	83	0.067
	35 - 44	37	3.59	0.93			
INT	19 - 24	48	3.98	0.77	0.824	83	0.412
	35 - 44	37	3.85	0.70			
PEOU	19 - 24	48	4.10	0.81	1.563	83	0.122
	35 - 44	37	3.82	0.81			
PTC	19 - 24	48	4.12	0.97	1.101	83	0.274
	35 - 44	37	3.88	0.98			
PTS	19 - 24	48	3.86	0.87	0.976	83	0.332
	35 - 44	37	3.68	0.87			
PU	19 - 24	48	3.99	0.70	1.238	83	0.219
	35 - 44	37	3.77	0.94			
SR	19 - 24	48	3.87	0.81	0.595	83	0.554
	35 - 44	37	3.75	1.05			

Participants were asked if they previously knew about the new usage areas of İstanbulcard. Table 19 indicates that there are no statistically significant difference between those who knew these services prior to this study and those who did not.

Table 19. Independent Samples T-test for Differences between Those who were Aware of İstanbulcard's New Usage Areas and Those who were not

Variables	New Usage Areas of İstanbulcard	N	Mean	SD	t-test for Equality of Means		
					t	df	Sig. (2-tailed)
CVD	Knew	229	3.82	0.89	0.799	410.780	0.424
	Did not Knew	185	3.75	0.76			
INT	Knew	229	3.82	0.85	-0.905	412	0.366
	Did not Knew	185	3.89	0.76			
PEOU	Knew	229	3.96	0.92	-1.268	412	0.206
	Did not Knew	185	4.07	0.83			
PTC	Knew	229	3.93	1.00	-0.526	412	0.599
	Did not Knew	185	3.98	0.92			
PTS	Knew	229	3.72	0.91	-0.069	412	0.945
	Did not Knew	185	3.73	0.91			
PU	Knew	229	3.85	0.90	-0.484	412	0.629
	Did not Knew	185	3.89	0.79			
SR	Knew	229	3.78	1.00	0.854	412	0.394
	Did not Knew	185	3.70	1.04			

Participants were asked if they believed that İstanbul is a smart city or not. Table 20 demonstrates that there are statistically significant differences for all variables in terms of the perceptions of participants.

Table 20. Independent Samples T-test for Differences between Those who Believed that İstanbul is a Smart City and Those who did not

Variables	İstanbul is a Smart City	N	Mean	SD	t-test for Equality of Means		
					t	df	Sig. (2-tailed)
CVD	Yes	260	3.88	0.77	2.736	281.738	0.007
	No	154	3.64	0.91			
INT	Yes	260	3.92	0.77	2.110	292.839	0.036
	No	154	3.74	0.86			
PEOU	Yes	260	4.17	0.80	4.629	281.512	0.000
	No	154	3.75	0.94			
PTC	Yes	260	4.07	0.85	3.045	259.561	0.003
	No	154	3.75	1.10			
PTS	Yes	260	3.82	0.84	2.673	277.904	0.008
	No	154	3.57	1.00			
PU	Yes	260	3.98	0.78	3.456	281.476	0.001
	No	154	3.67	0.92			
SR	Yes	260	3.87	0.93	3.256	275.367	0.001
	No	154	3.52	1.12			

Although the vast majority of Istanbulites have İstanbulcard, not everyone uses it actively. Therefore, participants were asked if they used İstanbulcard frequently. Table 21 indicates that there is a significant difference between active users and the other group in terms of PEOU and PU.

Table 21. Independent Samples T-test for Differences between Those who Actively Use İstanbulcard and Those who do not

Variables	Do you actively use İstanbulcard?	N	Mean	SD	t-test for Equality of Means		
					t	df	Sig. (2-tailed)
CVD	Yes	273	3.83	0.82	1.262	412	0.208
	No	141	3.72	0.85			
INT	Yes	273	3.90	0.82	1.790	412	0.074
	No	141	3.75	0.79			
PEOU	Yes	273	4.08	0.88	2.271	412	0.024
	No	141	3.88	0.87			
PTC	Yes	273	3.98	0.95	0.908	412	0.364
	No	141	3.89	0.98			
PTS	Yes	273	3.76	0.93	0.918	412	0.359
	No	141	3.67	0.86			
PU	Yes	273	3.94	0.87	2.479	412	0.014
	No	141	3.72	0.79			
SR	Yes	273	3.74	1.05	-0.091	412	0.927
	No	141	3.75	0.97			

5. DISCUSSION

Analyses are set out to understand the factors affecting the acceptance of İstanbulcard as a payment method for new services that are offered by the metropolitan municipality of İstanbul. Considering that this ecosystem is in line with the smart city plans of İstanbul Metropolitan Municipality, İstanbulcard's acceptance as a payment method also implies its acceptance as a smart city card. Perceived transaction convenience, perceived transaction speed, perceived ease of use, perceived usefulness, perceived COVID-19 risk and perceived security all directly or indirectly are hypothesized to lead to intention to use İstanbulcard as a payment method. This study found evidence for all hypothesized relationships among variables (Table 14).

Support was found for the extended version of TAM that is utilized in this study. In terms of in-sample predict power, PTC, PTS and PEOU were three exogenous variables that predicted PU and they explained 70% variance in it, which is considerably high in consumer research given that consumers are black boxes. Moreover, the model explained almost 79% variance in intention to use.

It is crucial to compare the results of hypotheses with previous literature and provide interpretations. Therefore, the rest of this section summarizes the findings of previous work that are related to or (in a sense) proximate to the findings of this study. Hypotheses are discussed in a sequence and studies that focused on the adoption of m-payment, m-commerce, online banking, contactless cards and such are included in discussion. Studies that took place only in Turkey and studies that made a comparison between Turkish sample and samples from other countries are also discussed separately. Lastly, comments were made on group differences.

5.1 On Hypotheses

H₁ and H₂, the positive influence of PTC and PTS on PU, were supported. These results are expected; because, İstanbulcard is a contactless payment instrument and the *raison d'être* of contactless cards are offering convenient and rapid transactions to increase the perception of usefulness. İstanbulcard provides these benefits seamlessly with tap and go payment which does not require any authorization such as signature or PIN codes. The fact that İstanbulcard is accepted by various merchants throughout İstanbul increases its perceived convenience in the eyes of İstanbulites.

İstanbulcard's transactional superiority in convenience and speed might be more evident when it is compared to cash. To elaborate on this, carrying cash and handling remainders of the exchange might be seen as burdensome and slow by consumers. İstanbulcard, however, does solve these problems with its contactless technology.

Similar results to H₁ and H₂ exist in the previous literature although there are cases with dissimilarities. Teo et al. (2015) utilized Chen's (2008) PTC and PTS; however, with the sibling variable of PU, that is, performance expectancy. PTC had a statistically meaningful relationship with performance expectancy whereas PTS did not significantly affect it. Likewise, performance expectancy was not influenced by PTS in other m-payment acceptance research (Do et al., 2019). Pham et al. (2018) found that transaction convenience has a significant effect on repurchase intention on online shopping. In the same vein, Duarte et al. (2018) empirically supported that transaction convenience is an important factor in the online shopping context. Time risk is incorporated in adoption of electronic payment research and found to be a significant factor in some (Lee, 2009; Featherman & Pavlou, 2003) and insignificant in other (Yang et al., 2015). Time risk is related to speed in a sense; therefore, their support for the significance of time risk may back the significance effects of PTS on PU in this study. Previous literature also utilized convenience as a mixture of convenience and speed and established its effect on intention to use mobile payment (Ozturk et al., 2017).

Therefore, although there are exceptions, the effects of PTC and PTS on utilitarian values such as PU and performance expectancy are supported in prior research.

In support of H₃, the effect of PEOU on PU is found to be statistically significant. İstanbulcard is something İstanbulites are using for a very long time; however, its usage evolves with time. For instance, the machines that are used to deposit money on the card are changing. Moreover, there are new methods of depositing money to İstanbulcard via SMS or online. Therefore, PEOU might still be a significant construct that has an effect on perceived usefulness; because, there is still some room to learn new features of İstanbulcard.

The relationship between PEOU and PU has been established in previous research in mobile payment adoption (Ramos-de-Luna et al., 2016; Bailey et al., 2017; Schierz et al., 2010). Evidence is also found in online shopping context (Li & Huang, 2009) and mobile commerce (Sujatha & Sekkizhar, 2019; Natarajan et al., 2017). Liébana-Cabanillas et al. (2015) empirically supported this hypothesis in the adoption of QR based mobile payment. On the other hand, there are cases in which this effect is insignificant in some research (Koenig-Lewis et al., 2015; Tan et al., 2014).

H₄ claims that PEOU affects INT and it was supported. This is expected; because, there are a variety of payment methods consumers can choose to make their payments. However, consumers tend to choose easier payment methods for them. Therefore, the level of ease of using the device or material that will realize the payment is important.

Prior studies also noted the effect of PEOU on intention to use payment technology. Chen (2008) found that PEOU affects intention to use mobile payment. Li and Huang (2009) empirically supported this in online shopping context and Natarajan et al. (2017) in mobile application shopping context. On the other hand, there are studies that this effect did not find empirical support (Koenig-Lewis et al., 2015; Ooi & Tan, 2016).

H₅, which suggests that PU predicts intention to use, was statistically meaningful. In order to use a payment method, consumers seek a sort of benefit in it. These benefits may be unique and possessed by only one payment method. On the other hand, they may also be

comparatively better than other payment methods. Whether these advantageous benefits are unique or not, they should be meaningful in the context that payments are being realized; because, a unique but useless feature will not be favored by consumers.

İstanbulcard offers this contextuality in a seamless way. İstanbulcard holders can take the ferry, pay for their snacks which they get from Beltur Café inside the ferry and rent a bike after they got off the ferry. All these can be paid by İstanbulcard, which makes it convenient, fast and thus, useful. This applicability in various contexts stimulates a sense of increased performance in the eyes of consumers.

Empirical support for the relationship between PU and intention to use a payment technology accords with the previous literature (Koenig-Lewis et al., 2015; Li & Huang, 2009; Ooi & Tan, 2016; Tan et al., 2014). This result also reflects other studies (Sujatha & Sekkizhar, 2019; Natarajan et al., 2017) that were conducted in the context of mobile commerce.

H₆, positive effect of CVD on INT, is supported. Usually, globalization helps new technologies to penetrate into new countries and these new technologies come with various risks. These risks, then, are investigated in several categories such as; physiological, performance, finance, psychological and social. However, this time, globalization brought us a pandemic and therefore, a new risk variable to investigate.

Unlike other perceived risk variables that diminish the intention to use new technology, perceived COVID-19 risk is actually hypothesized to result in higher usage intention. Given that cash changes hands so frequently, it is expected that consumers will fear getting infected by coronavirus if they used cash. Hence, this study found that CVD is a significant factor in the adoption of İstanbulcard.

Similar to this study's perceived COVID-19 risk variable, Puriwat and Tripopsakul (2021) utilized "perceived seriousness" and "perceived susceptibility" from Health Belief Model to look for the effects of the COVID-19 pandemic. They concluded that as participants' fear of consequences of catching coronavirus and their perceived likelihood of

being infected by it increases, they intend to use contactless payments. Moreover, Aji et al. (2020) tested perceived COVID-19 risks of Indonesian and Malaysian samples and their intention to use e-wallets. In line with this study's results, they found that as participants had a fear of catching coronavirus while using cash, they intended to use e-wallets.

H₇, which predicts that SR will lead to INT, is supported. Making their payments in a safe environment is crucial for consumers. Loss of money during a payment process or the storage of value might be a painful experience. Therefore, consumers choose payment methods that will help them keep their money in a safe place and realize the payment without jeopardizing the amount exchanged. Compared to cash, it is safer to store money with İstanbulcard.

The effect of perceived security on intention to use smartcard of a city was evident in the previous literature (Belanche-Gracia et al., 2015). On the other hand, the effect of security risk was not backed by empirical findings in the study of Ooi and Tan (2016) on smartphone credit card adoption. Perceived security was one of the significant factors in mobile payment adoption study of Schierz et al. (2010) although it was not hypothesized to have a direct relationship with intention to use.

5.2 On Similar Studies in Turkey

To look at other studies conducted in Turkey, in the context of contactless card adoption, Eyüboğlu and Sevim (2017) supported the effect of PEOU on PU and intention to use. However, contrary to most literature they found that PU inversely influenced the intention to use.

In the context of mobile payment, the study of Bozpolat and Seyhan (2020) empirically found evidence for the relationships between PEOU and PU, and PEOU and intention to use although PU did not significantly influence intention to use.

Kalyoncuoğlu (2018) found that perceived ease of using virtual cards in online shopping affected perceived usefulness. They, contrary to expectations, did not find

empirical support for PU's effect on intention to use. Çelik and Yılmaz (2011) showed that PEOU predicts PU in online shopping and PU was an important factor that is predicting intention to use which resulted in e-purchase.

In Internet banking adoption, Şiker (2011) found that PU and PEOU predicted intention to use in a statistically meaningful way. Furthermore, Çelik (2008) not only found that PU affected intention to use Internet banking but also showed that PEOU predicted perceived usefulness. Özcan et al. (2019) found that PEOU of mobile banking affects PU of it, which affects intention to use.

Above studies in Turkey presents interesting results in which PU does not come up as a significant factor or has an inverse relationship with intention to use. Therefore, it is safe to say that scales that are tailored to western samples might not be a good fit for Turkish samples and they need to be improved. However, there are also studies that supported the significance of PU in payment adoption research in Turkey. Thus, it may be concluded that Turkish consumers might prefer easiness of a payment method than its usefulness and usefulness might not appear as a significant factor in the adoption of payment methods. In this study, however, both these factors are found to be significant in the adoption of İstanbulcard as a payment method.

5.3 On Cross-cultural Comparisons Including Turkey

Comparison studies between cultures might provide further understanding to the results as most construct measurements are tailored to western respondents. The study of Mao et al. (2005) compared respondents of Unites States and Turkey on the acceptance of mobile phone services that also included payments. Results were significant and in line with this study regarding PEOU's effect on PU, and PU's effect on intention to use. However, PEOU had a non-significant effect on INT in the sample of the U.S. whereas this effect was significant in Turkish sample.

Kurt and Tingöy (2017) used technology acceptance model to explain and compare the adoption of virtual learning technologies in Turkey and United Kingdom. They found that effort expectancy was more important to Turkish sample than performance expectancy. Au contraire, performance expectancy was more important to UK sample.

Above cross-cultural studies indicate significant differences across cultures. In both studies, Turkish sample leaned more over to the hedonic aspect (ease) of the technology rather than utilitarian aspect (usefulness) of it. On the other hand, the U.S. (Mao et al., 2005) and the UK (Kurt & Tingöy, 2017) sample put more value in utilitarian aspects. In the present study, however, both factors were equally important in participant's intention to use İstanbulcard as a payment method.

5.4 On Group Differences

Comparison between men and women did not result in any significant difference on the variables. This result is expected considering that the majority of respondents are younger adults and they are tech-savvy. Moreover, tests on different age brackets (19-24 and 35-44) did not result in any statistically significant difference. These findings are in line with previous smart city card acceptance research (Belanche-Gracia et al., 2015).

When the difference between who had prior knowledge on the new usage areas of İstanbulcard and those who did not is tested, no significant difference was observed. This may indicate that promotional efforts of İstanbul Metropolitan Municipality and Belbim are not enough to make a difference on the usage intention. Otherwise, there would be a significant difference between these groups.

There was a significant difference between those who perceive İstanbul as a smart city and those who do not believe that İstanbul is a smart city. Smart city advocates were inclined to have more positive attitudes towards İstanbulcard's new usage areas. Citizens are the most important stakeholders of the city and this result may suggest that if citizens believe

in the future plans of their municipality, they might be more supportive about the initiatives of their municipality (Konecnik & Go, 2008; Konecnik-Ruzzier & De Chernatony, 2013).

A significant difference in terms of average means in PEOU and PU is observed between active İstanbulcard users and those who do not use it actively. Active users had more positive attitudes about the easiness and usefulness of İstanbulcard payment method. These results suggest that those who do not use İstanbulcard actively have some reservations about its ease of use and usefulness.



6. CONCLUSION

This thesis attempted to understand the perceptions of İstanbulites on adopting their municipality payment card's new usage areas in smart city context. Specifically, this study is focused on İstanbulcard and its usage in İstanbul. The card is produced by Belbim which is a subsidiary company of İstanbul Metropolitan Municipality. İstanbulites have been using this plastic card for a long time; however, as the city evolves, so does İstanbulcard's role in the city.

The municipality envisions İstanbul to be a smart city; therefore, as one of the technology subsidiaries of the municipality, Belbim strives to be a part of this smart city plan. Formerly, İstanbulcard was only used for paying in-city public transportation fees. However, with the new vision of Belbim about İstanbulcard, the usage area of it grows each passing day. New partnerships are announced frequently and both public and private companies acknowledge it as a valid payment method. To name a few; cafés, mobile taxi apps, convenience stores, car parks and e-grocery apps are now accepting payment with İstanbulcard.

İstanbulcard is not only an instrument of payment for consumers but also a promising multi-purpose tool for the municipality to manage the city. To elaborate on this, the municipality distributes social aid to those who suffers from poverty via depositing money on their İstanbulcards. In the COVID-19 pandemic, it also has been used as a validator in public transportation, informing the driver about whether the passenger has to be in quarantine or not. This can be considered as a health management method.

Therefore, this thesis claims that İstanbulcard is not only a payment method but also a multi-purpose smart city card that helps the municipality to pursue its smart city ambitions. Then, if consumers accept its usage beyond transportation, it can be concluded that they are embracing it as a smart city card.

Backed by the literature, this study does not treat the smart city concept as an unachievable high-tech utopia. It would not be a good practice for city managers to implement each smart product and service of high-tech corporates without a careful planning and consideration just to brand themselves as a smart city. Therefore, the smart city concept in this study does not answer the question ‘how many expensive high technology solutions can a city afford to buy’; however, it solely focuses on solutions whether they are technology related or not.

As a consequence of these, the discussion of whether cities are smart or ‘not smart’ will not have a meaningful contribution to their progress except for marketing purposes. Then, rather than contemplating on labeling cities as smart or not, interrogating their place on a continuous line which determines the degree of smartness might be a better approach. Taking this approach helps individual solutions that are adding to the smartness of cities to gain importance.

6.1 Academic Implications

As a theoretical contribution, an extension to TAM is tested and validated in this study. The usage of TAM is also extended into the field of municipality multi-purpose-card adoption research. Conducting analyses with PLSc-PM algorithm is also a novelty in the electronic payment adoption research. The parsimonious research model of this study explained the variance in PU and INT by almost 70% and 79%, respectively.

Furthermore, another theoretical contribution of this study is that it took a municipality card as a research focus in a smart city context. This topic has not drawn much attention among scholars although some research exists on cards that are primarily used for paying public transportation fees. Therefore, to the best of author’s knowledge, this thesis is one of the firsts to conduct a research on a municipality card that has diverse applications as in the case of İstanbulcard.

This adds to the current discussion of smart cities by siding with scholars who take a more human-oriented approach rather than a high-technology-oriented one. İstanbulcard, a simple plastic card that touches the lives of citizens of İstanbul on various aspects, is given as an example to a low-tech but smart solution in city management. The results of this research indicates that consumers might accept municipality payment cards as smart city cards to interact with both public and private services offered to them.

Two rather untapped constructs, PTC and PTS are found to be the predictors of perceived usefulness. Moreover, this study is conducted in a period of pandemic and established the effect of CVD on intention to use. Therefore, this work also extended the understanding of payment technology adoption with a health behavior. In addition, this study demonstrated that the effects of PEOU on PU and on INT, and the effect of SR on INT are relevant in smart city card adoption research.

6.2 Managerial Implications

On a managerial perspective, results imply that PU, PEOU, CVD and SR are important factors in the adoption intention of card-based electronic payment methods and of municipality cards. Therefore, suggestions in this section may apply for both city managers and managers in the electronic payment industry.

To enhance PU of a payment method, PTC, PTS and PEOU need to be increased. In the domain of municipality cards, cities should increase the number of participating merchants. Creating an ecosystem in which municipality cards can be widely used in both public and private services would enhance convenience perceptions of citizens. This can be done by allowing merchants to accept payments with their smartphones. As in the case of Octopus Card, smartphones can be utilized as mobile POS machines. This connected ecosystem may induce a perception in citizens that they do not need any other payment methods than their municipality cards; because, their cards will apply to most businesses.

A meaningful spatial interconnectedness between İstanbulcard and participating companies would also improve the sense of convenience. For instance, the municipality can deploy İsbike bike stations proximate to Beltur cafés. This would allow İsbike users to give a small break and purchase beverages from Beltur cafés. This scenario is possible without the bike stations near Beltur; however, the time spent resting would cost additional renting fee if the bike was not returned back to a dock.

To increase the perceived speed of smart city cards, contactless solutions as İstanbulcard should be preferred. The fact that these smart cards do not need PIN codes for validation increases both their perceived speed and convenience. The amount of time contactless cards save compared to traditional payment methods, such as cash, should be one of the focus points on municipalities' value proposition. The hassle of handling remainders of a transaction should be emphasized in promotional efforts. Therefore, municipalities should not only increase the perceived benefits of using their cards but also effectively communicate them to citizens.

Improving the user-friendliness of the payment method is vital and it starts with depositing money in the prepaid card. Therefore, both online and offline channels for reloading should be provided to consumers in order to increase the perceived ease of use. Moreover, as in the case of İstanbulcard's mobile app, a digital version of the plastic card should be offered. However, considering the children and the elderly, the existence of a card-based solution is crucial. Therefore, both online and offline solutions should coexist so that people can opt for whichever they find easier to use.

Additionally, citizens should have no reservations on the technical capability of municipality about the safety of monetary transactions. When it comes to financial issues, trust is delicate and it can be lost easily. Considering that banks have diverse and solid security measures, it is hard for municipalities to compete with them in the protection of financial values of users. However, citizens should be provided with channels in which they can report any emergency about the safety of their cards. Both online and offline solutions should be offered to those who need to take action about the security of their cards in case of

loss, theft or technical problems. Moreover, consumers also should be given the right to withdraw money from the card either physically from ATMs or digitally by having the money transferred back to their bank accounts. This would give citizens a sense of control on their financial values.

Findings on perceived COVID-19 risk construct suggest that in times of a pandemic, consumers might refrain from using cash and lean towards contactless options. Therefore, this might be an opportunity for contactless payment providers to promote themselves as hygienic and defame cash by stating that it is insanitary. Considering that cash will always carry germs with or without the current coronavirus pandemic, municipalities can exploit current high-awareness of citizens about these issues and alienate them from using cash unnecessarily. This can be achieved via advertisements that will demarket the use of cash.

Moreover, Belbim's successful utilization of İstanbulcard as a multi-purpose card should be observed carefully by other city managers. In the COVID-19 crisis, the partnership between İstanbulcard and the Ministry of Health was both a prominent example of successful e-government implementation and of a low-cost smart solution. Briefly, the Ministry assigned codes to citizens and these codes indicated whether they could use public transportation or not. These personal codes were registered to personal İstanbulcards. People who were tested positive for coronavirus or were exposed to it, were not allowed to use public transportation. The fact that the majority of İstanbulites already had İstanbulcards helped this solution to achieve success in little time. This shows that the usage rates of municipal cards have the utmost importance for future smart cities to manage their citizens.

The efforts of Belbim to have corporate employees integrated into its ecosystem also should not go unnoticed. Employee-İstanbulcards that have additional usage possibilities, such as; ID, door key and meal card have a promising future. This is because not only they will be convenient for employees but also administrations will use them as a personnel attendance control system.

One can assume that İstanbulcard will turn into a student-İstanbulcard (not to be confused with the discounted student card) and penetrate into schools and university campuses, as well. Partnerships with school canteens would allow students to pay with İstanbulcard. The city can promote the usage of this card by offering discounts in the museums that accept İstanbulcard as a payment method. By doing this, the city can fulfill its duty to cultivate smart people which participate in cultural activities.

Lastly, it can be said that Belbim is on the right track with its current value proposition (convenience, speed and security) and advertisements (which put forward hygiene). Nevertheless, other municipalities should tailor their values according to the needs of their citizens, as the needs about smart city cards might not be universal.

6.3 Research Limitations

Regarding the limitations of the present research, given that the sample does not represent the population, the results should be interpreted accordingly. A bias could have stemmed from the fact that the majority of respondents belonging to the 25-34 age bracket and higher education levels. The incentive that is utilized to attract people into answering the questionnaire might have biased the results, as well.

A qualitative study beforehand could have helped fine-tuning the variables or finding other important factors in the adoption of smart city cards. However, due to time constraints and pandemic it was not possible to conduct a well-designed face-to-face qualitative study. Moreover, the lack of previous research in the adoption of municipality cards that has diverse functionality and applications like İstanbulcard makes it difficult to validate the results.

6.4 Further Research Directions

Future research should test this extended research model in the acceptance of other municipality cards in other cities. The effect of smart city cards on the customer-based brand equity of cities might be a research interest. A comparison study between the acceptances of

plastic municipality smart cards versus their mobile app equivalents can yield significant results especially for city managers.

Scholars can extend this model by investigating the effects of other risk variables. Privacy might be an important concern for citizens. Moreover, the effect of peer influence can be a factor in the adoption of smart city cards. Therefore, variables such as *subjective norms* can extend the current model. The fact that this study is conducted in pandemic also leaves important findings for post-pandemic researchers for making comparison studies.



REFERENCES

- Abosag, N. H. (2019). Impact of privacy issues on smart city services in a model smart city. *International Journal of Advanced Computer Science and Applications*, 10(2), 177-185.
- Abu-Shanab, E., & Ghaleb, O. (2012). Adoption of mobile commerce technology: An involvement of trust and risk concerns. *International Journal of Technology Diffusion (IJTD)*, 3(2), 36-49.
- Adams, J., Khan, H. T., Raeside, R., & White, D. I. (2007). *Research methods for graduate business and social science students*. SAGE Publications.
- Ağraş, S., Yıldız, A., & Aktürk, E. (2020). Akıllı Turizmin Türkiye’de Uygulanabilirliği: İstanbul Örneği. *Bartın Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 11(21), 207-231.
- Ahvenniemi, H., Huovila, A., Pinto-Seppä, I., & Airaksinen, M. (2017). What are the differences between sustainable and smart cities?. *Cities*, 60, 234-245.
- Aji, H. M., Berakon, I., & Husin, M. M. (2020). COVID-19 and e-wallet usage intention: A multigroup analysis between Indonesia and Malaysia. *Cogent Business & Management*, 7(1), 1804181.
- Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckmann (Eds.), *Action-control: From cognition to behavior*. Heidelberg: Springer. 11-39
- Ajzen, I. (2020). The theory of planned behavior: Frequently asked questions. *Human Behavior and Emerging Technologies*, 2(4), 314-324.
- Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, N.J: Prentice-Hall.
- Akhlaq, A., & Ahmed, E. (2013). The effect of motivation on trust in the acceptance of internet banking in a low income country. *The International Journal of Bank Marketing*, 31(2), 115-125.
- Akin, U., & Ongel, A. (2017). Smart city policies and practices for Istanbul in a Nutshell. In Pardalos, P. M., & Gakis, K. (Eds.). (2017). *Network Design and Optimization for Smart Cities (Vol. 8)*. World Scientific. 361-385.

- Akinci, S., Aksoy, Ş., & Atilgan, E. (2004). Adoption of internet banking among sophisticated consumer segments in an advanced developing country. *International journal of bank marketing*, 22(3), 212-232.
- Al-Awadhi, S., & Morris, A. (2008, January). The Use of the UTAUT Model in the Adoption of E-government Services in Kuwait. In *Proceedings of the 41st annual Hawaii international conference on system sciences (HICSS 2008)*. 219-219.
- Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of urban technology*, 22(1), 3-21.
- Al-Jabri, I. M., & Sohail, M. S. (2012). Mobile banking adoption: Application of diffusion of innovation theory. *Journal of Electronic Commerce Research*, 13(4), 379-391.
- Alvarez, M. D., & Yarcın, Ş. (2010). Istanbul as a world city: a cultural perspective. *International Journal of Culture, Tourism and Hospitality Research*, 4(3), 266-276.
- Angelidou, M. (2014). Smart city policies: A spatial approach. *Cities*, 41, 3-11.
- Angelidou, M. (2015). Smart cities: A conjuncture of four forces. *Cities*, 47, 95-106.
- Angelidou, M. (2017). The role of smart city characteristics in the plans of fifteen cities. *Journal of Urban Technology*, 24(4), 3-28.
- Anthopoulos, L. G. (2017). The rise of the smart city. In *Understanding smart cities: A tool for smart government or an industrial trick?* Springer, Cham. 5-45.
- Anthopoulos, L., Fitsilis, P., & Ziozias, C. (2019). What is the Source of Smart City Value?: A Business Model Analysis. In *Smart Cities and Smart Spaces: Concepts, Methodologies, Tools, and Applications*. IGI Global. 56-77.
- Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of marketing research*, 14(3), 396-402.
- Arroub, A., Zahi, B., Sabir, E., & Sadik, M. (2016, October). A literature review on Smart Cities: Paradigms, opportunities and open problems. In *2016 International Conference on Wireless Networks and Mobile Communications (WINCOM)*. IEEE.180-186.
- Ashley, C., Noble, S. M., Donthu, N., & Lemon, K. N. (2011). Why customers won't relate: Obstacles to relationship marketing engagement. *Journal of Business Research*, 64(7), 749-756.

- Ateş, M., & Önder, D. E. (2019). 'Akıllı Şehir' Kavramı ve Dönüşen Anlamı Bağlamında Eleştiriler. *Megaron*, 14(1), 41-50.
- Babalik-Sutcliffe, E., & Cengiz, E. C. (2015). Bus rapid transit system in Istanbul: a success story or flawed planning decision?. *Transport Reviews*, 35(6), 792-813.
- Bagozzi, R. P. (2011). Measurement and meaning in information systems and organizational research: Methodological and philosophical foundations. *MIS quarterly*, 35(2), 261-292.
- Bailey, A. A., Pentina, I., Mishra, A. S., & Mimoun, M. S. B. (2017). Mobile payments adoption by US consumers: an extended TAM. *International Journal of Retail & Distribution Management*. 45(6), 626-640.
- Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs, NJ, 1986.
- Bandura, A., & Walters, R. H. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice-hall.
- Belanche-Gracia, D., Casaló-Ariño, L. V., & Pérez-Rueda, A. (2015). Determinants of multi-service smartcard success for smart cities development: A study based on citizens' privacy and security perceptions. *Government information quarterly*, 32(2), 154-163.
- Bergsten, E. E. (1967). Credit Cards—A Prelude to the Cashless Society. *Boston College Law Review*, 8(3), 485-518.
- Bilbil, E. T. (2017). The operationalizing aspects of smart cities: The case of Turkey's smart strategies. *Journal of the Knowledge Economy*, 8(3), 1032-1048.
- Bower, L. L. (2018, November). The development impact of smart city programs: A case study: Istanbul's smarter city initiative. In *2018 IEEE International Symposium on Technology and Society (ISTAS)*. 20-25.
- Bozpolat, C., & Seyhan, H. (2020). Mobil Ödeme Teknolojisi Kabulünün Teknoloji Kabul Modeli ile Incelenmesi: Ampirik Bir Arastırma. *Cankiri Karatekin Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 10(1), 119-145.
- Brdulak, A. (2017). The concept of a smart city in the context of an ageing population. *Transport Economics and Logistics*, 68, 65-75.
- Calzada, I. 2021. *Smart City Citizenship*. Cambridge, Massachusetts: Elsevier.

- Calzada, I., & Cobo, C. (2015). Unplugging: Deconstructing the smart city. *Journal of Urban Technology*, 22(1), 23-43.
- Cameron, J., & Pierce, W. D. (1994). Reinforcement, reward, and intrinsic motivation: A meta-analysis. *Review of Educational research*, 64(3), 363-423.
- Cameron, J., & Pierce, W. D. (1996). The debate about rewards and intrinsic motivation: Protests and accusations do not alter the results. *Review of Educational Research*, 66(1), 39-51.
- Capdevila, I., & Zarlenga, M. I. (2015). Smart city or smart citizens? The Barcelona case. *Journal of Strategy and Management*, 8(3), 266-282.
- Castaneda, J. A., Frias, D. M., Munoz-Leiva, F., & Rodriguez, M. A. (2007). Extrinsic and intrinsic motivation in the use of the internet as a tourist information source. *International Journal of Internet Marketing and Advertising*, 4(1), 37-52.
- Çelik, H. (2008). What determines Turkish customers' acceptance of internet banking?. *The International Journal of Bank Marketing*, 26(5), 353-370.
- Çelik, H. E., & Yilmaz, V. (2011). Extending the technology acceptance model for adoption of e-shopping by consumers in Turkey. *Journal of Electronic Commerce Research*, 12(2), 152-164.
- Chan, S. C. (2004). Understanding internet banking adoption and use behavior: A Hong Kong perspective. *Journal of Global Information Management (JGIM)*, 12(3), 21-43.
- Chau, P. Y., & Hu, P. J. H. (2001). Information technology acceptance by individual professionals: A model comparison approach. *Decision sciences*, 32(4), 699-719.
- Chau, P. Y., & Poon, S. (2003). Octopus: an e-cash payment system success story. *Communications of the ACM*, 46(9), 129-133.
- Chen, K. Y., & Chang, M. L. (2013). User acceptance of 'near field communication' mobile phone service: an investigation based on the 'unified theory of acceptance and use of technology' model. *The Service Industries Journal*, 33(6), 609-623.
- Chen, L. D. (2008). A model of consumer acceptance of mobile payment. *International Journal of Mobile Communications*, 6(1), 32-52.
- Chiu, Y. T. H., Fang, S. C., & Tseng, C. C. (2010). Early versus potential adopters: Exploring the antecedents of use intention in the context of retail service

- innovations. *International Journal of Retail and Distribution Management*, 38(6), 443-459.
- Churchill Jr, G. A. (1979). A paradigm for developing better measures of marketing constructs. *Journal of marketing research*, 16(1), 64-73.
- Clever, S., Crago, T., Polka, A., Al-Jaroodi, J., & Mohamed, N. (2018). *Ethical analyses of smart city applications*. *Urban science*, 2(4), 96.
- Cocchia, A. (2014). Smart and digital city: A systematic literature review. In *Smart city* (pp. 13-43). Springer, Cham.
- Colding, J., Colding, M., & Barthel, S. (2020). The smart city model: A new panacea for urban sustainability or unmanageable complexity?. *Environment and Planning B: Urban Analytics and City Science*, 47(1), 179-187.
- Compeau, D. R., & Higgins, C. A. (1995a). Application of social cognitive theory to training for computer skills. *Information systems research*, 6(2), 118-143.
- Compeau, D. R., & Higgins, C. A. (1995b). Computer self-efficacy: Development of a measure and initial test. *MIS quarterly*, 19(2), 189-211.
- Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches*. SAGE Publications.
- Cronin, D., & McGuinness, A. (2010). Retail Payment Practices: How They Have Evolved in Recent Times and Where They Might Be Going. *Quarterly Bulletin*, 2, 56-82.
- Csikszentmihalyi, M. (2008). *Flow: The Psychology of Optimal Experience*. ser. PS Series, HarperCollins.
- Cugurullo, F. (2013). How to build a sandcastle: An analysis of the genesis and development of Masdar City. *Journal of urban technology*, 20(1), 23-37.
- Dameri, R. P., & Rosenthal-Sabroux, C. (2014). Smart city and value creation. In *Smart city* (pp. 1-12). Springer, Cham.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 13(3), 319-340.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace 1. *Journal of applied social psychology*, 22(14), 1111-1132.

- De Kerviler, G., Demoulin, N. T., & Zidda, P. (2016). Adoption of in-store mobile payment: Are perceived risk and convenience the only drivers?. *Journal of Retailing and Consumer Services*, 31, 334-344.
- Denscombe, M. (2010). *The good research guide: For small-scale social research projects*. McGraw-Hill Education.
- Dewan, S. G., & Chen, L. D. (2005). Mobile payment adoption in the US: A cross-industry, crossplatform solution. *Journal of Information Privacy and Security*, 1(2), 4-28.
- Dijkstra, T. K., & Henseler, J. (2015). Consistent partial least squares path modeling. *MIS quarterly*, 39(2), 297-316.
- Do, N., Tham, J., Khatibi, A., & Azam, S. (2019). An empirical analysis of Cambodian behavior intention towards mobile payment. *Management Science Letters*, 9(12), 1941-1954.
- Duarte, P., e Silva, S. C., & Ferreira, M. B. (2018). How convenient is it? Delivering online shopping convenience to enhance customer satisfaction and encourage e-WOM. *Journal of Retailing and Consumer Services*, 44, 161-169.
- Efron, B. (1987). Better bootstrap confidence intervals. *Journal of the American statistical Association*, 82(397), 171-185.
- Evans, J., Schliwa, G., & Luke, K. (2016). The glorious failure of the experimental city: Cautionary tales from Arcosanti and Masdar City. In Evans, J., Karvonen, A., & Raven, R. (Eds.). *The experimental city*. Routledge.
- Eyuboglu, K., & Sevim, U. (2017). Determinants of contactless credit cards acceptance in Turkey. *Uluslararası Yönetim İktisat ve İşletme Dergisi*, 13(2), 331-346.
- Falconer, G., & Mitchell, S. (2012). Smart city framework. *Cisco Internet Business Solutions Group (IBSG)*, 12(9), 2-10.
- Featherman, M. S., & Pavlou, P. A. (2003). Predicting e-services adoption: a perceived risk facets perspective. *International journal of human-computer studies*, 59(4), 451-474.
- Ferguson, R. (2006). Using private label credit cards as a loyalty tool. *Journal of Consumer Marketing*, 23(7), 374-378.
- Fernandez-Anez, V., Fernández-Güell, J. M., & Giffinger, R. (2018). Smart City implementation and discourses: An integrated conceptual model. The case of Vienna. *Cities*, 78, 4-16.

- Fishbein, M., & Ajzen, I. (2011). Predicting and changing behavior: The reasoned action approach. Taylor & Francis.
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of marketing research*, 18(1), 39-50.
- Fromhold-Eisebith, M., & Eisebith, G. (2019). What can Smart City policies in emerging economies actually achieve? Conceptual considerations and empirical insights from India. *World Development*, 123, 104614.
- Garcia, G. (1980). Credit cards: An interdisciplinary survey. *Journal of Consumer Research*, 6(4), 327-337.
- Gbongli, K., Xu, Y., & Amedjonekou, K. M. (2019). Extended Technology Acceptance Model to predict mobile-based money acceptance and sustainability: a multi-analytical structural equation modeling and neural network approach. *Sustainability*, 11(13), 3639.
- George, D., & Mallery, M. (2010). SPSS for Windows Step by Step: A Simple Guide and Reference, 17.0 update (10a ed.). Boston: Pearson.
- Gil-Garcia, J. R., Pardo, T. A., & Nam, T. (2015). What makes a city smart? Identifying core components and proposing an integrative and comprehensive conceptualization. *Information Polity*, 20(1), 61-87.
- Haarstad, H. (2017). Constructing the sustainable city: Examining the role of sustainability in the 'smart city' discourse. *Journal of Environmental Policy & Planning*, 19(4), 423-437.
- Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2016). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage publications.
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing theory and Practice*, 19(2), 139-152.
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019b). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2-24.
- Hair, J. F., Sarstedt, M., & Ringle, C. M. (2019a). Rethinking some of the rethinking of partial least squares. *European Journal of Marketing*, 53(4), 566-584.
- Hair, J.F., William, C.B., Babin, B.J. & Anderson, R.E. (2014). *Multivariate Data Analysis*. Pearson Education.

- Hegner, S. M., Beldad, A. D., & Brunswick, G. J. (2019). In automatic we trust: investigating the impact of trust, control, personality characteristics, and extrinsic and intrinsic motivations on the acceptance of autonomous vehicles. *International Journal of Human-Computer Interaction*, 35(19), 1769-1780.
- Henseler, J. (2017). Partial least squares path modeling. In *Advanced methods for modeling markets* (pp. 361-381). Springer, Cham.
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science*, 43(1), 115-135.
- Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. In *New challenges to international marketing*. Emerald Group Publishing Limited.
- Ho, K. K., & See-To, E. W. K. (2010). An exploratory study on the impact of trust on different E-payment gateways: Octopus card vs. credit card. In *PACIS 2010 proceedings*, 475-486.
- Hoelter, J. W. (1983). The analysis of covariance structures: Goodness-of-fit indices. *Sociological Methods & Research*, 11(3), 325-344.
- Hollands, R. G. (2008). Will the real smart city please stand up? Intelligent, progressive or entrepreneurial?. *City*, 12(3), 303-320.
- Hollands, R. G. (2015). Critical interventions into the corporate smart city. Cambridge *Journal of Regions, Economy and Society*, 8(1), 61-77.
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal*, 6(1), 1-55.
- Huang, T. C. K., Liu, C. C., & Chang, D. C. (2012). An empirical investigation of factors influencing the adoption of data mining tools. *International Journal of Information Management*, 32(3), 257-270.
- Huffman, W. E., Rousu, M., Shogren, J. F., & Tegene, A. (2007). The effects of prior beliefs and learning on consumers' acceptance of genetically modified foods. *Journal of Economic Behavior & Organization*, 63(1), 193-206.
- Hughes, J. R., Keely, J. P., Fagerstrom, K. O., & Callas, P. W. (2005). Intentions to quit smoking change over short periods of time. *Addictive Behaviors*, 30(4), 653-662.

- Huh, H. J., Kim, T. T., & Law, R. (2009). A comparison of competing theoretical models for understanding acceptance behavior of information systems in upscale hotels. *International Journal of Hospitality Management*, 28(1), 121-134.
- Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research: A review of four recent studies. *Strategic management journal*, 20(2), 195-204.
- Humphrey, D. (2014). Payments and payment systems (2nd ed.). *The Oxford Handbook of Banking*. <https://doi.org/10.1093/oxfordhb/9780199688500.013.0017>
- Im, I., Hong, S., & Kang, M. S. (2011). An international comparison of technology adoption: Testing the UTAUT model. *Information & management*, 48(1), 1-8.
- Jansson-Boyd, C. V. (2019). Quantitative Research: Its Place in Consumer Psychology. In Hackett, P. M. W. (Ed.). *Quantitative research methods in consumer psychology: Contemporary and data driven approaches*. Taylor & Francis. pp. 1–21.
- Jaradat, M. I. R. M., & Al-Mashaqba, A. M. (2014). Understanding the adoption and usage of mobile payment services by using TAM3. *International Journal of Business Information Systems*, 16(3), 271-296.
- Joss, S., Cook, M., & Dayot, Y. (2017). Smart cities: Towards a new citizenship regime? A discourse analysis of the British smart city standard. *Journal of Urban Technology*, 24(4), 29-49.
- Kalyoncuoğlu, S. (2018). Tüketicilerin online alışverişlerindeki sanal kart kullanımlarının teknoloji kabul modeli ile incelenmesi. *Afyon Kocatepe Üniversitesi Sosyal Bilimler Dergisi*, 20(2), 193-213.
- Keeling, D. I. (2019). Contemporary Approaches to Modelling the Consumer. In Hackett, P. M. W. (Ed.). *Quantitative research methods in consumer psychology: Contemporary and data driven approaches*. Taylor & Francis. pp. 222–246.
- Kitchin, R. (2014). The real-time city? Big data and smart urbanism. *GeoJournal*, 79(1), 1-14.
- Kline, R. B. (2011). *Principles and practice of structural equation modeling*. NY: New York. Guilford publications.
- Koenig-Lewis, N., Marquet, M., Palmer, A., & Zhao, A. L. (2015). Enjoyment and social influence predicting mobile payment adoption. *The Service Industries Journal*, 35(10), 537-554.

- Kohn, A. (1996). By all available means: Cameron and Pierce's defense of extrinsic motivators. *Review of educational research*, 66(1), 1-4.
- Konecnik, M., & Go, F. (2008). Tourism destination brand identity: The case of Slovenia. *Journal of brand management*, 15(3), 177-189.
- Konecnik-Ruzzier, M., & De Chernatony, L. (2013). Developing and applying a place brand identity model: The case of Slovenia. *Journal of Business Research*, 66(1), 45-52.
- Kumar, D., & Ryu, Y. (2009). A brief introduction of biometrics and fingerprint payment technology. *International Journal of advanced science and Technology*, 4, 25-38.
- Kurt, Ö. E., & Tingöy, Ö. (2017). The acceptance and use of a virtual learning environment in higher education: an empirical study in Turkey, and the UK. *International Journal of Educational Technology in Higher Education*, 14(1), 1-15.
- Kwong, S. W., & Park, J. (2008). Digital music services: consumer intention and adoption. *The service industries journal*, 28(10), 1463-1481.
- Lee, M. C. (2009). Factors influencing the adoption of internet banking: An integration of TAM and TPB with perceived risk and perceived benefit. *Electronic commerce research and applications*, 8(3), 130-141.
- Lee, Y. H., Hsieh, Y. C., & Chen, Y. H. (2013). An investigation of employees' use of e-learning systems: applying the technology acceptance model. *Behaviour & Information Technology*, 32(2), 173-189.
- Lepper, M. R., Keavney, M., & Drake, M. (1996). Intrinsic motivation and extrinsic rewards: A commentary on Cameron and Pierce's meta-analysis. *Review of educational research*, 66(1), 5-32.
- Letaifa, S. B. (2015). How to strategize smart cities: Revealing the SMART model. *Journal of business research*, 68(7), 1414-1419.
- Li, Y. H., & Huang, J. W. (2009). Applying theory of perceived risk and technology acceptance model in the online shopping channel. *World Academy of Science, Engineering and Technology*, 53(1), 919-925.
- Liébana-Cabanillas, F., Muñoz-Leiva, F., & Sánchez-Fernández, J. (2015). Behavioral model of younger users in m-payment systems. *Journal of Organizational Computing and Electronic Commerce*, 25(2), 169-190.

- Liu, Y. C., Kuo, R. L., & Shih, S. R. (2020). COVID-19: The first documented coronavirus pandemic in history. *Biomedical journal*, 43(4), 328-333.
- Lu, Y., Yang, S., Chau, P. Y., & Cao, Y. (2011). Dynamics between the trust transfer process and intention to use mobile payment services: A cross-environment perspective. *Information & management*, 48(8), 393-403.
- Lytras, M. D., & Visvizi, A. (2018). Who uses smart city services and what to make of it: Toward interdisciplinary smart cities research. *Sustainability*, 10(6), 1998.
- Mackenzie, N., & Knipe, S. (2006). Research dilemmas: Paradigms, methods and methodology. *Issues in educational research*, 16(2), 193-205.
- Madden, T. J., Ellen, P. S., & Ajzen, I. (1992). A comparison of the theory of planned behavior and the theory of reasoned action. *Personality and social psychology Bulletin*, 18(1), 3-9.
- Manski, C. F. (1990). The use of intentions data to predict behavior: A best-case analysis. *Journal of the American Statistical Association*, 85(412), 934-940.
- Manstead, A. S., & Van Eekelen, S. A. (1998). Distinguishing between perceived behavioral control and self-efficacy in the domain of academic achievement intentions and behaviors. *Journal of applied social psychology*, 28(15), 1375-1392.
- Mao, E., Srite, M., Bennett Thatcher, J., & Yaprak, O. (2005). A research model for mobile phone service behaviors: empirical validation in the US and Turkey. *Journal of Global Information Technology Management*, 8(4), 7-28.
- Martins, C., Oliveira, T., & Popovič, A. (2014). Understanding the Internet banking adoption: A unified theory of acceptance and use of technology and perceived risk application. *International Journal of Information Management*, 34(1), 1-13.
- Meijer, A., & Bolívar, M. P. R. (2016). Governing the smart city: a review of the literature on smart urban governance. *International Review of Administrative Sciences*, 82(2), 392-408.
- Ming, L. T. (2011). Value Chain Flexibility with RFID: A Case Study of the Octopus Card. *International Journal of Engineering Business Management*, 3(1.), 44-49.
- Mishkin, F. S. (2007). The economics of money, banking, and financial markets. Pearson education.

- Muk, A., & Chung, C. (2015). Applying the technology acceptance model in a two-country study of SMS advertising. *Journal of Business Research*, 68(1), 1-6.
- Mukhtar, A., & Butt, M. M. (2012). Intention to choose Halal products: the role of religiosity. *Journal of Islamic Marketing*, 3(2), 108-120.
- Nam, T., & Pardo, T. A. (2011, June). Conceptualizing smart city with dimensions of technology, people, and institutions. In *Proceedings of the 12th annual international digital government research conference: digital government innovation in challenging times*. 282-291.
- Natan, M. B., Beyil, V., & Neta, O. (2009). Nurses' perception of the quality of care they provide to hospitalized drug addicts: Testing the theory of reasoned action. *International Journal of Nursing Practice*, 15(6), 566-573.
- Natarajan, T., Balasubramanian, S. A., & Kasilingam, D. L. (2017). Understanding the intention to use mobile shopping applications and its influence on price sensitivity. *Journal of Retailing and Consumer Services*, 37, 8-22.
- Nilssen, M. (2019). To the smart city and beyond? Developing a typology of smart urban innovation. *Technological forecasting and social change*, 142, 98-104.
- Nov, O., & Ye, C. (2008). Users' personality and perceived ease of use of digital libraries: The case for resistance to change. *Journal of the American Society for Information Science and Technology*, 59(5), 845-851.
- Ogden, J. (2003). Some problems with social cognition models: A pragmatic and conceptual analysis. *Health psychology*, 22(4), 424.
- Ooi, K. B., & Tan, G. W. H. (2016). Mobile technology acceptance model: An investigation using mobile users to explore smartphone credit card. *Expert Systems with Applications*, 59, 33-46.
- Özcan, H. P., ÇELİK, Ş. S., & Alper, Ö. Z. E. R. (2019). Bireysel Müşterilerin Mobil Bankacılık Kullanım Niyetini Etkileyen Faktörler. *Çankırı Karatekin Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 9(2), 475-506.
- Ozturk, A. B., Bilgihan, A., Nusair, K., & Okumus, F. (2016). What keeps the mobile hotel booking users loyal? Investigating the roles of self-efficacy, compatibility, perceived ease of use, and perceived convenience. *International Journal of Information Management*, 36(6), 1350-1359.

- Ozturk, A. B., Bilgihan, A., Salehi-Esfahani, S., & Hua, N. (2017). Understanding the mobile payment technology acceptance based on valence theory. *International Journal of Contemporary Hospitality Management*, 29(8), 2027-2049.
- Pham, Q. T., Tran, X. P., Misra, S., Maskeliūnas, R., & Damaševičius, R. (2018). Relationship between convenience, perceived value, and repurchase intention in online shopping in Vietnam. *Sustainability*, 10(1), 156.
- Pryor, B. W., & Pryor, C. R. (2009). What Will Teachers Do to Involve Parents in Education?: Using a Theory of Reasoned Action. *Journal of Educational Research & Policy Studies*, 9(1), 45-59.
- Pryor, F. L. (1977). The origins of money. *Journal of Money, Credit and Banking*, 9(3), 391-409.
- Puriwat, W., & Tripopsakul, S. (2021). Explaining an Adoption and Continuance Intention to Use Contactless Payment Technologies: During the COVID-19 Pandemic. *Emerging Science Journal*, 5(1), 85-95.
- Ramos-de-Luna, I., Montoro-Ríos, F., & Liébana-Cabanillas, F. (2016). Determinants of the intention to use NFC technology as a payment system: an acceptance model approach. *Information Systems and e-Business Management*, 14(2), 293-314.
- Rode, H. (2016). To share or not to share: the effects of extrinsic and intrinsic motivations on knowledge-sharing in enterprise social media platforms. *Journal of Information Technology*, 31(2), 152-165.
- Rogers, E. M. (1983). *Diffusion of Innovations*. The Free Press, 1983.
- Rogers, E. M. (2002). Diffusion of preventive innovations. *Addictive behaviors*, 27(6), 989-993.
- Rossi, A. N., & Armstrong, J. B. (1999). Theory of reasoned action vs. theory of planned behavior: Testing the suitability and sufficiency of a popular behavior model using hunting intentions. *Human Dimensions of Wildlife*, 4(3), 40-56.
- Rysman, M., & Schuh, S. (2017). New innovations in payments. *Innovation Policy and the Economy*, 17(1), 27-48.
- Ryu, H. S. (2018, January). Understanding benefit and risk framework of fintech adoption: Comparison of early adopters and late adopters. In *Proceedings of the 51st Hawaii International Conference on System Sciences*. <http://hdl.handle.net/10125/50374>
- Salkind, N. J. (Ed.). (2010). *Encyclopedia of research design* (Vol. 1). Sage.

- Samar, S., Ghani, M., & Alnaser, F. (2017). Predicting customer's intentions to use internet banking: the role of technology acceptance model (TAM) in e-banking. *Management Science Letters*, 7(11), 513-524.
- Sarstedt, M., Ringle, C. M., Smith, D., Reams, R., & Hair Jr, J. F. (2014). Partial least squares structural equation modeling (PLS-SEM): A useful tool for family business researchers. *Journal of Family Business Strategy*, 5(1), 105-115.
- Sarver, V.T. (1983). Ajzen and Fishbein's "Theory of Reasoned Action": A Critical Assessment. *Journal for the Theory of Social Behaviour*, 13(2), 155-164.
- Saunders, M., Lewis, P., & Thornhill, A. (2019). *Research methods for business students*. Pearson education.
- Sayar, C., & Wolfe, S. (2007). Internet banking market performance: Turkey versus the UK. *International Journal of Bank Marketing*, 25(3), 122-141.
- Schierz, P. G., Schilke, O., & Wirtz, B. W. (2010). Understanding consumer acceptance of mobile payment services: An empirical analysis. *Electronic commerce research and applications*, 9(3), 209-216.
- Shang, R. A., Chen, Y. C., & Shen, L. (2005). Extrinsic versus intrinsic motivations for consumers to shop on-line. *Information & Management*, 42(3), 401-413.
- Shelton, T., Zook, M., & Wiig, A. (2015). The 'actually existing smart city'. *Cambridge Journal of Regions, Economy and Society*, 8(1), 13-25.
- Sheppard, B. H., Hartwick, J., & Warshaw, P. R. (1988). The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of consumer research*, 15(3), 325-343.
- Shin, S., & Lee, W. J. (2014). The effects of technology readiness and technology acceptance on NFC mobile payment services in Korea. *Journal of Applied Business Research (JABR)*, 30(6), 1615-1626.
- Şıker, P. (2011). Müşterilerin internet bankacılığını benimsemelerine yönelik keşifsel bir araştırma. *İnternet Uygulamaları ve Yönetimi Dergisi*, 2(2), 35-50.
- Singh, K., Leong, S. M., Tan, C. T., & Wong, K. C. (1995). A theory of reasoned action perspective of voting behavior: Model and empirical test. *Psychology & Marketing*, 12(1), 37-51.
- Slade, E. L., Dwivedi, Y. K., Piercy, N. C., & Williams, M. D. (2015). Modeling consumers' adoption intentions of remote mobile payments in the United

- Kingdom: extending UTAUT with innovativeness, risk, and trust. *Psychology & Marketing*, 32(8), 860-873.
- Söderström, O., Paasche, T., & Klauser, F. (2014). Smart cities as corporate storytelling. *City*, 18(3), 307-320.
- Stockemer, D. (2019). *Quantitative methods for the social sciences*. Springer International Publishing.
- Su, P., Wang, L., & Yan, J. (2018). How users' Internet experience affects the adoption of mobile payment: a mediation model. *Technology Analysis & Strategic Management*, 30(2), 186-197.
- Sujatha, R., & Sekkizhar, J. (2019). Determinants of M-Commerce Adoption in India Using Technology Acceptance Model Infused with Innovation Diffusion Theory. *Journal of Management Research*, 19(3), 193-204.
- Surowiecki, J. (2012). A brief history of money. *IEEE Spectrum*, 49(6), 44-79.
- Tan, G. W. H., Ooi, K. B., Chong, S. C., & Hew, T. S. (2014). NFC mobile credit card: the next frontier of mobile payment?. *Telematics and Informatics*, 31(2), 292-307.
- Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information systems research*, 6(2), 144-176.
- Teo, A. C., Tan, G. W. H., Ooi, K. B., Hew, T. S., & Yew, K. T. (2015). The effects of convenience and speed in m-payment. *Industrial Management & Data Systems*, 115(2), 311-331.
- Thakur, R. (2013). Customer adoption of mobile payment services by professionals across two cities in India: An empirical study using modified technology acceptance model. *Business Perspectives and Research*, 1(2), 17-30.
- Thakur, R., & Srivastava, M. (2014). Adoption readiness, personal innovativeness, perceived risk and usage intention across customer groups for mobile payment services in India. *Internet Research: Electronic Networking Applications and Policy*, 24(3), 369-392.
- Thompson, R. L., Higgins, C. A., & Howell, J. M. (1991). Personal computing: toward a conceptual model of utilization. *MIS quarterly*, 15(1), 125-143.
- Trafimow, D. (2009). The theory of reasoned action: A case study of falsification in psychology. *Theory & Psychology*, 19(4), 501-518.

- Türkoğlu, H., Bölen, F., Baran, P. K., & Terzi, F. (2011). Measuring quality of urban life in Istanbul. In *Investigating quality of urban life*. Springer, Dordrecht. 209-231.
- Tymoigne, É., & Wray, L. R. (2006). Money: an alternative story. *A Handbook of Alternative Monetary Economics*, 1-16.
- Van den Bergh, J., & Viaene, S. (2016). Unveiling smart city implementation challenges: The case of Ghent. *Information Polity*, 21(1), 5-19.
- Vanolo, A. (2014). Smartmentality: The smart city as disciplinary strategy. *Urban studies*, 51(5), 883-898.
- Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information systems research*, 11(4), 342-365.
- Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision sciences*, 39(2), 273-315.
- Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management science*, 46(2), 186-204.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 27(3), 425-478.
- Walravens, N. (2015). Mobile city applications for Brussels citizens: Smart City trends, challenges and a reality check. *Telematics and Informatics*, 32(2), 282-299.
- Warshaw, P. R., & Davis, F. D. (1985). Disentangling behavioral intention and behavioral expectation. *Journal of experimental social psychology*, 21(3), 213-228.
- Wiig, A. (2015). IBM's smart city as techno-utopian policy mobility. *City*, 19(2-3), 258-273.
- Wu, M. Y., Chou, H. P., Weng, Y. C., & Huang, Y. H. (2011). TAM-2 based study of website user behavior-using web 2.0 websites as an example. *WSEAS Transactions on Business and Economics*, 4(8), 133-151.
- Wu, R., Wu, Z., Wen, J., Cai, Y., & Li, Y. (2019). Extrinsic and intrinsic motivations as predictors of bicycle sharing usage intention: An empirical study for Tianjin, China. *Journal of cleaner production*, 225, 451-458.
- Yang, Y., Liu, Y., Li, H., & Yu, B. (2015). Understanding perceived risks in mobile payment acceptance. *Industrial Management & Data Systems*, 115(2), 253-269.

- Yigitcanlar, T. (2015). Smart cities: an effective urban development and management model?. *Australian Planner*, 52(1), 27-34.
- Yin, C., Xiong, Z., Chen, H., Wang, J., Cooper, D., & David, B. (2015). A literature survey on smart cities. *Science China Information Sciences*, 58(10), 1-18.
- Yousafzai, S. Y., Foxall, G. R., & Pallister, J. G. (2010). Explaining internet banking behavior: theory of reasoned action, theory of planned behavior, or technology acceptance model?. *Journal of applied social psychology*, 40(5), 1172-1202.
- Zhang, J., & Mao, E. (2020). Cash, credit, or phone? An empirical study on the adoption of mobile payments in the United States. *Psychology & Marketing*, 37(1), 87-98.
- Zheng, L., Favier, M., Huang, P., & Coat, F. (2012). Chinese consumer perceived risk and risk relievers in e-shopping for clothing. *Journal of Electronic Commerce Research*, 13(3), 255.
- Zhou, T. (2013). An empirical examination of continuance intention of mobile payment services. *Decision support systems*, 54(2), 1085-1091.
- Zubizarreta, I., Seravalli, A., & Arrizabalaga, S. (2016). Smart city concept: What it is and what it should be. *Journal of Urban Planning and Development*, 142(1).
- Zygiaris, S. (2013). Smart city reference model: Assisting planners to conceptualize the building of smart city innovation ecosystems. *Journal of the knowledge economy*, 4(2), 217-231.

Internet Sources

- Akıllı Şehir İstanbul [@istakillisehir]. (2019, February 21). İstanbul İçin Tek Kart Çok Hizmet. [For İstanbul, One Card, Many Services]. [Image attached]. Twitter. <https://mobile.twitter.com/istakillisehir/status/1098490699077562368/photo/1>
- Bankalararası Kart Merkezi (n.d.-a). 2020 Faaliyet Raporu [2020 Annual Report]. https://bkm.com.tr/wp-content/uploads/2021/03/BKM_Faaliyet_Raporu_2020_high.pdf
- Bankalararası Kart Merkezi (n.d.-b). General Statistical Data for the Selected Month. <https://bkm.com.tr/en/secilen-aya-ait-istatistikler/>
- Belbim. (2019). Faaliyet Raporu [Annual Report]. https://webkurumsalapi.belbim.istanbul/Media/pdf/2019_Faaliyet_Raporu_V2.pdf

- Belbim. (2020). Faaliyet Raporu [Annual Report].
https://webkurumsalapi.belbim.istanbul/Media/2020_faaliyet_raporu.pdf
- Belbim. (2020, July 23). News. [Image]. <https://www.belbim.istanbul/haber-detay?id=67>
- Belbim. (2020, October 2). News. [Image]. <https://www.belbim.istanbul/haber-detay?id=71>
- Belbim. (2020, October 20). News. [Image]. <https://www.belbim.istanbul/haber-detay?id=1072>
- Belbim. (2020, September 4). News. [Image]. <https://www.belbim.istanbul/haber-detay?id=68>
- Belbim. (2021, April 6). News. [Image]. <https://www.belbim.istanbul/haber-detay?id=1079>
- Belbim. (2021, February 9). News. [Image]. <https://www.belbim.istanbul/haber-detay?id=1073>
- Belbim. (2021, January 12). News. [Image].
<https://www.belbim.istanbul/Preview/tr/e5bbc335-5709-4be1-b050-69496e4c4a5f?id=1076>
- Belbim. (2021, March 3). News. [Image]. <https://www.belbim.istanbul/haber-detay?id=1078>
- Belbim. (n.d.). Kağıt biletten dijitale: Zaman yolculuğu [From paper based tickets to digital ones: A journey through time]. <https://www.belbim.istanbul/belbim-kagit-biletten-dijitale>
- Collins, J. (2011, August 8). A short history of the debit card.
<https://www.marketplace.org/2011/08/18/short-history-debit-card/>
- Federal Financial Institutions Examination Council. (2016, April). Retail Payment Systems, IT Examination Handbook. <https://ithandbook.ffiec.gov/it-booklets/retail-payment-systems.aspx>
- Halk Bakkal. (n.d.). Public Grocery Stores. <https://halkbakkal.ibb.istanbul/>
- ING Turkey. (2020, September). Koronavirüs Türkiye'yi nakit kullanımından uzaklaştırdı [Coronavirus discouraged Turkey from using cash]. Newsletter,
https://www.ing.com.tr/F/Documents/Koronavirus_nakit_kullanimi.pdf
- İspark. (2017, March 8). Smart Car Park Systems [Photograph].
<https://ispark.istanbul/haberler/ispark-ile-akilli-otopark-sistemleri/>

- Israel, G. D. (2013). Determining sample size.
<https://www.krishanpandey.com/rpapersd/Determining%20Sample%20Size.pdf>.
- İstanbul Yatırım Ajansı. (n.d.). Smart City Vision. [İstanbul Investment Agency].
<https://istanbulyatirimajansi.istanbul/haberlesme-alt-yapisi/>
- İstanbulkart. (2020, February). Haberler [News]. Retrieved from
<https://www.istanbulkart.istanbul/haber-detay?id=78>
- İstanbulkart. (n.d.). Haberler [News]. [Screenshot]. <https://www.istanbulkart.istanbul/>
- Kokkola, T. (Ed.). (2010). The Payment System. European Central Bank.
<https://www.ecb.europa.eu/pub/pdf/other/paymentsystem201009en.pdf>
- Macrotrends. (n.d.). Largest world cities by population, in 2021. Retrived from
<https://www.macrotrends.net/cities/largest-cities-by-population>
- Mulcahy, A. (2019, June). In Payment Methods Report 2019, Innovations in the Way We Pay. <https://www.europeanpaymentscouncil.eu/>
- Norges Bank (2018, May 24). Retail payment services 2017 (No: 2). <https://www.norges-bank.no/en/news-events/news-publications/Reports/Norges-Bank-Papers/2018/norges-bank-memo-22018/>
- Octopus Card. (n.d.). What is Octopus?.
<https://www.octopus.com.hk/en/consumer/tourist/what-is-octopus/index.html>
- Standing Committee for Economic and Commercial Cooperation of the Organization of Islamic Cooperation. (2015, October). Retail Payment Systems in the OIC Member Countries. http://www.sbb.gov.tr/wp-content/uploads/2018/11/Retail_Payment_Systems_in_the_OIC_Member_Countries.pdf
- The Committee on Payment and Settlement Systems. (2000, January 24). Payment Systems in Turkey. Bank for International Settlements.
<https://www.bis.org/cpmi/publ/d36.htm>
- The Committee on Payment and Settlement Systems. (2012a, May 29). Innovations in retail payments. Bank for International Settlements.
<https://www.bis.org/cpmi/publ/d102.htm>
- The Committee on Payment and Settlement Systems. (2012b, November 26). Payment, clearing and settlement systems in Turkey. Bank for International Settlements.
https://www.bis.org/cpmi/paysysinfo_cpmi_ctrys.htm

Türk-Internet. (2020, April 27). *Contactless Pedestrian Button*. [Photograph]. <https://turk-internet.com/ibbden-covid-19a-karsi-temassiz-yaya-butonu/>

Turkish Statistical Institute. (2021, February). Adrese dayalı nüfus kayıt sistemi sonuçları [Census based on address records]. Haber bülteni [Newsletter], 37210. Retrieved from https://tuikweb.tuik.gov.tr/PreTabloArama.do?metod=search&araType=hb_x.

Türkiye Cumhuriyeti Çevre ve Şehircilik Bakanlığı. (n.d.). Akıllı şehirler beyaz bülteni [Smart cities newsletter]. https://webdosya.csb.gov.tr/db/cbs/menu/akillisehirler-kitap_20190311022214_20190313032959.pdf

UK Department for Business Innovation and Skills. (2013, October). Smart Cities: Background Paper. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/246019/bis-13-1209-smart-cities-background-paper-digital.pdf

United Nations e-Government Knowledgebase. (2020). Local Online Service Index. United Nations. <https://publicadministration.un.org/egovkb/en-us/Data/City>

Appendix 1 – Questionnaire in English

First section:

Dear Participant,

This questionnaire was prepared for a thesis conducted in Marmara University, Institute of Social Sciences. Participation in the questionnaire is voluntary.

The aim of the study is to measure the perceptions of participants on İstanbulcard payment method. The questionnaire takes about 5 – 7 minutes. Thanks to your valuable contribution, the accuracy of the analysis will increase.

Your answers will be kept confidential and will be used only for scientific purposes within the scope of this research. Please read the questions carefully and mark the answers that best suit you.

If you are answering the questionnaire using a mobile phone, you can turn your screen sideways to see the questions better.

Thank you for supporting my thesis.

For your questions and comments: omer.hurmaci@gmail.com

Second section:

- | | Yes | No |
|----------------------------|--------------------------|--------------------------|
| 1. I have an İstanbulcard. | ☐ | ☐ |

*: It is a filter question. If the answer is no, the survey is terminated.

Third section:

- | | Yes | No |
|---|--------------------------|--------------------------|
| 2. Have you watched the introductory video about İstanbulcard payment method? | ☐ | ☐ |

*: It is a filter question. If the answer is no, the survey is terminated.

Fourth section:

In the questions after this section, please consider the usage of İstanbulcard payment method in; Beltur, supermarkets, online grocery applications, Hamidiye water vending machines, İsbike, İspark and iTaksi.

Fifth section:

- ① : Strongly disagree
② : Disagree
③ : Neither agree nor disagree
④ : Agree
⑤ : Strongly agree

Please read the statements and check the appropriate box.

No	Statements	Answers				
3	I believe that using İstanbulcard payment method will be convenient.	①	②	③	④	⑤
4	Using İstanbulcard payment method is advantageous for me.	①	②	③	④	⑤
5	I believe that using İstanbulcard payment method will save me time.	①	②	③	④	⑤
6	I am afraid to get infected by coronavirus when using physical cash.	①	②	③	④	⑤
7	The use of İstanbulcard payment method is free of effort.	①	②	③	④	⑤
8	I am open to using İstanbulcard payment method in the near future.	①	②	③	④	⑤
9	Using İstanbulcard payment method enhances my effectiveness.	①	②	③	④	⑤
10	I believe that using İstanbulcard payment method will improve the speed of transaction.	①	②	③	④	⑤
11	İstanbulcard payment method is easy to use.	①	②	③	④	⑤

12	İstanbulcard payment method is useful for me.	①	②	③	④	⑤
13	I think İstanbulcard payment service has mechanisms to ensure the safe transmission of its users' information.	①	②	③	④	⑤
14	I am not comfortable making payment using physical cash.	①	②	③	④	⑤
15	I believe that using İstanbulcard payment method will be hassle-free.	①	②	③	④	⑤
16	Given the opportunity, I would use İstanbulcard payment method.	①	②	③	④	⑤
17	Compared to traditional payment methods (cash, credit/debit card), I believe that transactions will be fast if I use İstanbulcard payment method.	①	②	③	④	⑤
18	I feel safe using İstanbulcard for making transactions.	①	②	③	④	⑤
19	Compared to traditional payment methods (cash, credit/debit card), I believe that İstanbulcard payment method is more convenient.	①	②	③	④	⑤
20	I am worried to get infected by coronavirus when using physical cash.	①	②	③	④	⑤
21	İstanbulcard allows me to make small payments with security.	①	②	③	④	⑤
22	I am likely to use İstanbulcard payment method in the near future.	①	②	③	④	⑤
23	It is easy for me to operate with İstanbulcard.	①	②	③	④	⑤
24	I intend to use İstanbulcard payment method when the opportunity arises.	①	②	③	④	⑤
25	I am worried there is a coronavirus droplet in physical cash.	①	②	③	④	⑤

Sixth section:

	Yes	No
26 I previously knew about the new usage areas of İstanbulcard.	☐	☐
27 İstanbul is a "Smart City".	☐	☐
28 İstanbulcard is a "Smart City" card.	☐	☐
29 İstanbulcard is a "Smart Card".	☐	☐

30 I actively use İstanbulcard in my daily life. ☐ ☐

31 In general, which payment methods do you use? (You may choose more than one)

Cash ☐

Credit card / Debit card ☐

Prepaid card ☐

E-wallet ☐

Mobile payment ☐

Online payment ☐

Cripto currency ☐

Other: _____

32 I have used İstanbulcard at: (You may choose more than one)

İspark ☐

Beltur or İBB Recreational Facilities ☐

İsbike ☐

Havaist ☐

Supermarket ☐

Hamidiye Vending Machine ☐

Getir ☐

iTaksi ☐

Other: _____

33 Please specify your age: _____

34 Please specify your level of education.

Left Primary School ☐

Primary School Graduate ☐

- Left Secondary School ☐
- Secondary School Graduate ☐
- Left High School ☐
- High School Student ☐
- High School Graduate ☐
- Undergraduate Student ☐
- Bachelor's Degree ☐
- Graduate Student ☐
- Graduate Degree ☐
- Other: _____

35 Please select what best describes you.

- Woman ☐
- Man ☐

36 Before the pandemics, what was your monthly average İstanbulcard expenditure? (in Turkish Liras).

- 0 - 50 ☐
- 51 - 100 ☐
- 101 - 150 ☐
- 151 - 200 ☐
- 201 - 250 ☐
- 251 - 300 ☐
- 300+ ☐

Appendix 2 – Questionnaire in Turkish

Birinci bölüm:

Değerli Katılımcı,

Bu anket Marmara Üniversitesi Sosyal Bilimler Enstitüsünde yürütülen bir tez için hazırlanmıştır. Ankete katılım gönüllülük esasına dayanır.

Çalışmanın amacı, katılımcıların İstanbulkart ile ödeme yöntemi hakkındaki algılarını ölçmektir. Anket yaklaşık 5 – 7 dakika sürmektedir. Değerli katkılarınız sayesinde analizlerin doğruluğu artacaktır.

Vereceğiniz cevaplar gizli tutulacak ve yalnızca araştırma kapsamında bilimsel amaçla kullanılacaktır. Soruları lütfen dikkatlice okuyunuz ve size en uygun cevapları işaretleyiniz.

Eğer anketi telefon kullanarak cevaplıyorsanız, ekranınızı yan çevirerek soruları daha iyi görebilirsiniz.

Tezime vermiş olduğunuz destek için çok teşekkür ederim. Sorularınız ve görüşleriniz için:

İkinci bölüm:

	Evet	Hayır
1.* Bir İstanbulkart'ım var.	☐	☐

*: Filtre sorusudur. Cevap hayır ise anket sonlanır.

Üçüncü bölüm:

	Evet	Hayır
2.* İstanbulkart ile ödeme yöntemi hakkındaki tanıtıcı videoyu izlediniz mi?	☐	☐

*: Filtre sorusudur. Cevap hayır ise anket sonlanır.

Dördüncü bölüm:

Bu bölümden sonraki sorularda lütfen İstanbulkart ile ödeme yönteminin; Beltur, süpermarket, çevrimiçi market uygulamaları, Hamidiye su otomatları, İsbike, İspark ve iTaksi ödemelerinde kullanımını da göz önünde bulundurunuz.

Beşinci bölüm:

- ① : Kesinlikle katılmıyorum
② : Katılmıyorum
③ : Ne katılıyorum ne katılmıyorum
④ : Katılıyorum
⑤ : Kesinlikle katılıyorum

Lütfen ifadeleri okuyunuz ve uygun seçeneği işaretleyiniz.

No	İfadeler	Yanıtlar				
3	İstanbulkart ile ödeme yönteminin pratik olacağına inanıyorum.	①	②	③	④	⑤
4	İstanbulkart ile ödeme yöntemini kullanmak avantajlıdır.	①	②	③	④	⑤
5	İstanbulkart ile ödeme yönteminin bana zaman kazandıracağına inanıyorum.	①	②	③	④	⑤
6	Nakit para kullanırken korona virüsünün bana bulaşmasından korkarım.	①	②	③	④	⑤
7	İstanbulkart ile ödeme yöntemini kullanmak çaba gerektirmez.	①	②	③	④	⑤
8	İstanbulkart ile ödeme yöntemini yakın gelecekte kullanmaya açığım.	①	②	③	④	⑤
9	İstanbulkart ile ödeme yöntemini kullanmak verimliliğimi artırır.	①	②	③	④	⑤
10	İstanbulkart ile ödeme yönteminin, ödeme işleminin hızını artıracığına inanıyorum.	①	②	③	④	⑤
11	İstanbulkart ile ödeme yöntemini kullanmak basittir.	①	②	③	④	⑤

12	İstanbulkart ile ödeme yöntemi kullanışlıdır.	①	②	③	④	⑤
13	İstanbulkart ile ödeme yönteminin sağlayıcılarının, kullanıcılarının bilgilerinin güvenle iletilmesini temin eden sistemleri olduğunu düşünüyorum.	①	②	③	④	⑤
14	Ödemeyi nakit para kullanarak yaparken içim rahat değildir.	①	②	③	④	⑤
15	İstanbulkart ile ödeme yönteminin sorunsuz olacağına inanıyorum.	①	②	③	④	⑤
16	Fırsat verilseydi, İstanbulkart ile ödeme yöntemini kullanırdım.	①	②	③	④	⑤
17	Geleneksel ödeme yöntemleriyle kıyaslandığında (nakit, kredi/banka kartı), İstanbulkart ile ödeme yöntemini kullanırsam işlemlerin hızlı olacağına inanıyorum.	①	②	③	④	⑤
18	İstanbulkart'ı alışverişlerimde kullanırken güvende hissedirim.	①	②	③	④	⑤
19	Geleneksel ödeme yöntemleriyle kıyaslandığında (nakit, kredi/banka kartı), İstanbulkart ile ödeme yönteminin daha rahat olduğuna inanıyorum.	①	②	③	④	⑤
20	Nakit para kullanırken korona virüsünün bana bulaşmasından endişeleniyorum.	①	②	③	④	⑤
21	İstanbulkart, küçük ödemeleri güvenle yapmamı sağlar.	①	②	③	④	⑤
22	Muhtemelen, İstanbulkart ile ödeme yöntemini yakın gelecekte kullanacağım.	①	②	③	④	⑤
23	İstanbulkart'ı kullanmak benim için kolaydır.	①	②	③	④	⑤
24	Fırsatını bulduğumda, İstanbulkart ile ödeme yöntemini kullanmaya niyetim var.	①	②	③	④	⑤
25	Nakit paralarda korona virüsü içeren damlacık olduğundan endişeleniyorum.	①	②	③	④	⑤

Altıncı bölüm:

	Evet	Hayır
26 İstanbulkart'ın yeni kullanım alanlarından daha önceden haberim vardı.	☐	☐
27 İstanbul, bir "Akıllı Şehirdir".	☐	☐
28 İstanbulkart, bir "Akıllı Şehir" kartıdır.	☐	☐
29 İstanbulkart, bir "Akıllı Karttır".	☐	☐

30 Günlük hayatımda aktif bir şekilde İstanbulkart kullanıyorum. ☐ ☐

31 Genel olarak hangi ödeme yöntemlerini kullanıyorsunuz? (Birden fazla seçebilirsiniz)

- Nakit ☐
- Kredi kartı / Banka kartı ☐
- Ön ödemeli kart ☐
- E - cüzdan ☐
- Mobil ödeme ☐
- Online ödeme ☐
- Kripto Para ☐
- Diğer: _____ ☐

32 İstanbulkart'ı aşağıdaki yerlerde kullandım. (Birden fazla seçebilirsiniz)

- İspark ☐
- Beltur veya İBB Sosyal Tesisleri ☐
- İsbike ☐
- Havaist ☐
- Süpermarket ☐
- Hamidiye Su otomatı ☐
- Getir ☐
- iTaksi ☐
- Diğer: _____ ☐

33 Yaşınızı Belirtiniz: _____

34 Eğitim durumunuzu işaretleyiniz.

- İlkokul Terk ☐
- İlkokul Mezunu ☐

- | | |
|--------------------------------------|--------------------------|
| Ortaokul Terk | ☐ |
| Ortaokul Mezunu | ☐ |
| Lise Terk | ☐ |
| Lise Öğrencisi | ☐ |
| Lise Mezunu | ☐ |
| Lisans Öğrencisi | ☐ |
| Lisans Mezunu | ☐ |
| Yüksek Lisans veya Doktora Öğrencisi | ☐ |
| Yüksek Lisans veya Doktora Mezunu | ☐ |
| Diğer: _____ | ☐ |

35 Size en uygun seçeneği işaretleyiniz.

- | | |
|-------|--------------------------|
| Kadın | ☐ |
| Erkek | ☐ |

36 Pandemiden önceki aylık ortalama İstanbulkart harcamanız (Türk Lirası).

- | | |
|-----------|--------------------------|
| 0 – 50 | ☐ |
| 51 - 100 | ☐ |
| 101 - 150 | ☐ |
| 151 - 200 | ☐ |
| 201 - 250 | ☐ |
| 251 - 300 | ☐ |
| 300+ | ☐ |

Appendix 3 – Measures of Central Tendency and Dispersion

Variable	No.	Missing	Mean	Median	Min	Max	SD	Excess Kurtosis	Skewness
CVD1	1	0	3.942	4	1	5	1.068	0.466	-1.005
CVD2	2	0	3.345	3	1	5	1.092	-0.674	-0.282
CVD3	3	0	4.056	4	1	5	1.076	1.08	-1.3
CVD4	4	0	3.816	4	1	5	1.086	0.1	-0.857
INT1	5	0	3.775	4	1	5	0.953	0.653	-0.865
INT2	6	0	3.833	4	1	5	0.903	0.805	-0.93
INT3	7	0	3.957	4	1	5	0.987	0.827	-1.017
INT4	8	0	3.831	4	1	5	0.896	1.106	-0.977
PEOU1	9	0	4.2	4	1	5	0.93	2.59	-1.547
PEOU2	10	0	3.87	4	1	5	0.964	0.983	-1.018
PEOU3	11	0	3.969	4	1	5	1.001	0.637	-0.996
PTC1	12	0	4.036	4	1	5	1.059	1.392	-1.333
PTC2	13	0	3.891	4	1	5	1.057	0.648	-1.04
PTC3	14	0	3.925	4	1	5	1.08	0.77	-1.11
PTS1	15	0	3.838	4	1	5	0.978	0.491	-0.867
PTS2	16	0	3.829	4	1	5	1.087	0.273	-0.891
PTS3	17	0	3.512	4	1	5	1.098	-0.448	-0.481
PU1	18	0	3.957	4	1	5	0.892	1.278	-1.063
PU2	19	0	3.843	4	1	5	1.006	-0.034	-0.653
PU3	20	0	3.792	4	1	5	0.966	-0.133	-0.607
SR1	21	0	3.652	4	1	5	1.072	0.017	-0.724
SR2	22	0	3.915	4	1	5	1.119	0.984	-1.277
SR3	23	0	3.662	4	1	5	1.117	0.261	-0.921